Illawarra Retirement Trust

Level 3, 77 Market Street
Wollongong NSW 2500

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31 May 2024

Attention: Mr Liam Allen

Dear Liam,

Re: IRT Towradgi Park Proposed Redevelopment
Eastern Apartment and Flood Storage Analysis

1. BACKGROUND

WMAwater was engaged by Illawarra Retirement Trust (IRT) to undertake a site-specific flood assessment for a proposed redevelopment of the Towradgi Park Retirement Village located at 17A Murranar Road, Towradgi. WMAwater's latest report (dated 19 December 2023, Reference 1) assessed compliance with Wollongong City Council's (WCC) flood-related development controls (Reference 2). In particular, the report identifies a flood planning level of 5.45 mAHD, which is 0.5 m above the PMF level. The internal road is also at this level, to facilitate ease of access to ground floor villas and apartments. There are three proposed basements underneath apartment blocks, located at Murranar Road, Edgar Street and to the south of the site. While the vehicle crest would be at the internal road level (and above the PMF level), it was conservatively assumed that walls (to be designed during detailed design) would protect the entry ramp to the same level, thus providing protection for the basements up to the PMF level. It is recognised that this approach is conservative and the WCC DCP (Reference 2) only requires basements to be protected to the 1% AEP level + 0.2 m freeboard.

IRT is investigating the potential for a fourth apartment block to be located on the eastern portion of the site. The proposed apartment block would have a basement carpark, and as such would reduce the available above-ground flood storage on the site. This letter provides information regarding the potential loss of flood storage and a re-assessment of on-site flood storage by accounting for storage within the basements.

2. CURRENT DESIGN

The current design for the IRT Towradgi Park site, as documented in Reference 1, allows for a significant portion of the site to act as flood storage. This was designed to ensure that there was no net loss of floodplain storage up to the PMF level (4.95 mAHD). An assessment of the flood storage was undertaken as outlined in Section 4.10 of Reference 1. This assessment relied on the existing and proposed terrain across the site to estimate the available flood storage at certain elevations. A comparison of the existing and proposed flood storage was provided in a diagram format (Diagram 1 in Reference 1), which demonstrated an increase in flood storage for all flood levels up to the PMF. The flood assessment conservatively assumed that proposed apartment basements were protected to the PMF level (i.e. do not contribute to flood storage).

The performance of the flood storage was ultimately demonstrated with the site-specific flood modelling that was undertaken. This demonstrated that there were no off-site flood impacts across a range of flood events and scenarios. This flood modelling accounts for the development as a whole (i.e. flood storage considerations, but also conveyance of water through the site, performance of proposed hydraulic structures, blockage due to buildings, etc). The flood modelling also assumed no inundation of the basements.

3. PROPOSED EASTERN APARTMENT

IRT is investigating an alternative to the existing unit block situated on the eastern side of the site, comprising an apartment block. A design for the apartment block can be seen in Diagram 1. The proposed unit block is elevated to provide flood storage underneath the development, while the alternative apartment block will include basement carparking (Diagram 2). As such, there would be a loss of floodplain storage.

Diagram 1: Alternative design for the eastern units consisting of an apartment block

