# Flood Response to Submissions

## Project Marvel

**Prepared for Mapletree SR Australia Management Pty Ltd/** / 21 Nov 2024

231204

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Your Partner in Engineering

## Contents

# 1.0 Introduction

In September 2023, Thomson Whitting Pty. Ltd. (TTW) prepared a flood impact assessment to support the State Significant Development Application (SSDA) for the proposed logistics centre at 20 Kelso Crescent, Moorebank. The assessment summarised the flood planning requirements for the site, referencing the Anzac Creek Floodplain Risk Management Study and Plan.

Subsequent feedback from the Liverpool City Council and the Department of Climate Change, Energy, the Environment, and Water (BCS) recommended utilising the Georges River Flood Study and Model to evaluate flooding risks associated with the Georges River. Accordingly, this study adopts the Georges River model and associated findings to assess flood impacts.

Furthermore, based on agency feedback, compensatory flood storage must be incorporated within the development to mitigate cumulative impacts on flood behaviour. This requirement is particularly critical as the southern portion of the site functions as flood storage. Detailed information on the proposed flood storage measures is provided in this report and a detailed itemised response to agency comments is provided in Appendix A.

This supplementary report is provided in addition to a Flood Emergency Response Plan for the site.

# 2.0 Georges River Flood Study - Final Draft, January 2020

The Georges River catchment covers approximately 960 km² and is situated southwest of Sydney. This river flows through one of the largest floodplain regions in Sydney.

The specific study area focuses on the Georges River floodplain, ranging from the East Hills Railway Line in Casula to downstream of the Salt Pan Creek confluence at Lugarno. In contrast, the entire Georges River catchment encompasses a much larger geographical area, extending from Appin, located south of Campbelltown, to the coastal outlets at Botany Bay. Key tributaries that feed into the Georges River within this region include Bow Bowing Creek, Cabramatta Creek, Prospect Creek, Salt Pan Creek, and the Woronora River.

Figure 1 illustrates the general locality of the study area, highlighting the broader floodplain topography and major river alignments. Additionally, presents the local topography of the main reach of the Georges River.

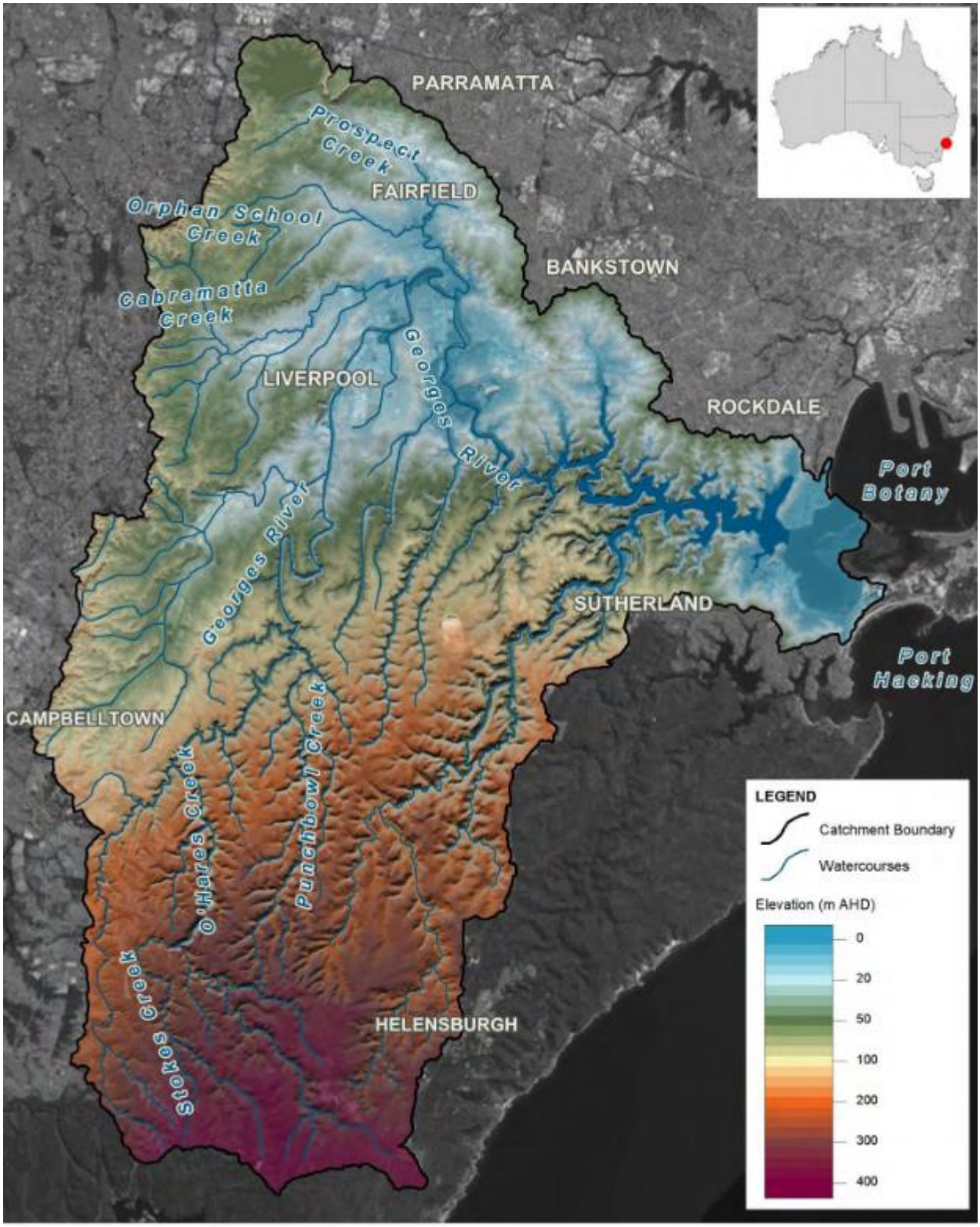


*Figure 1- The Study Locality- Source: Georges River Flood Study, Final Draft Report 2020, BMT WBM*

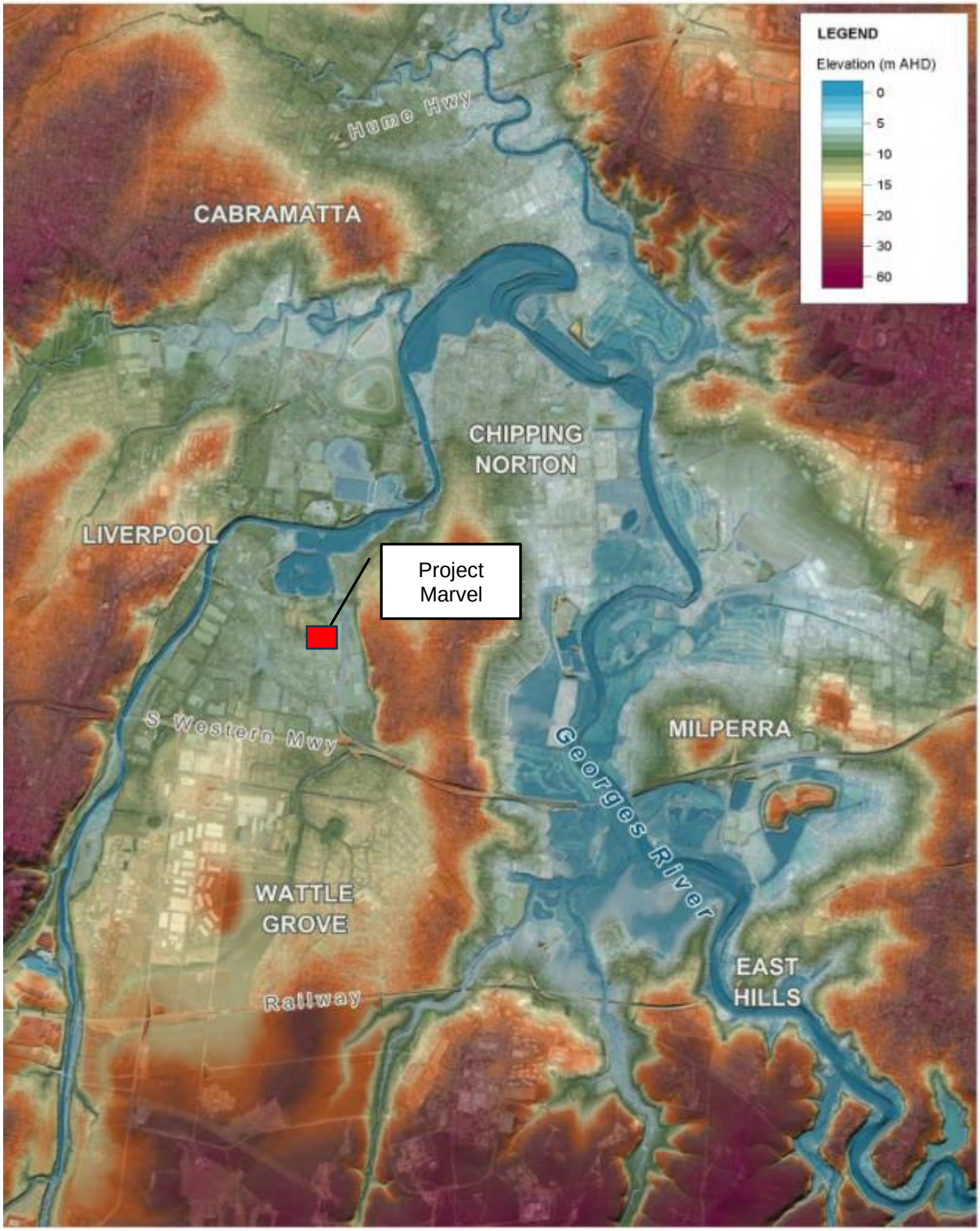


*Figure 2- Local Topography- Source: Georges River Flood Study, Final Draft Report 2020, BMT WBM*

This study was conducted to assist Council in effectively managing flood risks within the Georges River study area by providing accurate flood maps and detailed descriptions of flood behaviour. It leverages the latest data and modelling techniques to support informed decision-making.

