ABN : 55 616 964 517
Level 1, 50 Yeo Street
Neutral Bay NSW 2089
Australia
contact@rhelm.com.au

23 February 2024

Our ref: RL-01-2001-03

Mark Raikhman
Department of Planning, Housing and Infrastructure
Level 31, 4 Darcy Street
Parramatta NSW 2150

Via Email: mark.raikhman@dpie.nsw.gov.au

RE: Peer Review of the Flood Study for the 43-65 Cowper Street, Warrawong State-Assessed Planning Proposal (SAPP) Pilot Program

Dear Mark,

Rhelm Pty Ltd (Rhelm) have been commissioned by the NSW Department of Planning, Housing and Infrastructure (DPHI) to peer review the flood report and mapping associated with the Planning Proposal for Warrawong Plaza at 43-65 Cowper Street, Warrawong (the **Site**).

This planning proposal was lodged under the State-Assessed Planning Proposal Pilot Program on 14 September 2023. A revised proposal dated 15 December 2023 was later lodged and Rhelm has peer reviewed the following documents accompanying this revised planning proposal:

- Warrawong Plaza Planning Proposal – Flood Assessment Report (Water Technology, dated 20 December 2023),
- Flood Impact Assessment Report Warrawong Plaza Redevelopment (Water Technology, dated 19 December 2023).

This letter details the findings our peer review.

Site Context

The site currently exists as a major shopping centre and is zoned as E2 Commercial Centre under the Wollongong Local Environment Plan 2009. The applicant, Elanor Investors Group, has submitted a planning proposal to:

- retain existing zoning but make residential flat buildings an additional permitted use,
- increase the allowable building height,
- include the site as a Key Site, and
- introduce a new site-specific clause in Wollongong City Council's Local Environmental Plan.

The site is located within the extent of two floodplains:

- Lake Illawarra floodplain (mainstream flooding associated with the lake, see **Figure 1**)
- Kully Bay floodplain (local overland flooding). The site is bisected by an existing underground culvert (2500 mm by 900 mm, see **Figure 2**).

The extent of the floodplain (as defined by the Probable Maximum Flood) under the current conditions is shown in **Figure 1** and **2** below.

