

Our reference: 20-306

22 December 2021

Penrith City Council
PO Box 60
Penrith NSW 2751
C/O – Richard Crookes Construction

Attn: Stephen Masters

Dear Stephen,

RE: NEW PRIMARY SCHOOL IN MULGOA RISE – FLOOD RISK ASSESSMENT

In the Response to Submissions (RtS) letter dated the 14 December 2021, Penrith City Council requested a raised pedestrian crossing on Darug Avenue just south of the intersection with Deerubbin Drive.

The purpose of this letter is to supplement the Flood Summary Letter and Flood Impact Letter provided by Woolacotts dated 14 December 2021 and the 22 December 2021 respectively. This letter will provide clarity regarding predicted flood risk of the raised crossing / blisters on overland flow.

Existing Flood Risk

The existing flood risk assessment provided in this letter is for the sole purpose of establishing a baseline to which the impact of the proposed raised crossing / blister can be compared. It is Penrith City Council's responsibility to undertake their own risk assessment of the existing flood conditions.

The two main risks identified for flooding of the Darug Avenue and Deerubbin Drive intersection include risk to persons and risk to property.

Risk to persons includes both pedestrians and drivers. The proposed intersection reaches a maximum flood hazard classification of H2 during the 1% AEP flood event. This is considered low hazard for pedestrians with likely consequences being minor injuries for trips and falls. For most vehicles, a hazard rating of H2 classification is considered low hazard with the likely consequences being a minor car accident with minimal vehicle damage and / or minor injuries. For small vehicles a flood hazard classification of H2 it is considered high hazard as it is deemed unsafe for drivers. Therefore, the potential consequences are more severe and include a car accident resulting in major vehicle damage and / or injury.

Risk to property refers to the potential for floodwaters to cause property damage to the existing residential property on the south-western corner of the Darug Avenue / Deerubbin Drive intersection.

Under existing pre-raised crossing / protruding blister scenario and as stated in the Flood Impact Letter, the 1% AEP flood extent only impacts the existing landscaped areas by a maximum 100mm to 300mm and does not reach the building. Due to the above, the likely extent of damage is considered minor.

The above identified existing flood risks were categorised in accordance with a typical risk matrix (refer Attachment A) based on the anticipated consequence and likelihood. These risks have been categorised as low, moderate, high as summarised in Table 1 below.

Table 1 – Existing Conditions (Pre-Raised Crossing / Protruding Blister) Risk Assessment – 1% AEP Flood Event					
Type	Details	Risk	Likelihood	Consequence Type	Risk Category (Appx A)
Persons	Pedestrians crossing Darug Avenue during a 1% AEP flood event	Falling / tripping over	Rare	Minor Injury	Low Risk
Vehicles	Drivers of all vehicles (excluding small vehicles)	Minor Car accident*	Rare	Injury, Vehicle Damage	Low Risk
Vehicles	Drivers of small vehicles	Car accident*	Rare	Major Injury or vehicle damage	Moderate Risk
Property	Property owner adjacent intersection	Property damage	Rare	Minor financial loss	Low Risk

**Note: it is assumed that vehicles will be travelling slower than the 50km/hr speed limit and more cautiously due to very heavy rains and water over the roadway.*

Proposed Flood Risk with the addition of a raised pedestrian crossing / blisters

The impact of the raised pedestrian crossing and blisters on the above flood risk categorisations was re-assessed, as per below:

Raised Crossing

- **Risk to pedestrians** – As the flood depths only increases by a maximum 30mm, the risk to pedestrians remains minor and hence the risk categorisation of low remains unchanged.
- **Risk to all vehicles (excluding small vehicles)** – The provision of raised crossing will create a submerged obstruction for the full width of the roadway that has the potential to trap debris. This could potentially increase the risk and severity of a car accident as vehicles hit submerged objects / debris at the base of the crossing. As a result, the consequence of this risk has been upgraded to moderate due to the potential for more severe vehicle damage and / or injuries.
- **Risk to small vehicles** – As per the above, the provision of a raised crossing could potentially trap submerged debris at the base of the crossing. Although this would create an additional hazard to drivers, the consequence of this risk is already moderate, so the risk rating remains unchanged.
- **Risk to property** – As per Figure 2 above, the flood extents during the 1% AEP still remain within the residential property's landscape area and do not reach the building. Additionally, the flood depths only reach a maximum 30mm additional depth. Due to the above, the risk to property is still considered minor and as such the low risk category remains unchanged.