To guide flood impact assessments and establish development controls for potential future projects along the Georges River floodplain, a two-dimensional (2D) TUFLOW HPC hydraulic model was created. This model integrates the most recent topographical data and updated river cross-sections, ensuring it reflects current conditions.

The study incorporates inflow data derived from ARR 1987 rainfall-runoff modelling procedures, previously used in the Georges River Floodplain Risk Management Study by Bewsher Consulting (2004). This approach was selected after a thorough review and consultation with key stakeholders, providing a basis for Council's current flood mapping and maintaining alignment with established flood planning levels.

Historic flood data—specifically from the events of August 1986, April 1988, April 2015, and June 2016—was used to calibrate and validate the TUFLOW model. Analysis of hydrologic records and historical flow data at Liverpool Weir demonstrated that the model reliably represents flood responses across the catchment area. The parameters identified during these calibration and validation events were then applied to simulate design events. This model has a 10 m cell size and uses the TUFLOW release 2017-09-AC-GP.

## 2.1 Existing Site Flood Conditions

The Georges River Flood Study - Final Draft, January 2020 is used to develop the existing model. The new topography survey data for the site is integrated into the model. Additionally, the existing building located to the south of the development is nulled from the model.

Figures 3, 4, and 5 illustrate flood depths, levels, flow velocities, and hazards for the 1% AEP storm event. The results are consistent with the Anzac Creek model used in the initial report, indicating a flood level of 8.46 mAHD, velocities generally below 0.5 m/s, and flood hazards along the southern boundary of the site at Seton Road classified as H3 and H4.