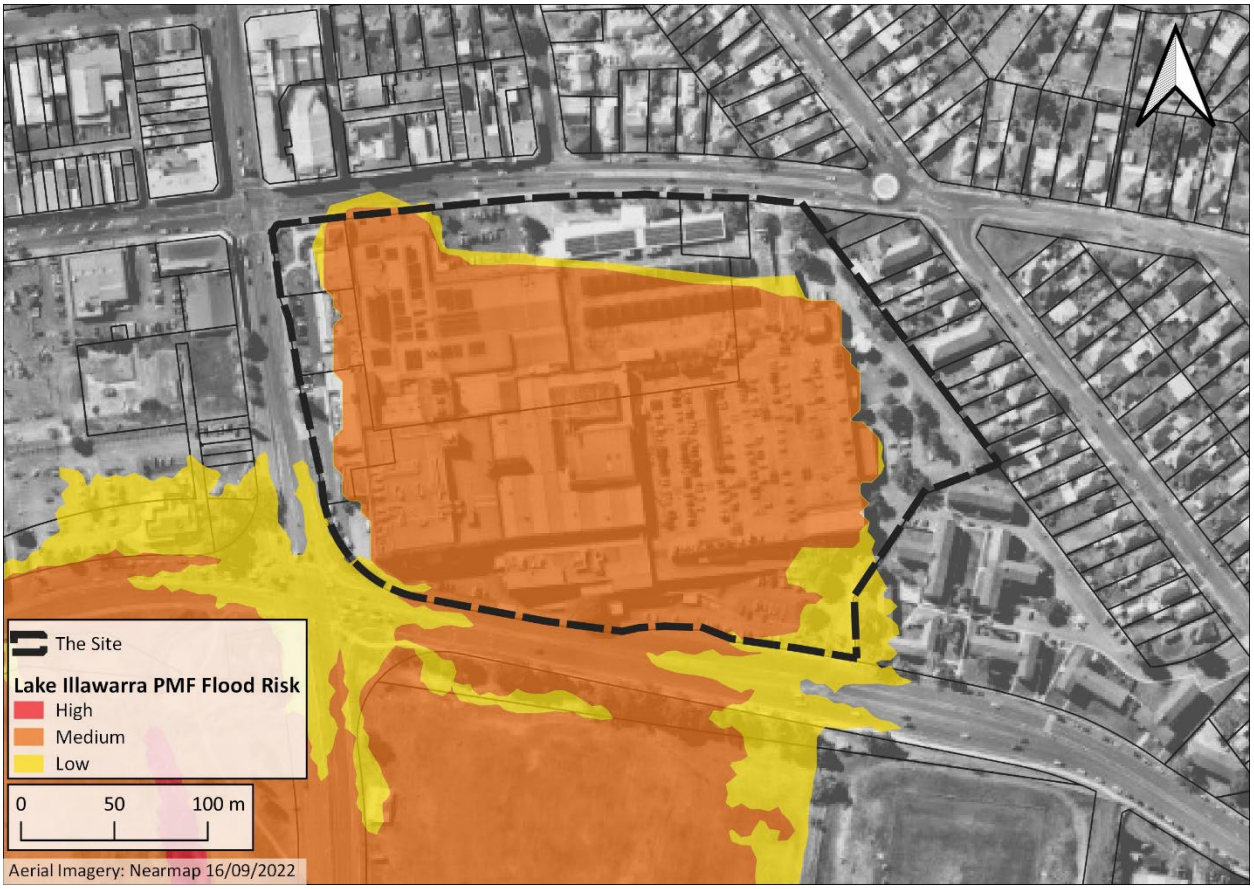

Figure 1 Lake Illawarra PMF Hazard and Extent

However, it is noted that the applicant has updated the Lake Illawarra floodplain extents using the available design flood level for the Lake using more recent and accurate topographic data showing that much less of the site is within the floodplain (refer figure 12 of the Warrawong Plaza Planning Proposal – Flood Assessment Report, dated 20 December 2023).