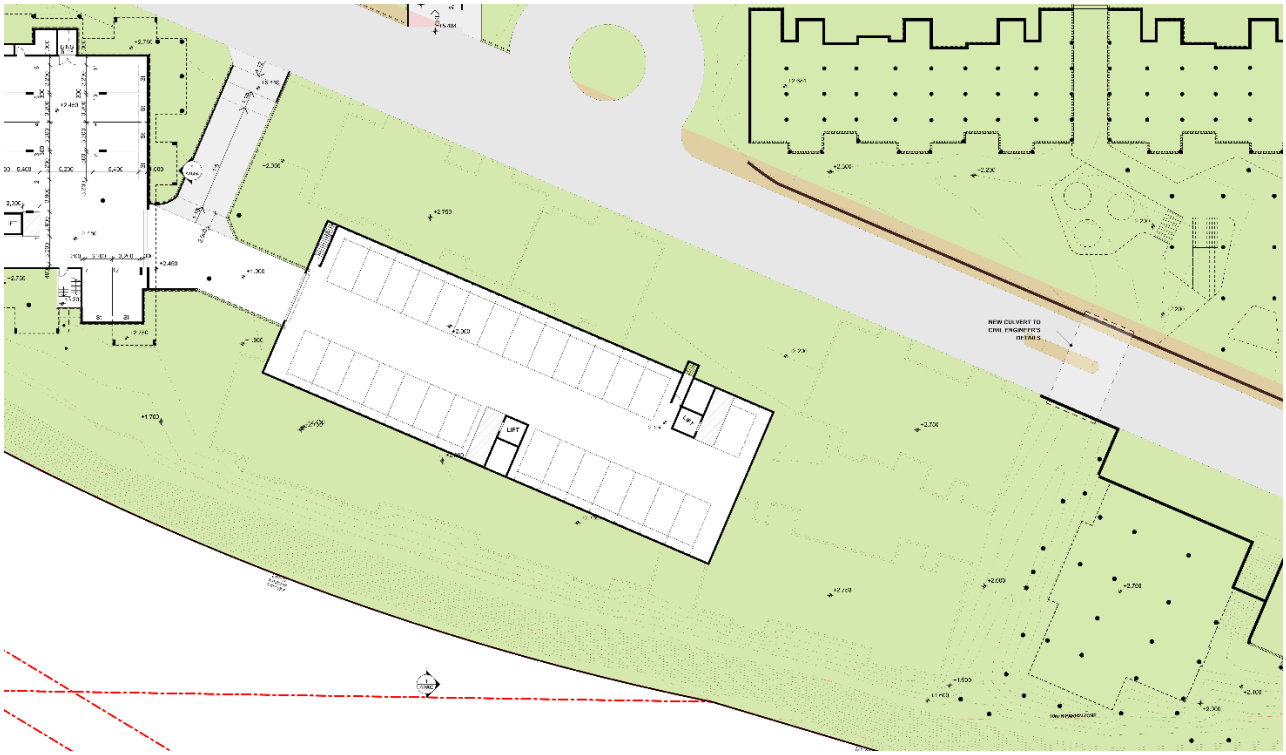

Diagram 2: Basement area for the eastern apartment block

Based on the current proposed terrain, a flood storage analysis was undertaken in a similar manner to that undertaken for Reference 1, with a portion of flood storage removed for the provision of the basement carpark. The assumption regarding the protection of the basements to the PMF level was retained. The difference in flood storage between the existing conditions and proposed conditions with the apartment basement is shown in Diagram 3. This indicates a reduction in the available flood storage (due to the new basement), across the full range of levels compared to the Development Application (DA) plan. Of particular note is that the flood storage crosses above ‘zero’ at approximately 4.55 mAHD. That is, there is now a net fill on the site above those levels compared to the existing condition (i.e. a reduction in available flood storage).