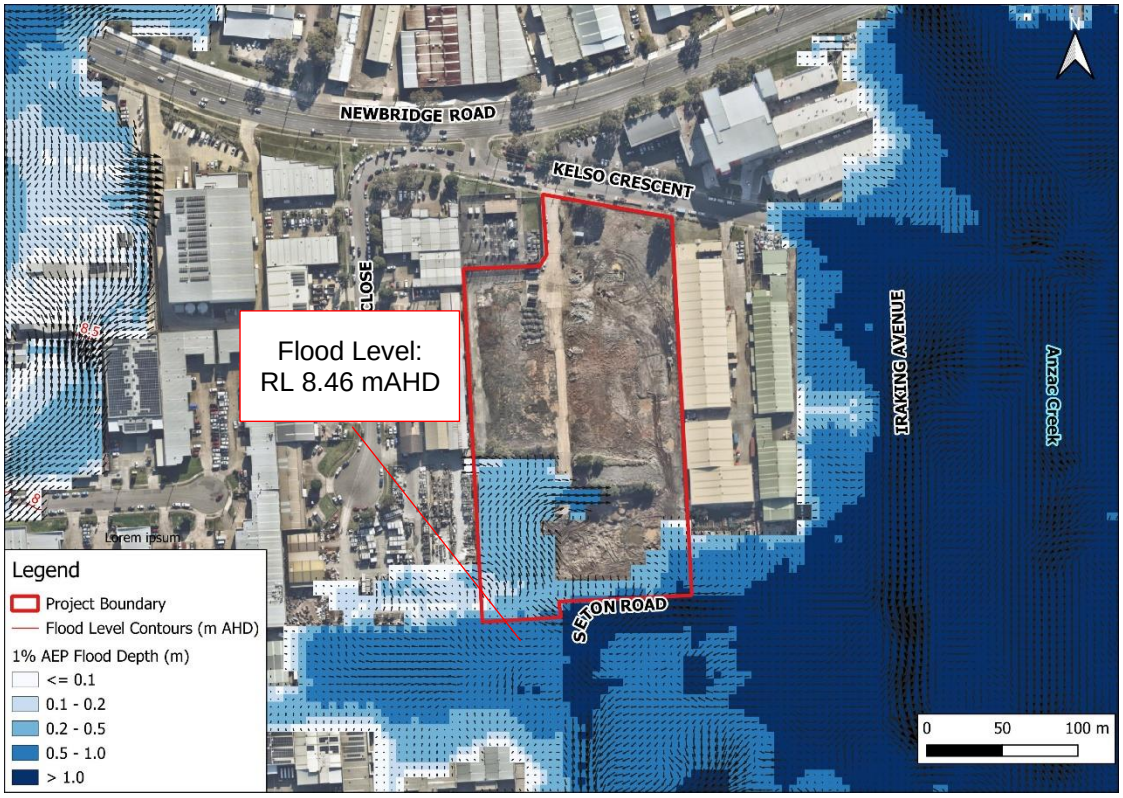


*Figure 3- Existing 1% AEP Flow Depths and Levels*

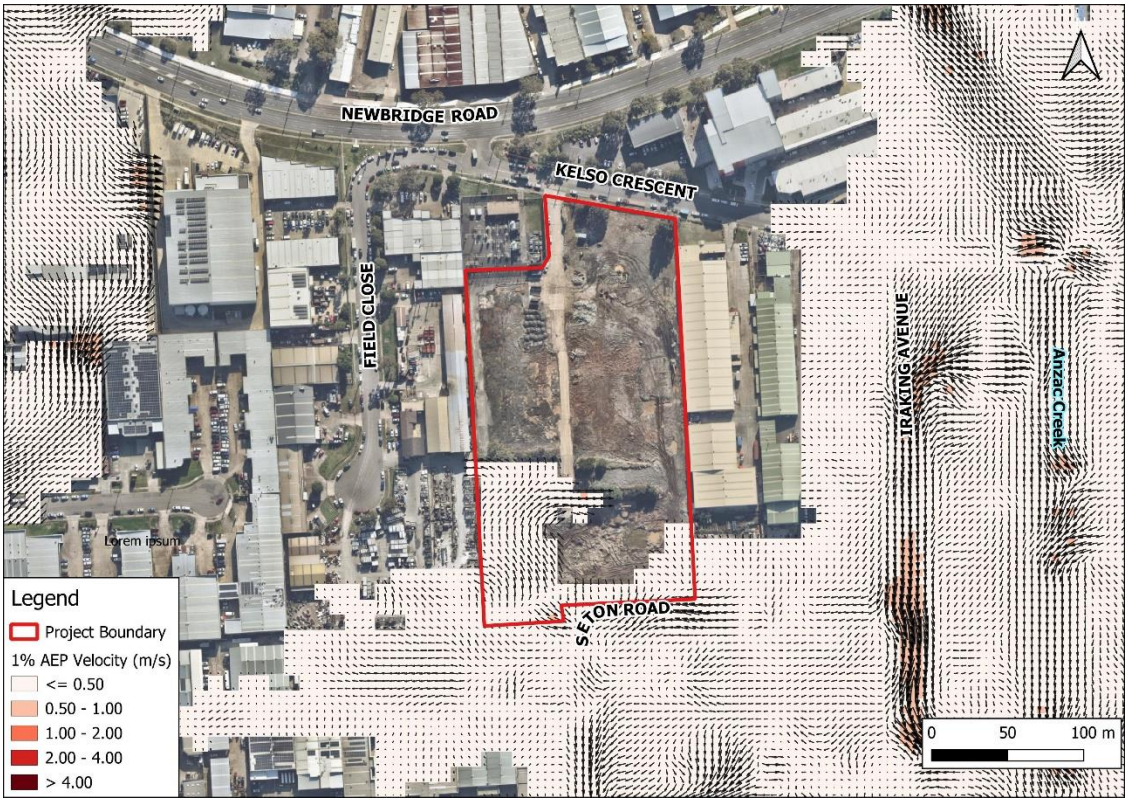


*Figure 4- Existing 1% AEP Flood Velocities*

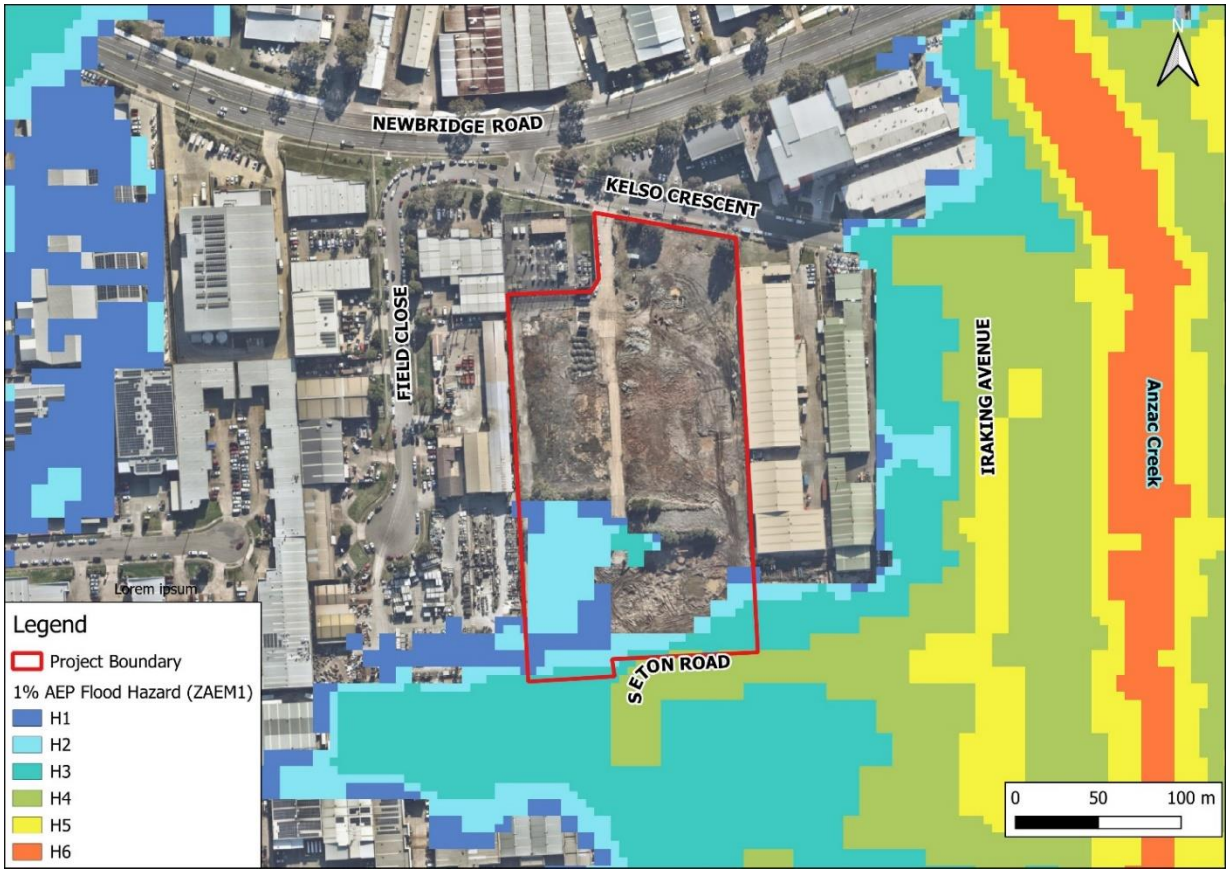


*Figure 5- Existing 1% AEP Flood Hazard*

## 2.2 Proposed Site Flood Conditions

In the proposed scenario, the development is entirely excluded from the model DEM to assess its impact on flood conditions. The post-development flow depths and levels, velocity and hazard for the 1% AEP are presented in Figure 6 to 8 respectively.

The results are consistent with the original modelling, showing a proposed flood level of RL 8.46 mAHD at the southern boundary of the site. Additionally, the new development has no significant impact on surrounding properties, as the flood storage displaced by the development is negligible compared to the extensive capacity of the floodplain.