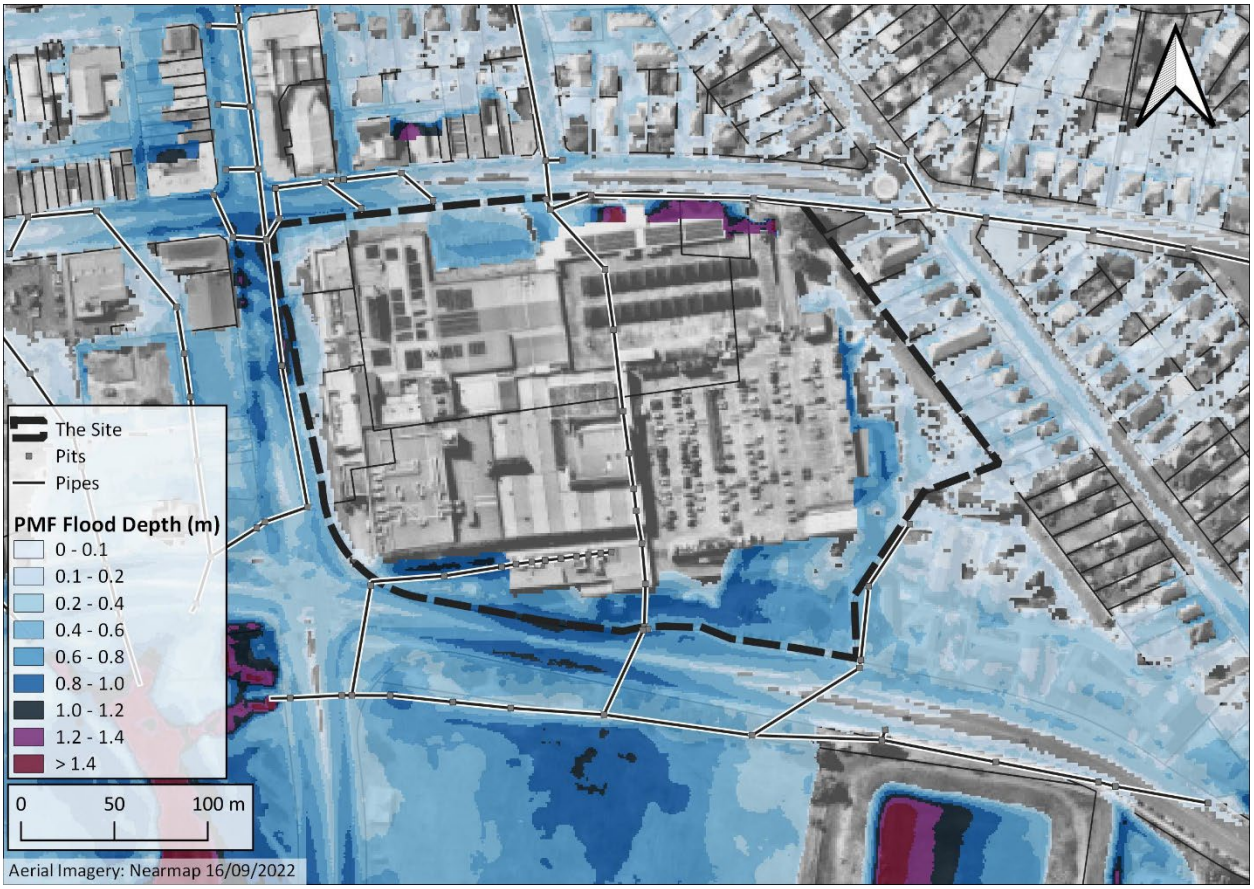

Figure 2 Kully Bay Overland Flow Study PMF Depths and Extent

Peer Review

The peer review of the flooding component of the Cowper Street, Warrawong SAPP is provided in the table below.

It should be noted that no review of numerical model files associated with the flood studies has been undertaken, with this advice focusing on issues that may have a significant impact on project outcomes and/or the design of mitigation/management measures rather than the specific modelling details. These are discussed below.

Cowper Street, Warrawong State Assessed Planning Proposal Overview	
Relevant planning documents	• Wollongong Local Environment Plan (LEP) 2009 • Wollongong Development Control Plan (DCP) 2009 • Section 9.1(2) Local Planning Directions (March, 2023)
Relevant project documentation	• Warrawong Plaza Planning Proposal – Flood Assessment Report (Water Technology, dated 20 December 2023) • Flood Impact Assessment Report Warrawong Plaza Redevelopment (Water Technology, dated 19 December 2023)
Related flood studies	• Kully Bay Overland Flow Study (Rhelm, 2019) • Lake Illawarra Floodplain Risk Management Study (FRMS) (Cardno, 2012) • Lake Illawarra Floodplain Risk Management Plan (FRMP) (Cardno, 2012)
Rhelm Review Findings	
Flood Impact Assessment Report Warrawong Plaza Redevelopment (Water Technology, dated 19 December 2023)	
General	The applicant has undertaken modelling to assess the flooding impacts of the proposed reference design. The Kully Bay Overland Flow Study (Rhelm, 2019) TUFLOW model has been used as the basis for this, and the following events have been modelled, in line with Wollongong City Council's DCP Chapter E13: Floodplain Management: • 20% Annual Exceedance Probability (AEP) • 1% AEP • 1% AEP + Climate Change (2050 and 2100) • Probable Maximum Flood (PMF) • PMF + Climate Change (2100). The site is affected by both overland flow from the Kully Bay Catchment and longer duration mainstream flooding from Lake Illawarra. Potential development at the site is challenging due to the complex flood behaviour. ***Modelling Issues*** The modelling methodology applied to the proposed conditions scenario is not described in sufficient detail to comment on its soundness. It appears that the reference

	design building footprint has been blocked out of the model extent which is consistent with the Kully Bay Overland Flow Study (Rhelm, 2019). The following aspects of the modelling methodology remain unclear: • How proposed basement carpark entries have been represented, • How ground levels within the reference design have been represented • Whether the existing culvert under Warrawong Plaza has been maintained in the proposed conditions scenario, given that the proposed basement carpark levels will intersect the culvert. • Whether the column used to block out the building at the SE Corner is appropriately sized to support Building F (proposed to be 8 storeys) and Building G (proposed to be 6 storeys) • How the ramp beneath Building F has been represented in the hydraulic model ***Roughness Assumptions*** Manning's n roughness values applied to the proposed site should be revised and/or explained in further detail. The area between buildings has been mapped as 'residential' having a roughness of 0.1. Although this is consistent with the methodology applied in the flood study, it is likely too high for the purposes of this site-specific analysis. It is also inconsistent with the intended use of this area, being open space. The eastern section of the site has been mapped as 'carpark' having a roughness value of 0.02. This is likely too low as the proposal shows significant canopy coverage over this area, and if planter boxed are proposed, these would further impede flow. ***Reference Design*** There is a structure that is blocked out of the model extent to the east of the site (see **Figure 3** in the reference design and the flood impact assessment should clarify the proposed use of this structure as it is surrounded by floodwaters in the 1% AEP and PMF events. It is understood that there are entrances to the underground carpark on Cowper Street and on Northcliffe Drive as these are mentioned throughout the planning proposal attachments. In the Reference Design there also appears to be an entrance underneath Building G (see **Figure 4**), opening to the pedestrian through-site link. The applicant should provide the proposed crest levels for this entrance and indicate if it is intended for vehicles only or for pedestrians. Furthermore, it appears that this entrance would be in, or very close to, the overland flow path through the south east of the site. The applicant should ensure that this entrance is suitably designed for the flood conditions on the site.