Blisters

- **Risk to pedestrians** – As the flood depths only increases by a maximum 10 to 20mm, the risk to pedestrians remains minor and hence the risk categorisation of low remains unchanged.
- **Risk to all vehicles (excluding small vehicles)** – The provision of blisters will create a submerged obstruction on either side of the road. Due to the large clear opening between the blisters, it is unlikely that submerged debris will be trapped as per the raised threshold. However, given the flood depths in this area of 300mm to 500mm, these blisters will be completely submerged this could potentially increase the risk and severity of a car accident as vehicles hit submerged blisters. As a result, the consequence of this risk has been upgraded to moderate due to the potential for more severe vehicle damage and / or injuries.
- **Risk to small vehicles** – As per the above, the provision of completely submerged blisters could potentially increase the risk and severity of a car accident as vehicles hit submerged blisters. Although this would create an additional hazard to drivers, the consequence of this risk is already moderate, so the risk rating remains unchanged.
- **Risk to property** – As the flood depths only increases by a maximum 10 to 20mm, the risk to property damage remains minor and hence the risk categorisation of low remains unchanged.

The results of the revised risk assessment, considering the provision of a raised pedestrian crossing, is summarised in Table 2 below.

Table 2 – Proposed Conditions (Raised Crossing / Protruding Blister) Risk Assessment – 1% AEP Flood Event					
Type	Details	Risk	Existing Risk Category	Raised Pedestrian Crossing Risk	Blisters Risk
Persons	Pedestrians crossing Darug Avenue	Falling / tripping over	Low Risk	Low Risk	Low Risk
Vehicles	Drivers of all vehicles excluding small vehicles	Car accident	Low Risk	Moderate Risk	Moderate Risk
Vehicles	Drivers of small vehicles	Car accident	Moderate Risk	Moderate Risk	Moderate Risk
Property	Property owner adjacent intersection	Property damage	Low Risk	Low Risk	Low Risk

In summary, during the 1% AEP flood event the provision of a raised pedestrian crossing or blisters on the intersection of Darug Avenue and Deerubbin Drive has low impact on the existing flood risk to pedestrians and property damage (the residential property on the south western corner of the intersection). However, the proposed raised crossing or blisters does have the potential to increase flood risk to drivers utilising Darug Avenue during a 1% AEP flood event.

Additionally, it is noted that the Darug Avenue / Deerubbin Drive intersection is already considered unsafe for small vehicles and the provision of a raised pedestrian crossing or blisters will only worsen the flood hazard for drivers as described above.

Please request any further information you may require.

Yours faithfully,
Woolacotts Consulting Engineers



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Attachment 1 – Risk Matrix

Attachment A - Risk Matrix

LIKELIHOOD (probability) How likely is the event to occur at some time in the (Linear Scale time specific matrix)	CONSEQUENCES What is the Severity of injuries /potential damages / financial impacts (if the risk event actually occurs)? (Logarithmic Scale, property industry specific matrix)				
	Insignificant	Minor	Moderate	Major	Catastrophic
	No Injuries First Aid No Envir Damage << \$1,000 Damage	Some First Aid required Low Envir Damage << \$10,000 Damage	External Medical Medium Envir Damage <<\$100,000 Damage	Extensive injuries High Envir Damage <<\$1,000,000 Damage	Death or Major Injuries Toxic Envir Damage >>\$1,000,000 Damage
Almost certain -	MODERATE	HIGH	HIGH	CRITICAL	CRITICAL
expected in normal circumstances (100%)	RISK	RISK	RISK	RISK	RISK
Likely -	MODERATE	MODERATE	HIGH	HIGH	CRITICAL
probably occur in most circumstances (10%)	RISK	RISK	RISK	RISK	RISK
Possible -	LOW	MODERATE	HIGH	HIGH	CRITICAL
might occur at some time. (1%)	RISK	RISK	RISK	RISK	RISK
Unlikely -	LOW	MODERATE	MODERATE	HIGH	HIGH
could occur at some future time (0.1%)	RISK	RISK	RISK	RISK	RISK
Rare -	LOW	LOW	MODERATE	MODERATE	HIGH
Only in exceptional circumstances (0.01%)	RISK	RISK	RISK	RISK	RISK