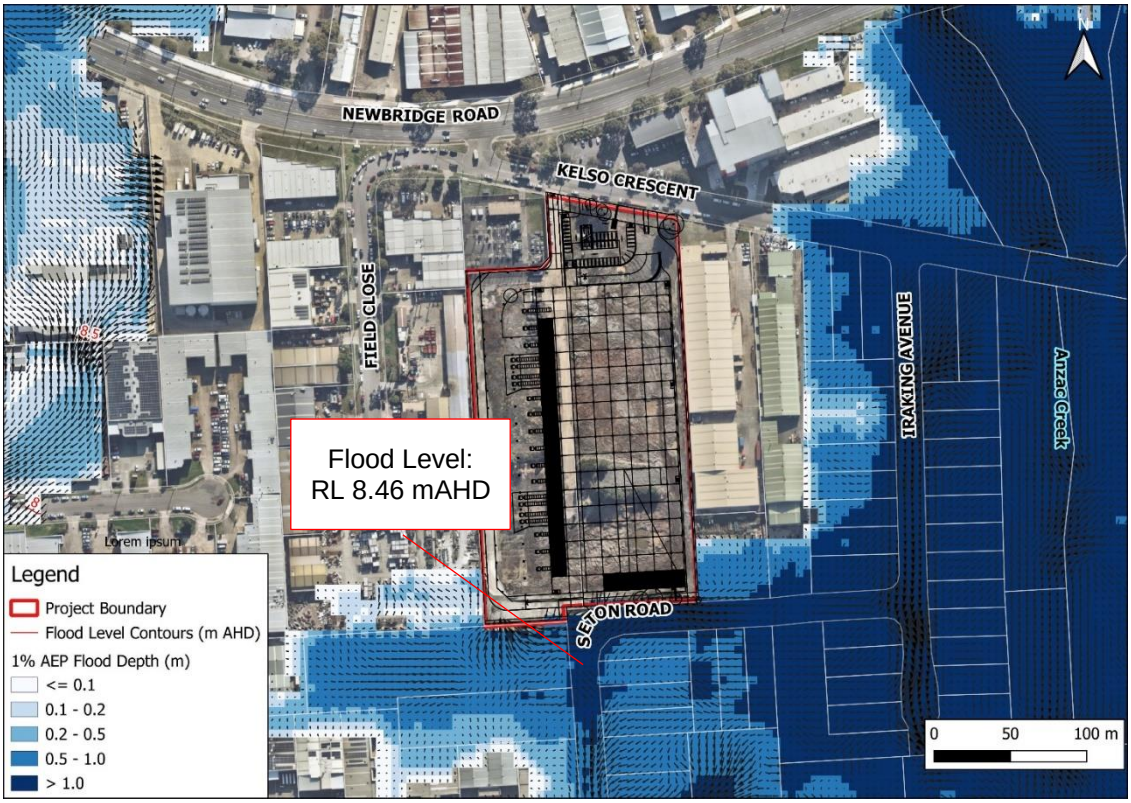


*Figure 6- Post Development 1% AEP Flood Depths and Level*

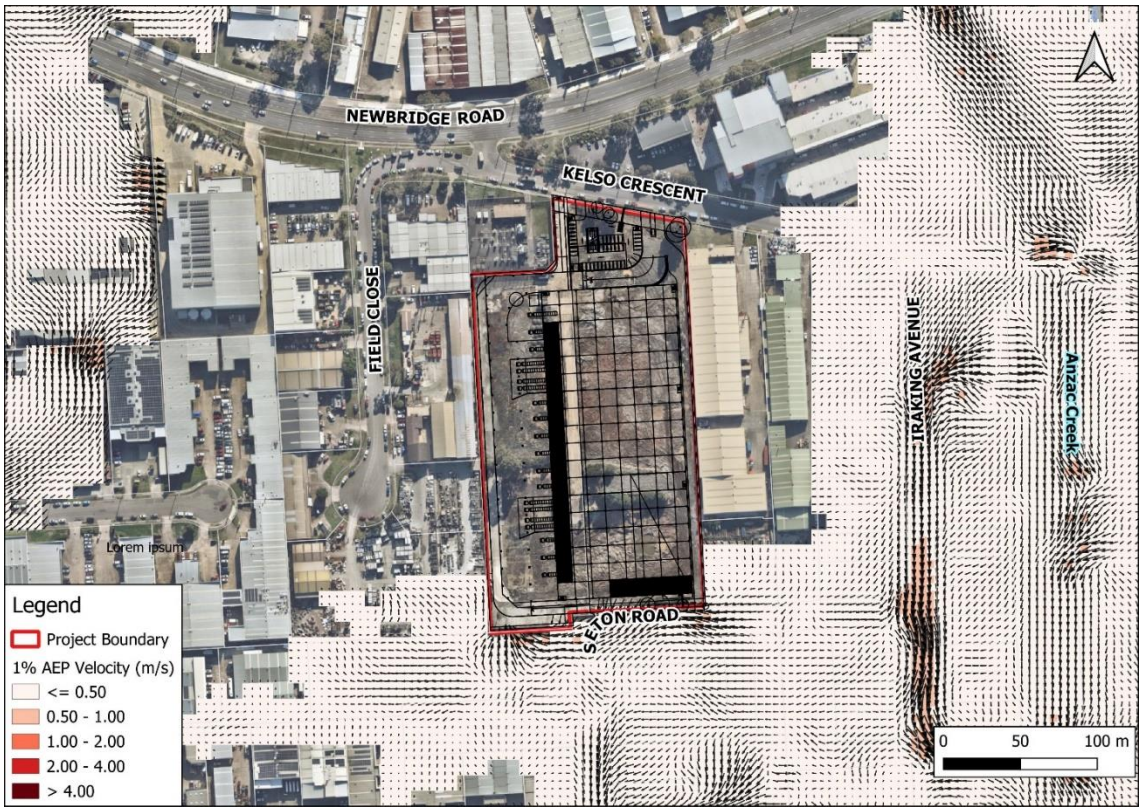


*Figure 7- Post Development 1% AEP Flood Velocities*

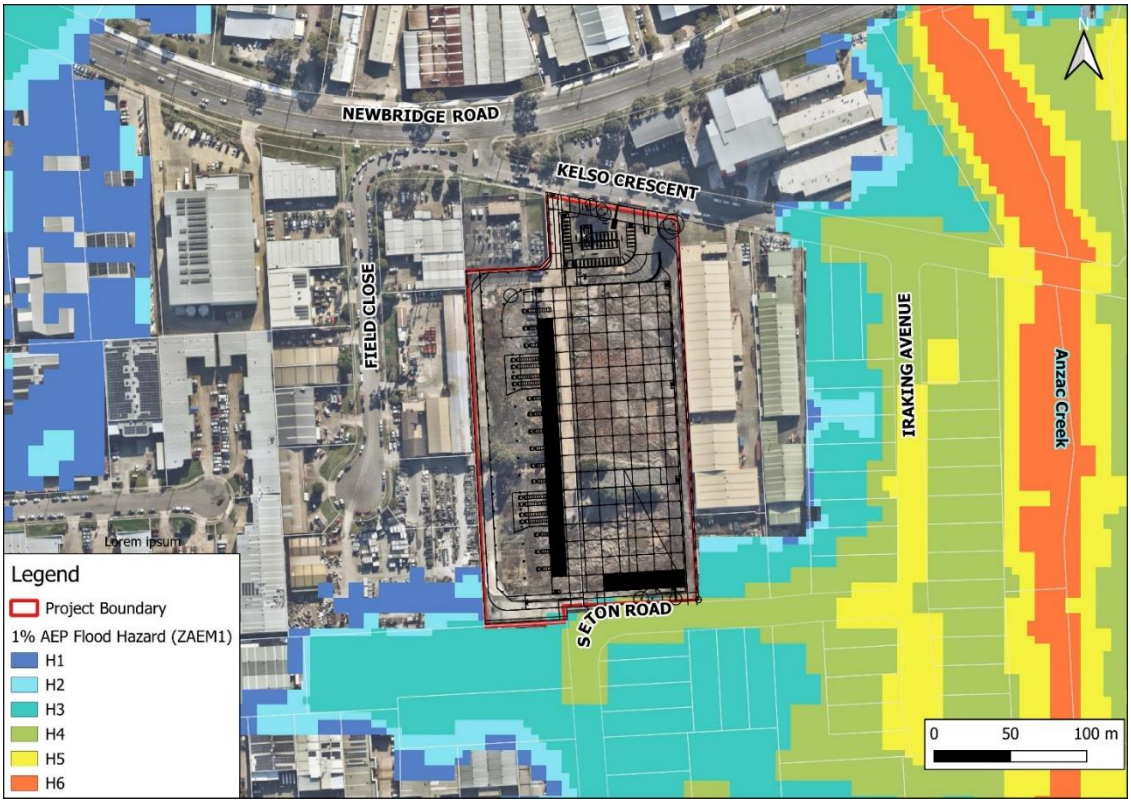


*Figure 8- Post Development 1% AEP Flood Hazard*

In the initial stage of this project, calculations using the GIS package estimated that the existing flooded area within the proposed development site covers approximately 9,225 m², containing about 7,500 m³ of floodplain volume. Figure 9 illustrates the flooded area under the existing conditions, which was used for these calculations.

*Figure 9- Flooded Area Considered for Volume Calculation in the previous stage*

At this stage of the study, a more precise calculation was conducted using 12d software to determine the difference between the design surface level and the 1% AEP flood level, yielding a more accurate result. The calculation reveals that the total flood storage occupied by the development is 3,350 m³. Figure 10 shows the flooded area under the existing scenario used for this calculation, while Figure 11 displays the output generated by the 12d software.

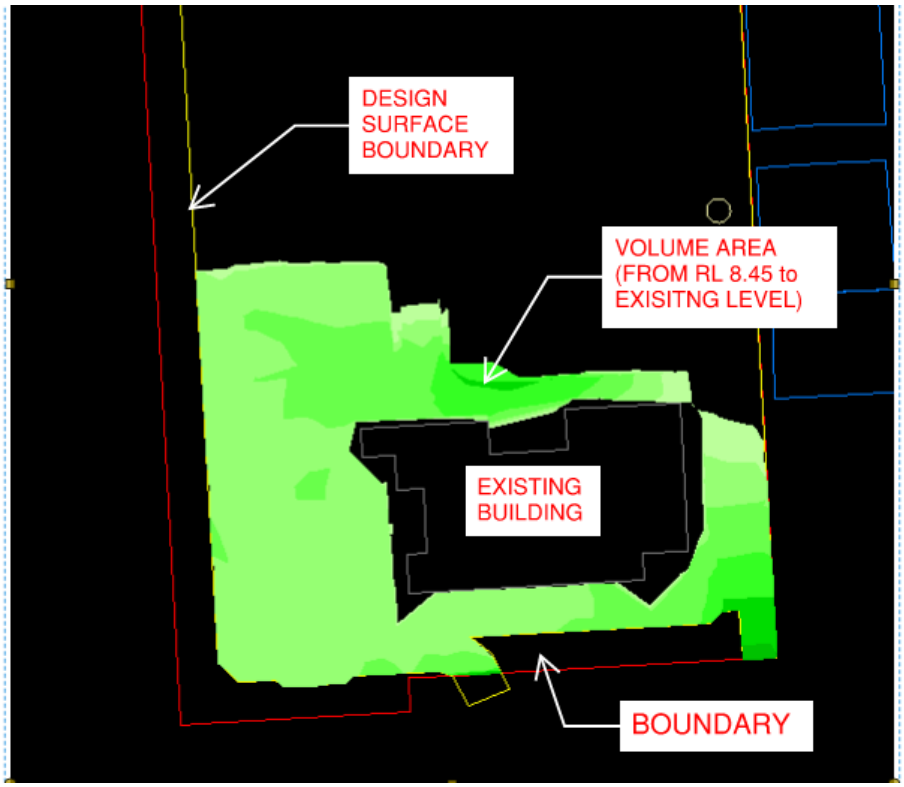


*Figure 10-Area used for 12d calculation*

```
Project:      Design
User:         jiheeh
Organization: Taylor Thomson Whitting (NSW) Pty Ltd
Date:         Mon Oct 21 17:40:13 2024
Report File:  Volume RL8450mm.rpt

Volumes from tin "Survey 150mm" to tin "VL RL8450mm" - (with plan polygon "RW")

   cut volumes are negative
   fill volumes are positive

=============================================================================================
------- Depth -------|------ Incremental ------|---------------- Accumulative -----------------|
    1         2      |    Cut          Fill    |      Cut            Fill           Balance     |
---------- ----------|------------ ------------|--------------- --------------- ---------------|

     0.000     0.250       0.000     1636.903          0.000        1636.903        1636.903
     0.250     0.500       0.000     1305.991          0.000        2942.894        2942.894
     0.500     0.750       0.000      277.005          0.000        3219.898        3219.898
     0.750     1.000       0.000       93.483          0.000        3313.381        3313.381
     1.000     1.250       0.000       19.611          0.000        3332.992        3332.992
     1.250     1.500       0.000        1.245          0.000        3334.238        3334.238
     1.500     1.750       0.000        0.000          0.000        3334.238        3334.238
     1.750     2.000       0.000        0.000          0.000        3334.238        3334.238
     2.000     2.500       0.000        0.000          0.000        3334.238        3334.238
     2.500     2.750       0.000        0.000          0.000        3334.238        3334.238
     2.750     3.000       0.000        0.000          0.000        3334.238        3334.238
     3.000   999.000       0.000        0.000          0.000        3334.238        3334.238

NOTE: Totals are for the above depth ranges only

Total cut                          0.000
Total fill                      3334.238
Total balance                   3334.238
ie excess of fill over cut      3334.238
```

*Figure 11 -12d – Volume calculation*

Based on the council DCP compensatory excavation needs to be provided to ensure that there is no net loss of floodplain storage volume below the 1% AEP flood. To satisfy this condition, the project civil design is modified to provide required storage volume within the proposed design. Two storage areas have been proposed. The first area where flood storage has been increased is along the emergency vehicle driveway, where the driveway grade has been lowered to 1% to ensure more volume under the flood level. The second area where flood storage has been increased is under the suspended slab of level 1. Excavation down to approximately RL6.00 is required, with a 1% grade excavated to the northern part of the suspended slab until the flood level at RL8.46. This allows for extra space under the flood level, increasing storage volume.  This is shown in Figure 12Figure 12 and Figure 13 and tabulated in Table 1.