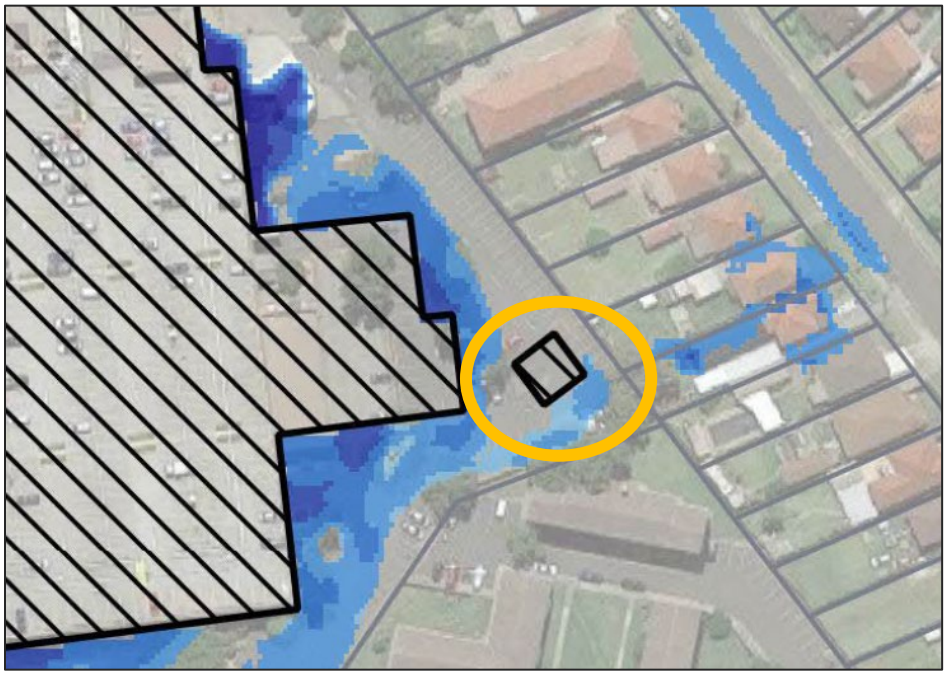

Figure 3 1% AEP flood depths at east of site, unknown building circled

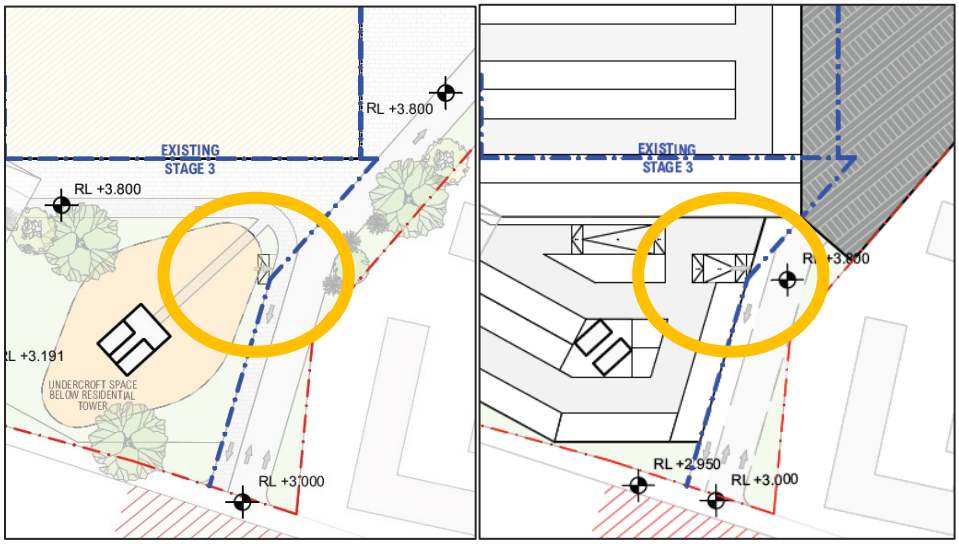

Figure 4 Third entrance to basement carpark (drawing number left: A-SK-029 rev. F, right: A-SK-006 rev. F)