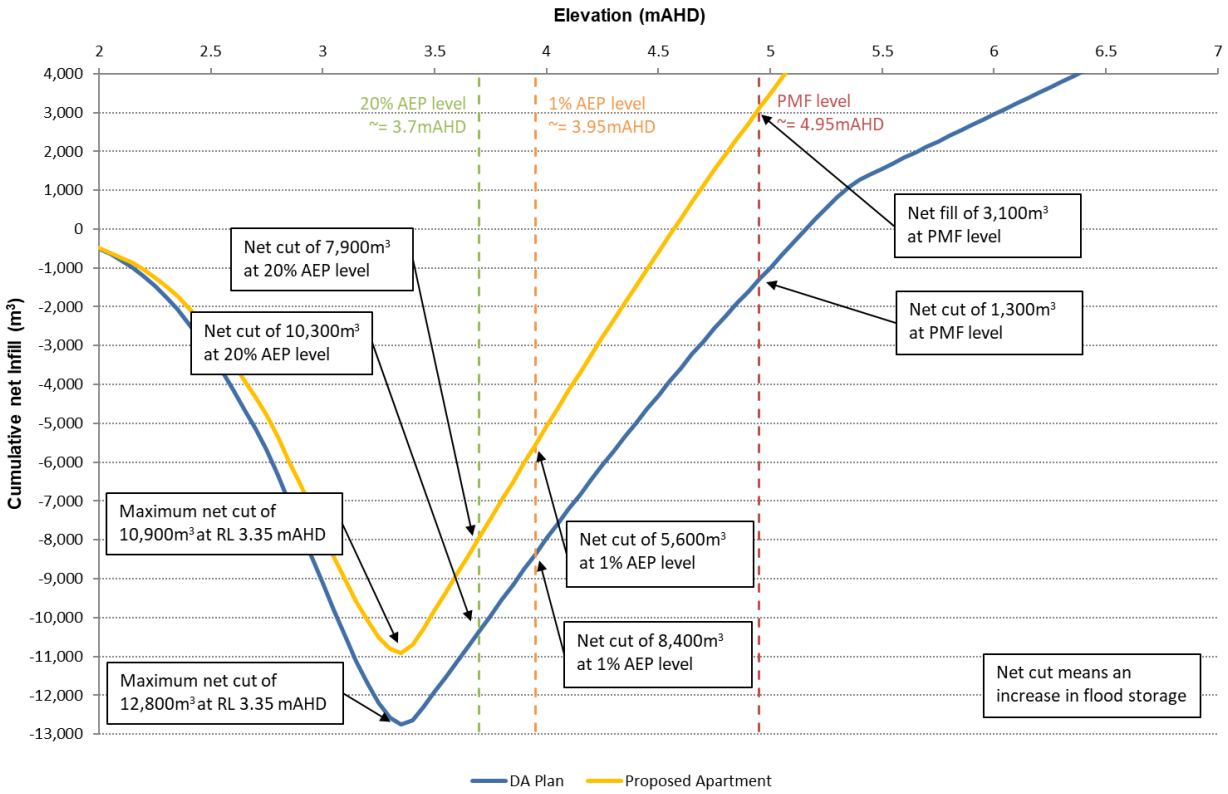

Diagram 3: Comparison of flood storage between the proposed condition and existing condition, with both the existing DA design and alternative apartment design. This assumed no inundation of the basements on site.

4. FLOOD STORAGE IN BASEMENTS

It is recognised that the previous assessment conservatively assumed that the basements would be protected to the PMF level, and would not contribute to flood storage. The basement entry points, however, have a minimum requirement of the 1% AEP flood level plus 0.2 m freeboard in accordance with WCC's DCP (Reference 2). WCC has determined that the acceptable level of risk for basement inundation is the 1% AEP event. As such, the basement crest levels can be at 4.15 mAHD (1% AEP + 0.2 m). This would mean that the basements would be subject to inundation when flood levels exceed 4.15 mAHD and there would be a reasonable volume of flood storage available that was not accounted for in the previous assessment.

A preliminary analysis of the available storage within the basements was undertaken using basement areas provided by IRT. It was assumed that 50% of the basement volume would be available for flood storage (to account for columns, cars, bins, utilities, etc). A summary of the basement characteristics is provided below in Table 1. A floor to ceiling height of 2.7 m was assumed, although it is noted that the entire basement level would not be flooded to the ceiling in the PMF event.

Table 1: Summary of apartment basement characteristics

Apartment Location	Area (m^2)	Floor Level (mAHD)	Ceiling Level (mAHD)	Assumed Flood Storage Available
Murranar Road	835	2.45	5.15	50%
Edgar Street	971	2.45	5.15	50%
Southern	578	2.45	5.15	50%
Proposed Eastern	1100	2.45	5.15	50%

While the minimum crest level (the level at which the basement is open to the surrounds and water can begin entering) is 4.15 mAHD, it is desirable to implement a crest level as high as possible to afford a greater level of protection of the basement. This would reduce the potential for flood damage and risk to life. Based on the assessment of flood storage provided in Section 3, additional flood storage is required only above a level of 4.55 mAHD. As such, this assessment assumes that the crest level of the basements to be at 4.55 mAHD, as the function of the basements (from a flood perspective) is to provide the required flood storage. This provides an additional 0.4 m of protection above the required minimum level as stipulated in WCC's DCP (Reference 2).

Assuming that each of the four basements have a crest level at 4.55 mAHD, the flood storage curve was revised to include the flood storage within the basements (Diagram 4). At 4.55 mAHD, the flood storage within the basements is activated and at the flood storage curve closely follows the DA plan, with an increase in flood storage of approximately 1,300 m^3 at the PMF level compared to the existing conditions. This meets WCC's requirements regarding flood storage up to the PMF level and exceeds WCC's requirements for minimum entry points for basements.