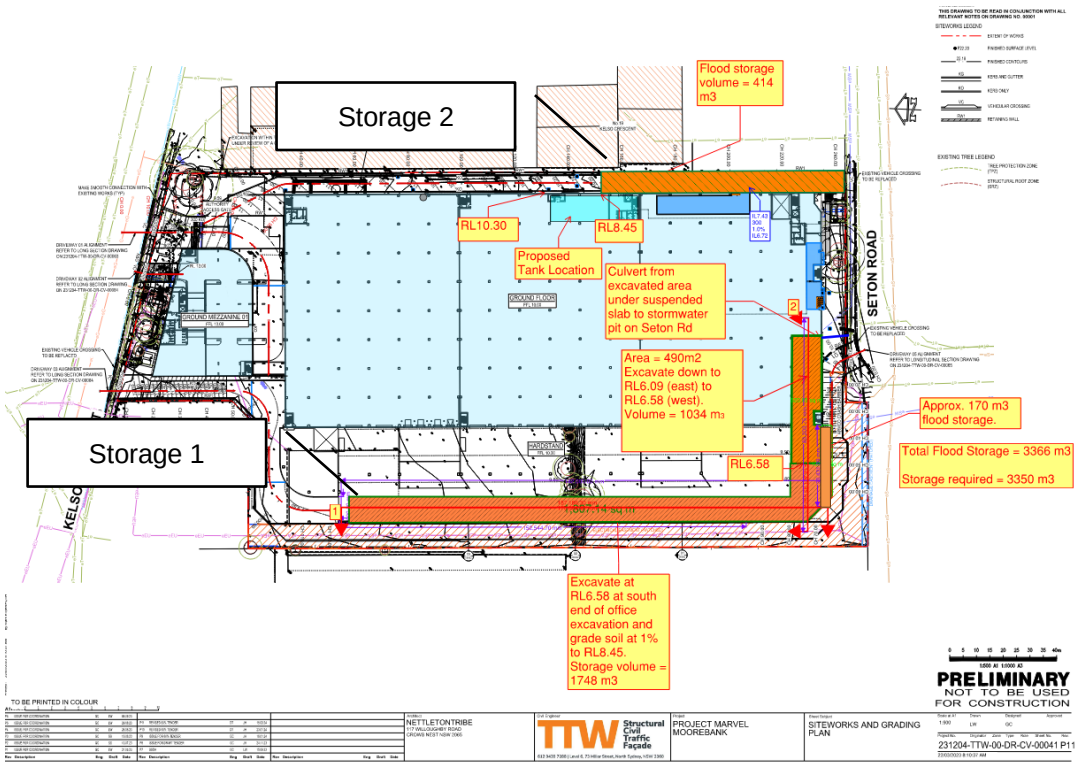


*Figure 12- Updated Civil Plan to accommodate flood volume*

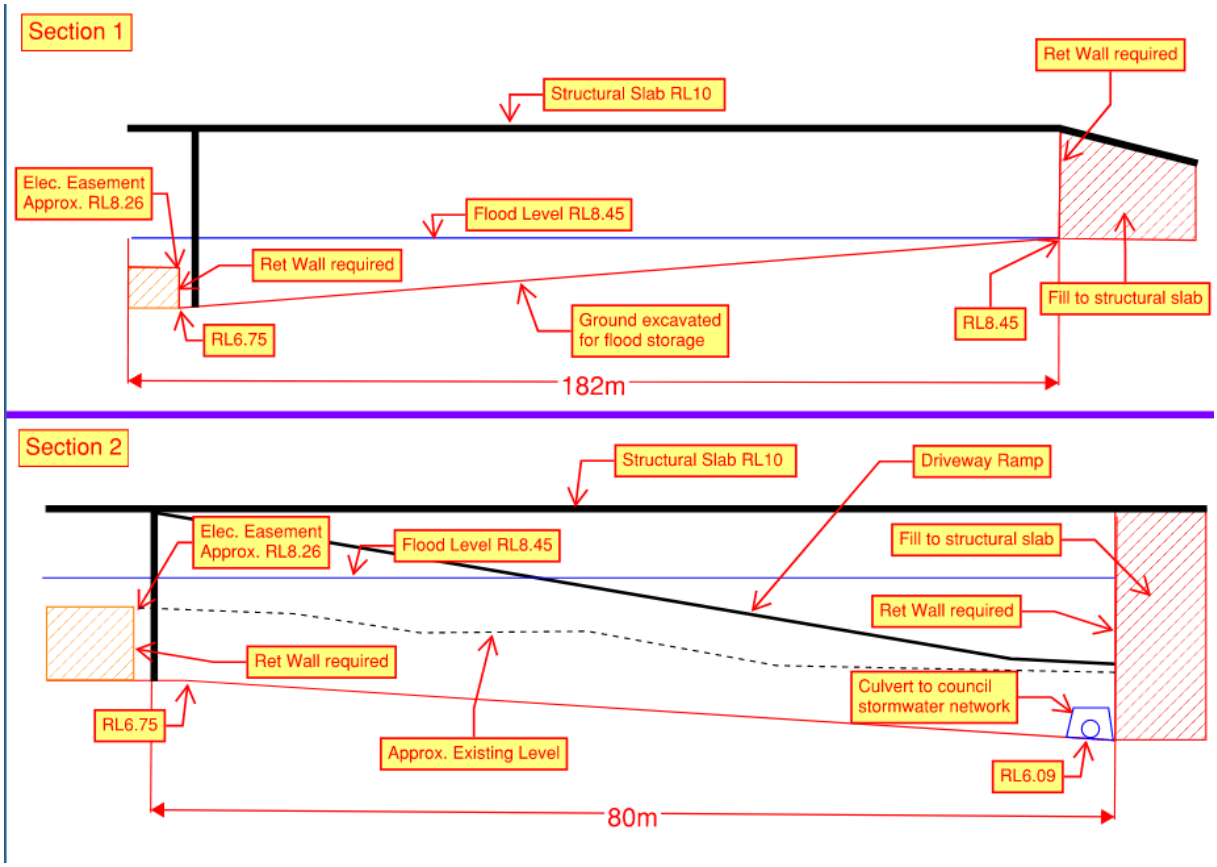


*Figure 13- Updated long section view for the proposed storages*

*Table 1- Provided Storage Volume*

| Storage | Volume (m3) |
|---|---|
| Storage 1 (Under the slab) | 2952 (1748+ 1034+170) |
| Storage 2 (Driveway) | 414 |
| Total | 3366 |

The storage areas are integrated into the proposed condition TUFLOW model as 1D elements, which no changes in flooding results are observed in the post-development scenario.

## 2.3 Post Development Flood Impact

A post-development flood impact assessment was also conducted for this study, and the results show no impact on surrounding properties during the 1% AEP storm event. The afflux map for 1% AEP storm is provided in Figure 14.