Flood Impacts	The flood impact assessment results indicate that there are no flood depth increases to any external properties in all events except the two PMF scenarios considered. One building and a large section of the carpark on 8 Northcliffe Drive experience increases in flood depths from existing. Increased flood depths also occur along Cowper Street.

Cowper Street, Warrawong State Assessed Planning Proposal Overview	
	The building footprints taken out of the model extent includes buildings from 172 Cowper Street to 254 Cowper Street (immediately north of the proposal). As flood depths increase along their Cowper Street frontage, depths within these properties will also increase, although it is not explicitly shown in the results. The flood impact assessment notes that in the existing PMF scenario, these properties experience up to 800 mm of flooding which would increase by 100 – 200 mm in the proposed conditions scenarios. The flood impact assessment indicates further survey information to verify the floor levels of these properties and verify the impacts of these flood depth increases. An assessment of any change in overfloor flooding depth and flood hazard at these properties would be essential, particularly when understanding whether any of those properties are essential services or vulnerable developments. Despite this, there appears to be no flooding impacts to other properties as a result of the proposed development under the 1% AEP and 1% AEP + Climate Change (2050 and 2100) scenarios. Impacts in the 1% AEP event are limited to the Cowper Street and King Street road reserves which are already flood affected in the existing scenario. Any change in the flood hazard or trafficability of Cowper Street and King Street should be analysed. It should be noted that King Street is a State Road managed by Transport for NSW (TfNSW). Typically TfNSW will not accept any flooding impacts on the State Road network.
Flood Hazard	Within the site boundary, the proposal results in increased maximum flood depths of approximately one metre in all events tested. In the 1% AEP flood event, the assessment states that the maximum depth at the site under the proposed conditions scenario reaches 2.75 m within the eastern carpark adjacent to the new Woolworths extension (circled in **Figure 5**). Depths of this magnitude would present a significant risk to life, and it is recommended that this be rectified in future design iterations. It is also recommended that the hydraulic hazard mapping be reviewed by the applicant as the locations where the deepest flooding occurs within the eastern carpark in the 1% AEP coincide with areas of H4 hazard (see **Figure 5**). Referring to figure 3-34 in the provided flood impact assessment, it is not possible to have depths of 2.75 m and a hazard category of anything lower than H5. There also appears to be inconsistencies between the existing flood hazard mapping presented in the flood impact assessment and in the Kully Bay Overland Flow Study (Rhelm, 2019), see **Figure 6**.

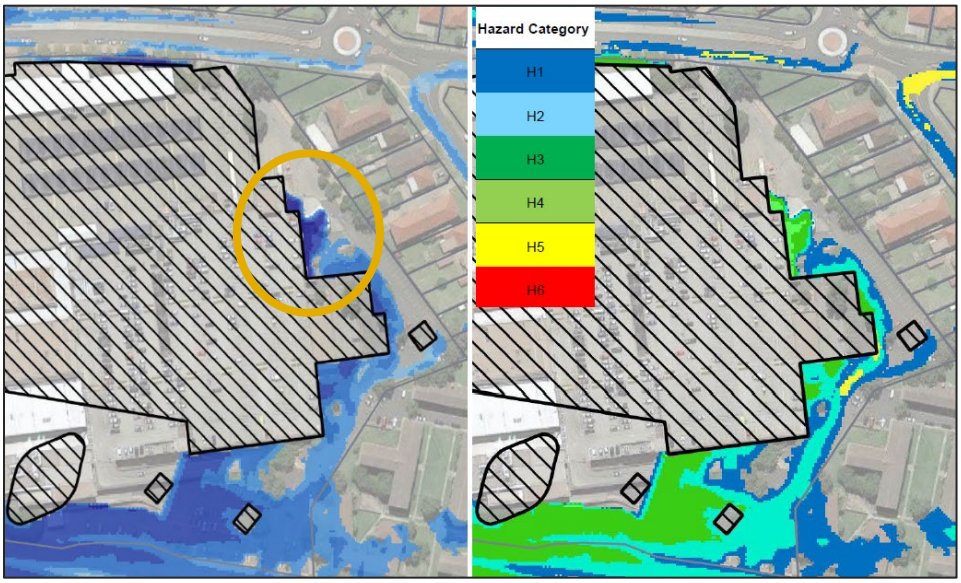

Figure 5 Post development 1% AEP flood depths (left) and flood hazard (right).