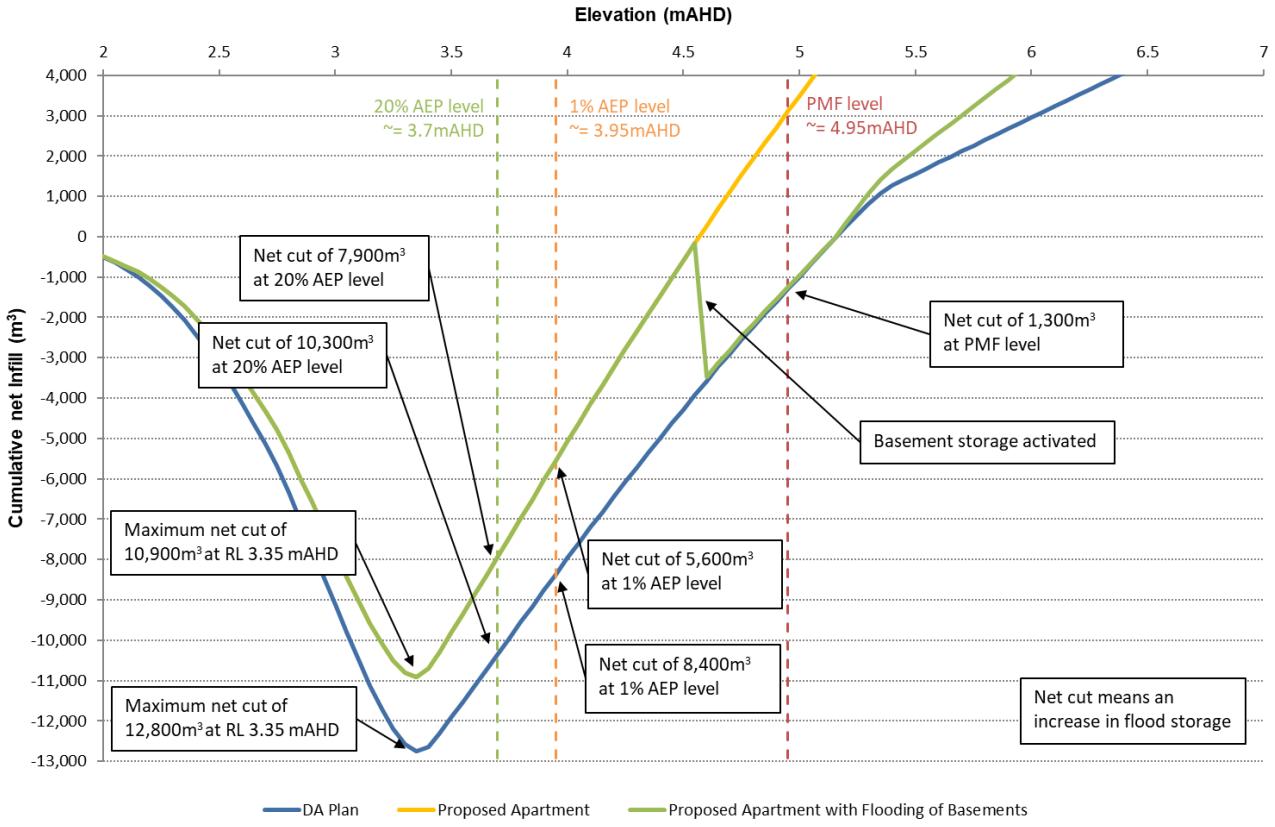

Diagram 4: Comparison of flood storage between the proposed condition and existing condition, with both the current DA design, alternative apartment design and alternative apartment design with flooding of the basements included

5. FLOOD RISK

It is also noted that the evacuation potential as outlined in Section 4.16 of Reference 1 would only be partially valid. While there would be no change to flood risk for ground floors and upper levels across the site, the flood risk in the basements would increase. The previous assessment conservatively assumed that the basements would be protected to the PMF level. The current assessment assumed that inundation of basements would occur for infrequent events in accordance with the DCP (Reference 2). The proposed crest level of the basements, at 4.55 mAHD, is 0.6 m above the 1% AEP flood level, and 0.4 m lower than the PMF level. Intermediate events between the 1% AEP and PMF were not simulated, however, the level of 4.55 mAHD would be greater than a 0.2% (1 in 500) AEP, and potentially much higher. In addition to this, climate change sensitivity results for the 1% AEP event (see Reference 1) indicated that the 1% AEP results may be up to 0.25 m higher at the site considering a 20% increase in rainfall intensity and 0.9 m sea level rise. The basement entry points are still well above these levels, indicating that protection above the 1% AEP into the future.