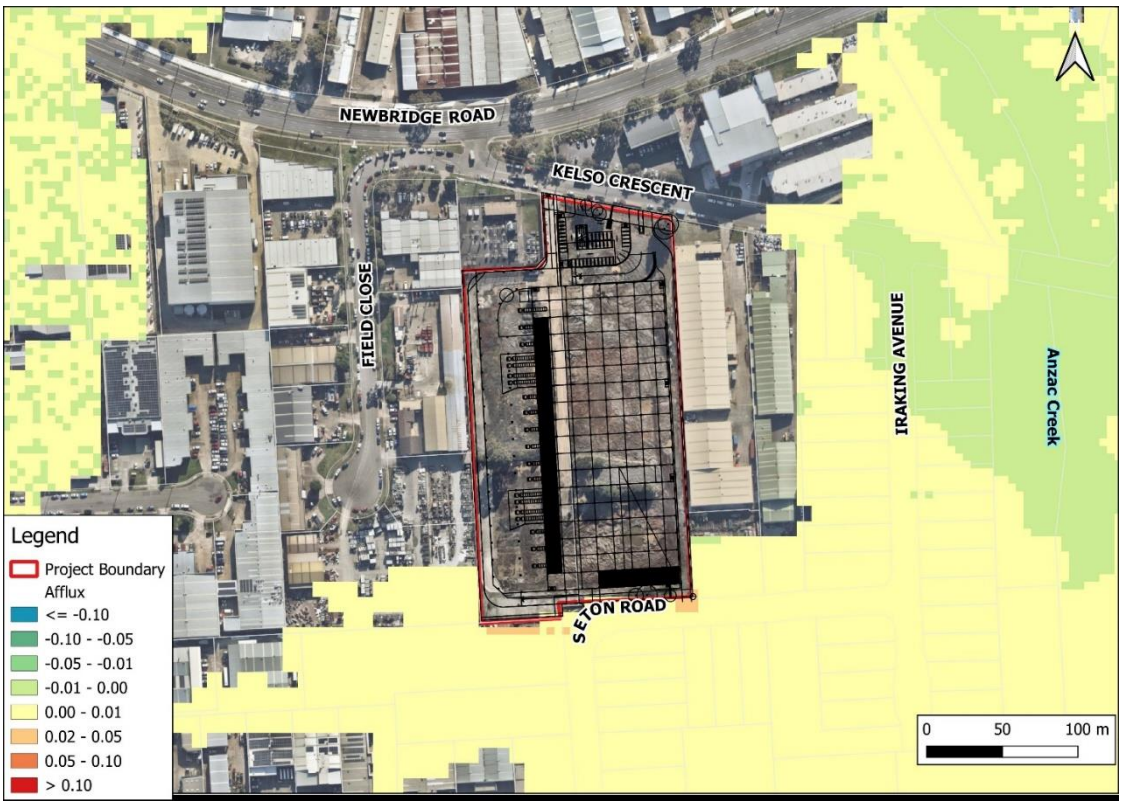


*Figure 14- Afflux map for 1% AEP storm event*

## 2.4 PMF Flood Modelling

PMF flood modelling was also conducted for this study. The results for the existing and post-development scenarios are presented in Figures 15 to 21. The findings show that the entire area is impacted during the PMF flooding, with only a flood island remaining to the northwest of the proposed development area. The flood depth is generally above 1 meter, with the flood level around 12.12 mAHD. The velocity is typically less than 0.5 m/s, and the hazard is predominantly categorized as H4 and H5. It should be noted that in the proposed condition, the development is nulled from the model. As a result, the flood maps show that the site is not impacted during the PMF event, which is inaccurate. The flood level at the site remains around 12.12 mAHD.