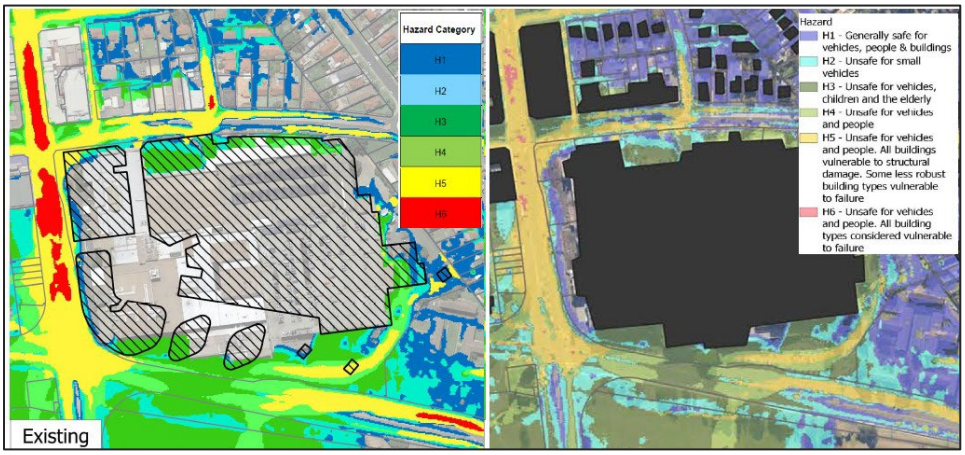

Figure 6 Existing PMF hazard mapping, Water Technology 2023 (left), Rhelm 2019 (right).

Lake Illawarra Cumulative Impacts	The Flood Impact Assessment report refers to the surface area of Lake Macquarie rather than Lake Illawarra, it is assumed this is a typographical error. The flood impact assessment presents calculations to estimate the effects of filling the site on lake levels and concludes that the site will result in a 0.74 mm increase in lake levels. This assessment simply does not meet the requirements of the Wollongong DCP as it has made no consideration of cumulative effects. The DCP states: "Filling of individual sites in isolation without consideration of the cumulative effects is not permitted. A case-by-case decision making approach cannot take into account the cumulative impact on flooding behaviour and associated risks caused by individual

Cowper Street, Warrawong State Assessed Planning Proposal Overview	
	developments. Any proposal to fill a site must be accompanied by an analysis of the effect on flood levels of similar filling of developable sites in the area." The DCP otherwise states, that filling in flood prone areas may be permitted if a Floodplain Risk Management Plan (FRMP) for the catchment which allows filling to occur has been adopted. The adopted Lake Illawarra FRMP (Cardno, 2012) states that no wholesale filling of sites around the foreshore of the lake is permitted unless supported by a sensitivity analysis indicating that there is no significant impact on flood levels. However, filling within existing building areas is permitted. It is recommended that the applicant revise the design to remove those aspects of the development that requires filling within the Lake Illawarra floodplain. Alternately, the applicant will need to undertake a cumulative assessment to support subsequent design iterations.
Warrawong Plaza Planning Proposal – Flood Assessment Report (Water Technology, dated 20 December 2023)	
Section 9.1 Ministerial Directions	The applicant has provided a table indicating how the planning proposal complies with the relevant planning controls and the 9.1 Ministerial Directions. The proposal partially complies with *Ministerial Direction 4.1(1)*. The flood impact assessment is consistent with the Flood Risk Management Manual 2023, however is not consistent with the Lake Illawarra FRMS 2012 as a cumulative assessment of filling within the floodplain has not been undertaken (see above for recommendations in this regard). *Ministerial Direction 4.1(2)* is not relevant as no rezoning is proposed. *Ministerial Direction 4.1(3)(a)* states that a planning proposal must not permit development in floodway areas. However, the applicant has not mapped the floodway to be able to determine compliance with this Direction. It is recommended that the applicant undertake floodway mapping for the site in the existing and proposed conditions, to confirm that none of the proposed structures are within the floodway, particularly the lobby areas of buildings F and G. If this cannot be done, it should be demonstrated that the lobby areas are lifted to be above the PMF level and there is no ingress of floodwater into the basement in the PMF. The proposal partially complies with *Ministerial Direction 4.1(3)(b).* There are no significant impacts to other properties in the 1% AEP event. There are minor flood impacts to adjacent properties in the PMF event, however this would be anticipated that this can be reduced in later design stages. A cumulative assessment of impacts of filling within the Lake Illawarra floodplain is required to comply with this direction. The proposal does not meet *Ministerial Directions 4.1(3)(c) and (d).* The proposal will result in development of lobby areas of Buildings F and G within the high hazard area. For this reason, *Direction 4.1(c)* is not met, regardless of the fact that these are not habitable floor levels.