While the likelihood of inundation of the basements as proposed here is rare (nominally above the 0.2% AEP), it poses a high hazard. This is because when water levels on the site rise above the crest level of the basement entry points, water will quickly flood the basements to hazardous depths. Historic occurrences of basement inundation indicate a duration to inundate in the order of 15 minutes (Reference 3). Given the nature of flooding on the site and the extreme event required to inundate the basements, the time to inundate the basements may be quicker than this. Evacuation of the basements to upper levels prior to water entering the basement will be essential in extreme flood events to reduce risk to life.

A previous letter-style report was prepared for IRT outlining the rate of rise and duration of inundation of the site (Reference 4). The outcomes of this report would remain the same and the results can be used to infer warning times for the inundation of basements. The following is noted:

- The 60 minute PMF event reaches a level of approximately 4.4 mAHD and would not inundate the basements
- The 120 minute PMF event reaches a level of approximately 4.95 mAHD within 130 minutes, with the crest level of the basements (4.55 mAHD) reached after approximately 95 minutes from the onset of rainfall.

6. CONCLUSIONS

This preliminary assessment demonstrates that the implementation of an eastern apartment block (as an alternative to the current DA design for elevated units) reduces the available flood storage on site such that there is a net infill above 4.55 mAHD, up to the PMF level of 4.95 mAHD. This assessment conservatively assumed no inundation of the basements (that they would be protected to the PMF level). The WCC DCP requires basement entry points to be at the 1% AEP + 0.2 m (crest level 4.15 mAHD for this site) and as such inundation of basements would be expected in events larger than the 1% AEP. The volume within the basements would contribute to the available flood storage on site. A higher crest level (4.55 mAHD) than the minimum required was identified as the level at which flood storage would be required. If the basement entry points are provided at the level of 4.55 mAHD (above the minimum required), the combined flood storage within open areas of the site and within the basements would provide the required volume to meet the existing conditions flood storage on site. This would meet (and exceed) the requirements of WCC's DCP (i.e. there is no net loss of flood storage up to the PMF and basement entry points to be at the 1% AEP level + 0.2 m).

If the eastern apartment block is to be adopted and it is assumed that basements contribute to flood storage, the following is to be undertaken:

- Flood modelling will need to be updated with the proposed eastern apartment and the inundation of the basements in the PMF event. The modelling will support this initial assessment and demonstrate that there are no adverse off-site impacts.
- Flood risk will need to be considered with regard to inundation of the basements. Basements will require evacuation in extreme events. It is understood that IRT has engaged a consultant to prepare the Flood Risk Management Plan for the site considering the inundation of basements to address this risk.
- There should be restrictions placed on the basement crest levels to ensure that these are not modified or raised, including the installation of flood barriers (manually operated or automatic). The basements above a level of 4.55 mAHD provide the required flood storage on site and this should not be modified. This could be implemented in a similar manner to the way that restrictions are placed on raised buildings to ensure that the undercroft opening is maintained.

Please do not hesitate to contact me for clarification of the above.

Yours Sincerely,

WMAwater

Michael Reeves

Principal

References

1. WMAwater
   IRT – Towradgi Park Proposed Redevelopment Assessment of Compliance with Flood-Related Development Controls
   Prepared for Illawarra Retirement Trust, 19 December 2023

2. Wollongong City Council
   Wollongong Development Control Plan
   2009 (updated 2020)

3. 7 News
   Traralgon parking garage completely flooded in incredible CCTV as rain batters Gippsland
   <https://7news.com.au/weather/severe-weather/traralgon-parking-garage-completely-flooded-in-incredible-cctv-as-rain-batters-gippsland-c-3073627>
   11 June 2021

4. WMAwater
   WIRT Towradgi Park Proposed Redevelopment Rate of Rise and Duration of Inundation Analysis
   2 April 2024