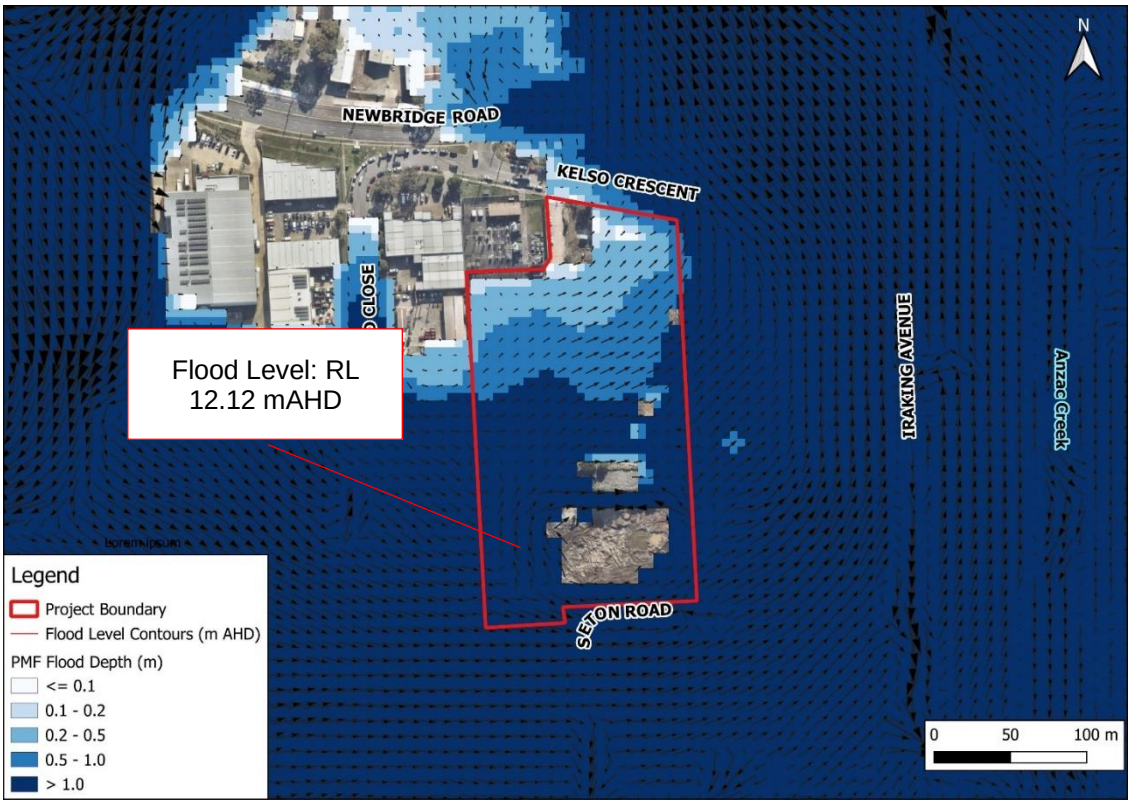


*Figure 15- Existing PMF Flow Depths and Levels*

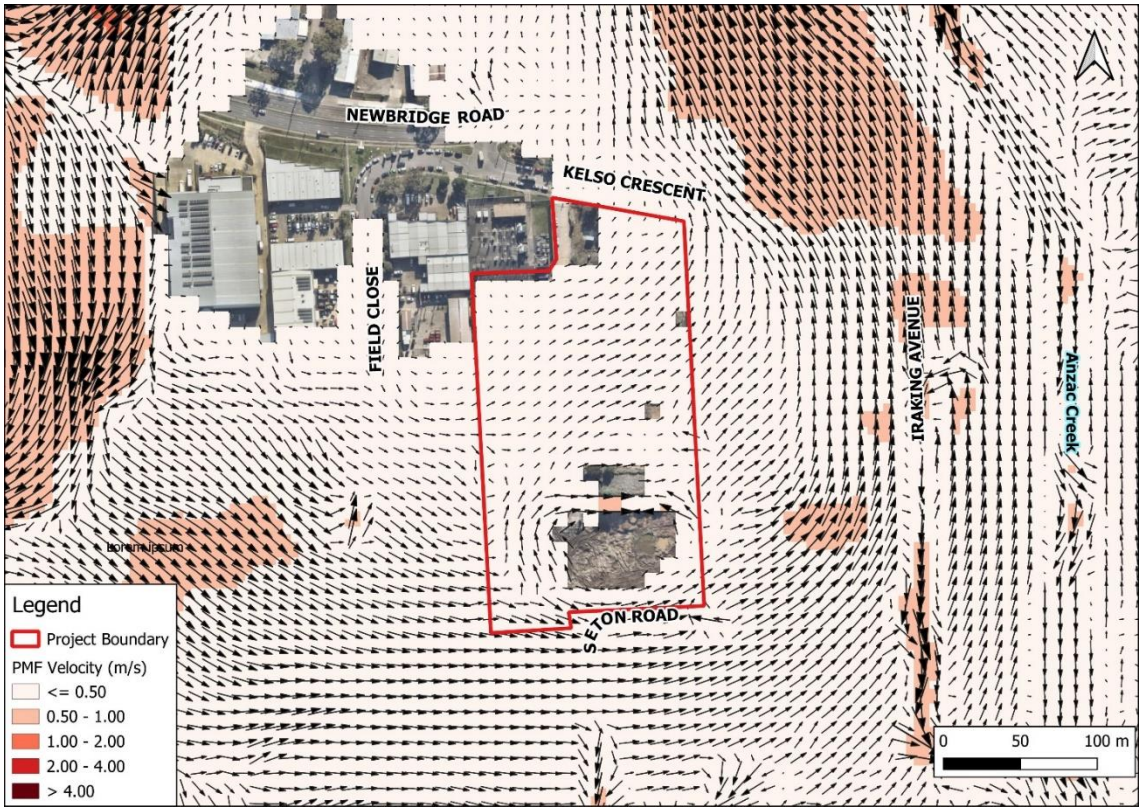


*Figure 16- Existing PMF Velocity*

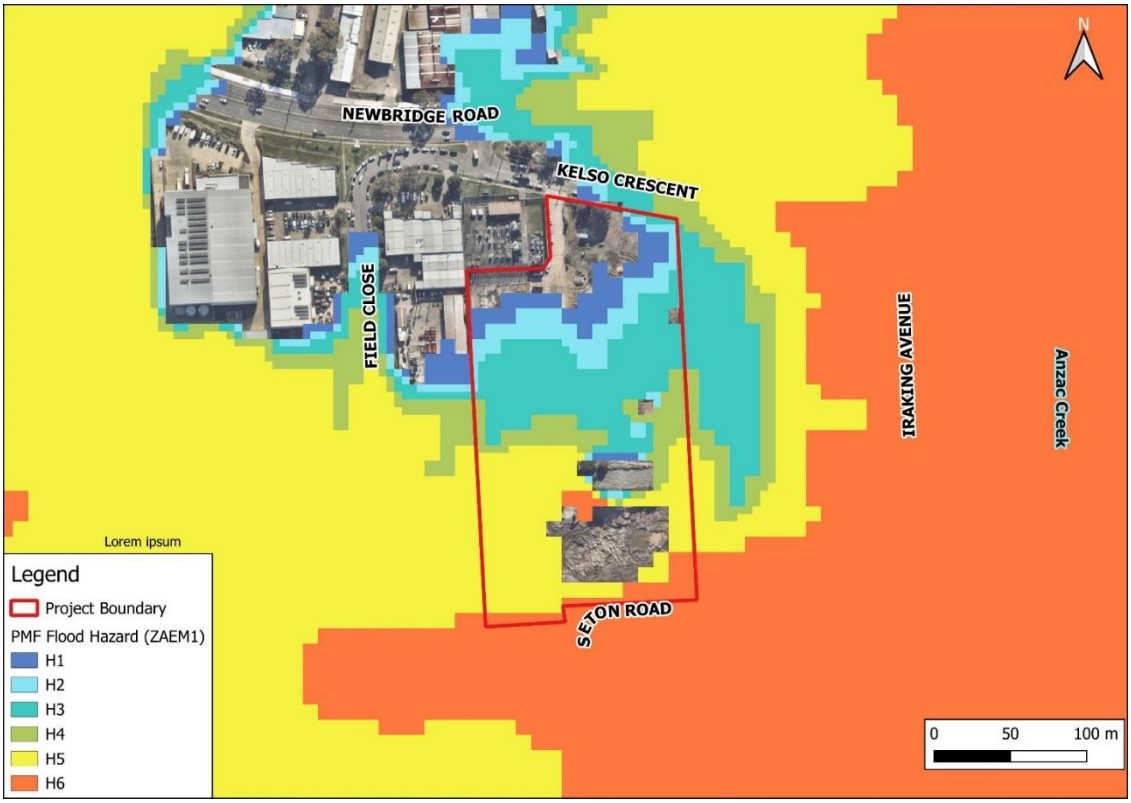


*Figure 17- Existing PMF Hazard (ZAEM1)*

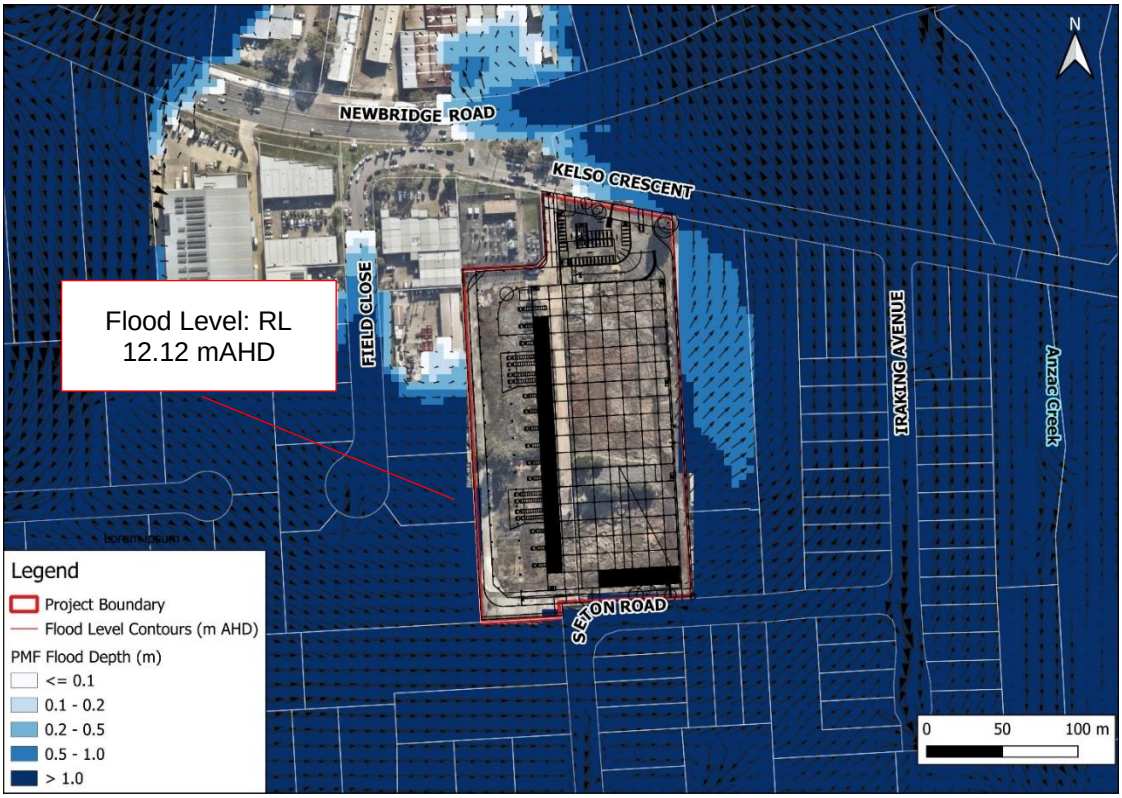


*Figure 18- Post Development PMF Flow Depths and Levels*

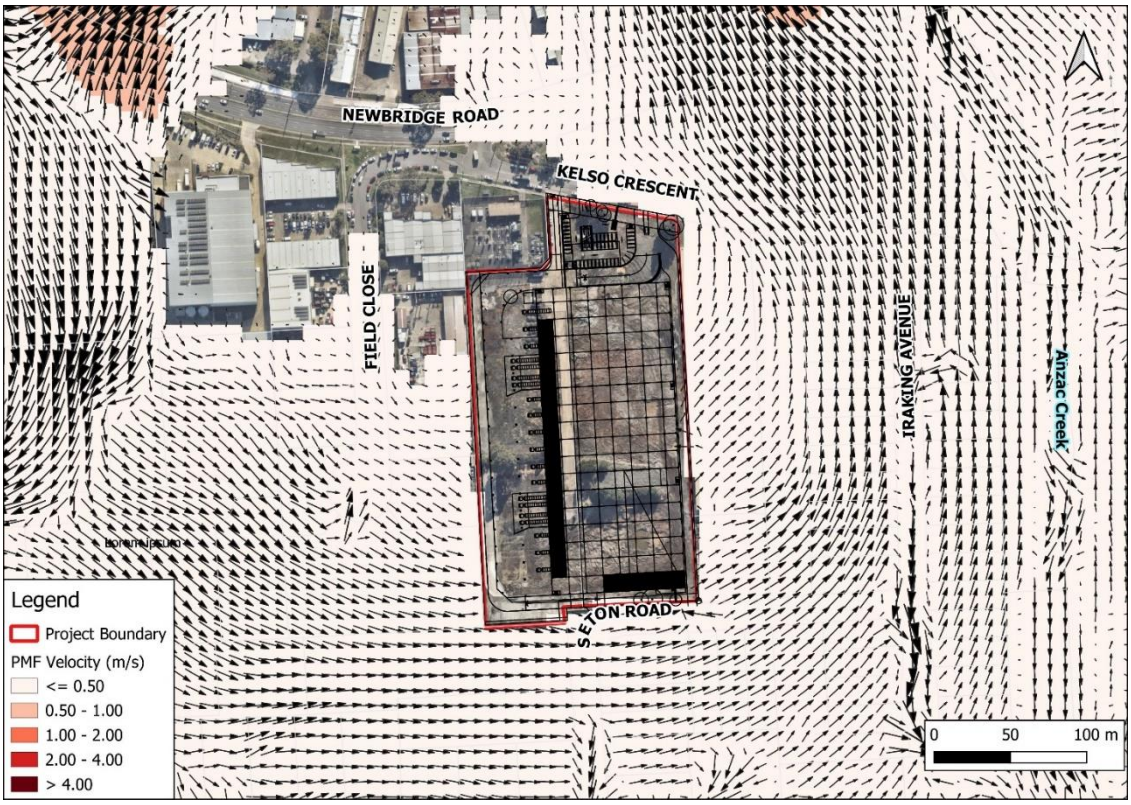


*Figure 19- Post Development PMF Velocity*

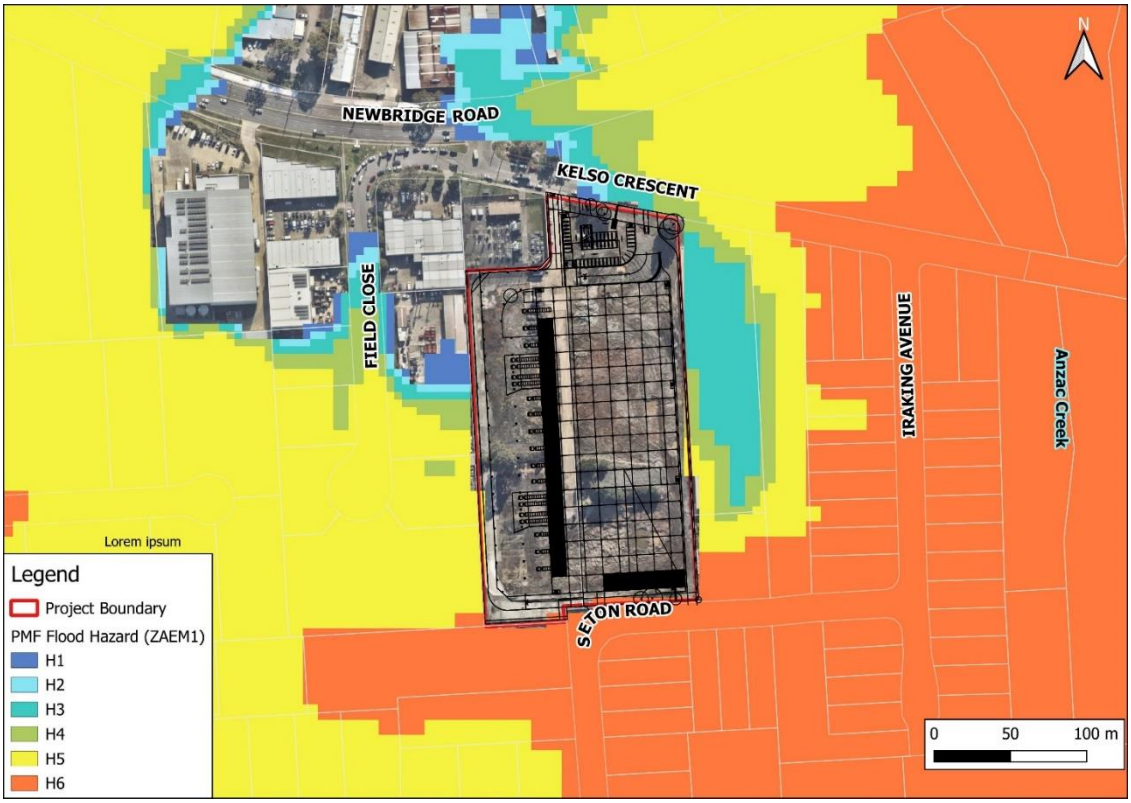


*Figure 20- Post Development PMF Hazard (ZAEM1)*

# 3.0 Conclusion

This Response to Submissions has been prepared to respond to submissions received following the submitted Flood Impact Assessment to support the State Significant Development Application (SSDA) for the proposed logistics centre at 20 Kelso Crescent, Moorebank.

This report references the Anzac Creek Floodplain Risk Management Study and Plan, while also incorporating feedback from Liverpool City Council and the Department of Climate Change, Energy, the Environment, and Water (BCS), which recommended utilising the Georges River Flood Study and Model to assess flooding risks.

The assessment shows that the proposed development has no significant impact on the surrounding properties or flood behaviour. The detailed modelling, which incorporates the latest topographic survey data and compensatory flood storage measures, confirms that the flood levels and hazards remain consistent with the existing conditions.

To mitigate the cumulative flood impacts, compensatory flood storage has been provided through modifications to the civil design, including excavation along the vehicle driveway and under the ground floor slab along the western boundary of the site. The proposed flood storage areas have been integrated into the TUFLOW model, showing no change in flooding results post-development. Additionally, PMF flood modelling indicates that the site remains impacted during the PMF event, with flood depths exceeding 1 metre and flood hazards categorized as H4 and H5.

It is important to note that Section 5.11 of the Flood Risk Management Report, issued by TTW on 13 September 2023, remains valid and is fully applicable to this assessment. This report should also be read in conjunction with the Flood Emergency Response Plan that has been prepared for the development.

Prepared by
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**Senior Civil Engineer**
CPEng, EA ID: 5293949

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# Appendix A

# Response to Submissions

| **Department of Climate Change, Energy, the Environment and Water (16 July 2024)** | |
|---|---|
| **Comment** | **TTW Response** |
| A shelter in place strategy for this development is not recommended and would not be consistent with the existing emergency management arrangements. The potential for secondary risks such as those resulting from fire and medical emergencies, as well as risks resulting from human behaviour need to be addressed. Occupants may attempt to evacuate by car despite a shelter in place strategy and encounter dangerous floodwater | Noted. A separate Flood Emergency Management Plan (FEMP) has been prepared for the proposed development. |
| Bulk earthworks have been proposed to facilitate the construction of building pads, basements and foundations for the warehouses. For the southern portion of the site, which is a flood storage, this area would be filled to prepare the building pads and the ancillary structures. BSC recommends compensatory storage be required to avoid cumulative impacts on flood behaviour. | Noted. Compensatory storage has been provided for the proposed development. Please refer to Section 2.2 of this report for details. |