Cowper Street, Warrawong State Assessed Planning Proposal Overview	
	The proposal will also result in approximately 1,300 new dwellings and approximately 3,250 people (assuming 2.5 people per household) at the site. Notwithstanding that all dwellings are proposed to be above the FPL, our view is that this would most certainly increase dwelling density as this would apply to the land which is within the FPA and not necessarily the space above the FPA. Inconsistency with these two clauses appears to be justifiable under consistency pathway (c) in the Ministerial Directions, given that all habitable floor levels are proposed to be above the FPL and the Flood Impact Assessment report has been largely prepared in accordance with the Flood Risk Management Manual 2023 (noting exceptions identified in this review). The proposal appears to comply with *Ministerial Directions 4.1(3)(e) through (h)* for the same reasons provided by the applicant. That being because: *e)* The proposal does not seek to change the permissibility of E2 zoning permitted uses *f)* The proposal will require development consent *g)* There would be no increase to government spending on flood mitigation *h)* There are no hazardous industries or storage proposed (that are identified in the documentation). Special flood considerations and *Ministerial Direction 4.1(4)* applies as Wollongong City Council has adopted Clause 5.22 of the standard instrument into its LEP. We recommend the same additional works mentioned above to meet *Direction 4.1(3)* be applied for areas of the site between the PMF level and the FPL in order to meet this direction. The proposal is consistent with *Ministerial Direction 4.1(5)* as the planning proposal does not propose to change the current FPA adopted by Council.
Local Planning Controls	Clause 5.21.(2)(a) of the Wollongong LEP states that development consent must not be granted unless the consent authority is satisfied that the development if compatible with the flood function and behaviour of the land. The lobby areas of buildings F and G and the columns supporting residential development above the FPL are located within the high flood risk precinct. The applicant has not demonstrated that these structures are compatible with the flood function and behaviour of the land. Referring to clause 5.21.2(b) of the Wollongong LEP, the impact assessment prepared by Water Technology for the proposed development indicates that it will not impact flooding on other properties in the 1% AEP event. However, a cumulative impact assessment on the development's impact to levels in Lake Illawarra is required to confirm this.
Evacuation & Shelter in Place	**Lake Flooding -** The current proposal states that there is no need to evacuate the site in any Lake Illawarra flood event and the site will not (nor will any individual building) be isolated by lake flooding. Cowper Street itself is unaffected by lake flooding in all events up to the PMF and therefore vehicular access is proposed to be maintained through the