| BCS notes section 2.7 of the EIS advises the site 'can be serviced immediately and at no cost to Government'. However, BCS notes that in major flooding events the site would be isolated for an extended duration and roads do not have sufficient capacity to evacuate | Noted. A separate Flood Emergency Management Plan (FEMP) has been prepared for this development to facilitate evacuation during major flooding. |
| Section 3.1 of the EIS indicates development of the site would include 'suitable mitigation measures where required, to minimise any unforeseen impacts arising in the future'. Measures to manage the flood risk have not been addressed and documented in the EIS and Flood Report. BCS considers that a strata arrangement with multiple lot owners would increase the flood risk compared to a single owner due to the increased complexity of emergency management | The EIS has been prepared in accordance with the Liverpool Council DCP and satisfies the required conditions to minimize flood impacts. Additionally, a Flood Emergency Management Plan (FEMP) has been developed for this project to reduce risks during evacuation. |

| Liverpool City Council (1 July 2024) | |
|---|---|
| **Comment** | **TTW Response** |
| The submitted Flood Impact Assessment report indicates that the development will fill the floodplain by approximately 7,500 m³. According to Council policy, there must be no net loss of flood storage volume below the 1% AEP flood level. Therefore, the design must be amended to include compensatory excavation, to ensure that the development does not result in any net loss of flood storage volume below the 1% AEP flood level. The Flood Impact Assessment Report shall be revised including the details of flood compensatory works, pre- and post-development flood storage volume calculations and a plan showing the location of flood compensatory excavation works. | Noted. Compensatory storage has been provided for the proposed development. Please refer to Section 2.2 of this report for details. |
| The Flood Report by TTW has not provided any detail about flood emergency response plans for the site. The report has only indicated a 'shelter-in-place' approach as the flood emergency management response for the site. However, the flood duration of the proposed development site is greater than 24 hours. Therefore, 'shelter-in-place' is not an acceptable flood emergency management response for the development site. | Noted. A separate Flood Emergency Management Plan (FEMP) has been prepared for the proposed development. |
| The proposed development site is located within the Liverpool Collaboration Area. Molino Stewart Pty Ltd, engaged by Council, conducted the Georges River Evacuation Modelling to examine flood evacuation challenges for the Moorebank Peninsula and Liverpool Collaboration Area. According to the Georges River Evacuation Modelling report (dated March 2022), the proposed development site faces significant flood evacuation constraints and will be completely isolated during the 1% AEP flood event | Noted. Georges River evacuation report which is prepared by Molino Steward Pty Ltd is used for preparing flood emergency report |
| | Noted. The Georges River evacuation |

| | |
|---|---|
| The applicant shall prepare a comprehensive Flood Emergency Response Plan (FERP) to ensure the safety of people during floods up to and including the Probable Maximum Flood. The FERP should be developed in consideration of the findings from the Georges River Evacuation Modelling report by Molino Stewart (dated March 2022) and in accordance with the NSW Flood Manual (2023) toolkit: 'Support for Emergency Planning—Guidance Template FMP1'. The NSW State Emergency Service (NSW SES) should be consulted during the preparation of the FERP. | report, prepared by Molino Stewart Pty Ltd, was used in the preparation of the flood emergency report. |