Cowper Street, Warrawong State Assessed Planning Proposal Overview	
	proposed basement carpark access and eastern driveway on Cowper Street. Furthermore, all habitable floor levels are located above the Lake Illawarra PMF level. Whilst the applicant states there is no need to evacuate, access to the site will be partly restricted due to flooding and access to Buildings F and G would be inundated. To access the residential towers (say in a medical or fire emergency) it appears that this would need to occur via the basement. This is not ideal. It is recommended that consideration of making the through-site link trafficable emergency services for all events up to and including the PMF, in a lake flooding event. **Local Catchment Flooding -** For local catchment flooding, there will be little to no warning time. The proposal identifies a 'shelter in place' emergency management strategy in an event such as this. Given that the property would only likely be isolated for a short period (30 minutes). This approach is reasonable and aligns with the draft Shelter in Place (SIP) Guideline (DPE, 2023) as the flood duration is less than six hours and habitable floor levels are to be located above the PMF level. However, the guideline also states that SIP is not appropriate in areas of high risk (e.g. floodways). The applicant should demonstrate that SIP is appropriate for the development in this regard by mapping floodway areas. **Joint Occurrence Flooding** - For concurrent lake and local catchment flooding, we note that the basement carpark within the existing Warrawong Plaza is known to flood. However, the complexity of the site is such that it is unknown whether the existing basement carpark floods through overtopping of the entry ramp levels or through surcharge of the carpark's internal drainage, or both. Further design iterations should provide measures to prevent flooding of the basement via overland flow at vehicular/pedestrian entry points and/or via surcharging through the stormwater culvert or drainage pits in the carpark. Note that systems, such as plant rooms, should also not be located in the basement carpark as the future buildings should be able to function normally in a PMF catchment or lake flooding event.
Existing Culvert	The condition of the existing culvert that runs north to south through the site should be confirmed through CCTV. This culvert was not surveyed as part of the Kully Bay Overland Flow Study (Rhelm, 2019) as it is a privately owned asset, however its inverts are based on Council's database, at 4.05 and 1.24 mAHD at the north and south of the site respectively. The flood assessment report states that it is likely that the proposed basement will intersect this culvert and proposed basement levels are 2.3-2.5 and 0.7 mAHD for level 1 and 2 respectively. It is not clear in the refence design whether the culvert would be removed. It may not be possible to retain this culvert in the proposed design from a hydraulic or structural standpoint. The applicant should identify if this is the case. If the culvert is to be removed or altered, there is a risk of significant flooding impacts on surrounding streets and properties. It is recommended the applicant confirm the condition and capacity of the existing culvert and ensure the basement design allows for the retention or upgrade of the culvert.

Cowper Street, Warrawong State Assessed Planning Proposal Overview	
Rhelm Finding Category	**Proposal requires further information**

Rhelm Recommendations	Based on the peer review above, the following recommendations are made:
	
	The applicant should attend to the following significant concerns immediately:
	
	• Remove all proposed development within floodways and high flood risk precinct areas (the applicant should provide mapping showing pre and post development flood function and assess whether the development is compatible with the flood function and behavior of the land).
	• Determine whether the existing north-south trunk drainage system will remain or be upgraded. If the culvert is to be modified, updated modelling will be required to assess any potential impacts.
	• If retention of the trunk drainage system is proposed, the capture of CCTV of the trunk drainage beneath the carpark is required confirm the condition of the trunk drainage system.
	• Demonstrate that ambulance/emergency service access to Buildings F and G is available in a Lake Illawarra PMF Flooding event. This may require amendment of the reference design (e.g. via alteration of the through-site link).
	• The applicant should attend to the following technical queries:
	  ○ For the easternmost structure that is not labelled in the planning proposal or any of its attachments (refer **Figure 3** of this letter), provide its intended use, and determine how its use is compatible with the flood function.
	  ○ For the third basement carpark entrance adjacent to Building G (refer **Figure 4**), provide an indication of the likely crest level and ensure that it is not within an overland flow path.
	  ○ Review the flood hazard mapping and provide an explanation on why it is inconsistent with the Kully Bay Overland Flow Study (Rhelm, 2019).
	
	The following matters could be dealt with prior to exhibition. However, should not preclude the proposal from exhibition and could be dealt with during subsequent approval stages (e.g. as part of an SSD application):
	
	• Provide further consideration is required as to how to mitigate large flood depths within the site boundary.
	• Undertake a sensitivity test and a cumulative assessment on the impact of filling in the Lake Illawarra Floodplain as per the requirements of the Wollongong LEP/DCP.
	• Provide further commentary on the hydraulic model methodology used to prepare the proposed conditions modelling,
	• Revise and/or explain the applicability of the roughness values for the proposed conditions scenario,
	• Report on design approaches to ensure that there will be no surcharge of flood water from internal stormwater and drainage pits within the basement carpark.
	
	It is not recommended that the Cowper Street, Warrawong SAPP be approved for public exhibition. However if the additional information described above can be provided, public exhibition may be supported.

If you have any queries or would like to discuss anything further, please do not hesitate to contact either myself or Oscar Garratt on 02 9098 6998.

Sincerely,

Louise Collier
Director