

Memo



REVIEW OF FLOOD RELATED MATERIALS FOR PROPOSED TOURISM DEVELOPMENT AT 39-65 OLD CASTLEREAGH ROAD, CASTLEREAGH

Project: P00256
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I have reviewed several flood related documents associated with this development application and have concerns, as outlined below. Underpinning much of the uncertainty is ongoing production of new information surrounding flood risks in the region, with significant recent studies relating to flood hydraulics and evacuation modelling. There seem to be multiple sources of guidance that could be considered, which adds uncertainty to what is acceptable or reasonable under the governing SEPP & DCP.

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Table 1 Identified Issues with Flood Assessment

Issue	Discussion
Figure 3.2, developed case	There is some strange triangulation of the as-developed DEM. If this has carried through to the model topography, it may warrant investigation.
Drainage from the Employment Zone south of Old Castlereagh Road.	Regarding the Employment Zone presently being developed to the south. Was the as-built landform and changes to this zone incorporated into the COFFS model? Connectivity of flow between the low point in Old Castlereagh Rd and the employment zone land seems to be non-existent (i.e., flow through culvert RHCO_4 seems to only come from the table drain on the southern side of Old Castlereagh Rd). However, for the as-built landform of the Employment Zone, how is the northeastern corner of that property drained? In early satellite photos (see below for example) features are present indicating some drainage through the embankment south of Old Castlereagh Road, although this may be high on the embankment, and may have been completely reconfigured now. Understanding this seems important for the assessment of cumulative impacts. 
No Impact assessment from regional flooding	The regional model from 2024 was not used for impact assessment, therefore, flood impacts relating to regional flooding (from Nepean R.) has not been modelled (only overland flows). The impact assessment could be considered incomplete in this regard. The reason for not applying the regional model was that it had a 15m grid size which is relatively coarse for the assessment of this proposal. However, local refinement to provide additional detail where it is needed could be included without excessively increasing computation - so the coarseness need not be a significant impediment. Whether the actual model built on behalf of Infrastructure NSW is readily available for others to use is a different matter (I'm unsure of this). The report refers to "<i>slow moving backflow as the lake system to the north equalises</i>" as being the primary mechanism for regional flooding at the site, but this is unclear to me. Would it be possible to plot peak flood velocities in and around the site for the 1% flood and above?

Table 2 Identified Issues with Flood Evacuation Modelling Report

Issue	Discussion
Justification for not using PMF rates of rise.	The evacuation timeline presented is for a 0.02% AEP, 72-hour duration event and the rate of rise in that event at Victoria Bridge is substantially slower than the 24hr PMF. Justification presented relating to adopting that event is that Infrastructure NSW (2023) adopted it for their assessment. This doesn't seem adequate justification. The reasons advanced by INSW for not using the PMF need to be assessed (refer p42 of that report). There doesn't seem to be a reason to not adopt the PMF rates of rise unless they are no longer considered credible. Furthermore, it is unclear whether 72 hours is the duration which results in the fastest rate of rise for the 0.02% event.
Nature of BoM warnings and reliance upon these.	I haven't reviewed the basis of the BoM warnings. However, based on Table 1 of the report, it seems that the warnings are based on the 24-hr PMF (i.e., a worst case scenario, there is a two hour time lag in the stage hydrograph between the colour coding discriminating between 6hr and 8hr warning times for the 24-hr PMF). The application of the 0.02% AEP 72hr event in this context seems inconsistent. Others seem to have interpreted the requirement of the DCP for early warning as requiring a bespoke, stand-alone early flood warning system for Penrith Lakes (Department of Planning and Environment, 2022; WMAWater, 2022). These two references were never adopted by the NSW government but provide some indication of how this requirement was meant to be interpreted. It seems that the proposed development, however, intends to rely on standard warnings from BoM and the SES. <u>As far as I can tell, no coordinated system or "Suitable Service Provider" has been established for Penrith Lakes. This is an issue and presents difficulties at development application time, if the intention is for flood evacuation from Penrith Lakes is to be coordinated, and completed early and without SES involvement.</u>
Timing for Evacuation of Penrith North	The modelling report "conservatively assumes" evacuation of Penrith North being triggered by a prediction of 26.1m AHD being reached at the Victoria Bridge Gauge. The basis of this assumption and its degree of conservatism is unclear, and it will be important to explain this.
Superfluous Data	It's unclear why Table 2 is presented in this report, it may be the intent is to indicate how frequently evacuation may be triggered, but this seems at odds with evacuation planning which I understand is meant to address residual risk, regardless of how frequent it may be.
Exclusion of Visitor Vehicles	Visitor vehicles were excluded from consideration of the capacity of the road network to manage the evacuation load. Visitors will comprise most of the potential traffic evacuating from the development site. Justification by stating a desire to be "consistent with the Infrastructure NSW modelling" needs more discussion. I assume that these visitor vehicles will still need to pass the low point on Andrews Rd. and will contribute to traffic load during evacuation?

Issue	Discussion
Exclusion of Residential Vehicles	The study notes that <i>“a proportion of the drivers would live within the floodplain and therefore would be included by the Infrastructure NSW modelling as traffic from the residential areas in the floodplain. These vehicles do not need to be considered in the vehicle limit for the Penrith Lakes evacuation sector”</i> . Again, this seems non conservative, while some of the workers at the development may live on the broader floodplain, I expect that they will still need to evacuate from the development, drive east on Old Castlereagh Rd. along Andrews Rd. and past the critical low point on that road. The logic behind excluding them when considering evacuation at this local scale has not been sufficiently justified.
Evacuation Capacity	<i>“Given that there is capacity for 1620 vehicles to evacuate from the Penrith Lakes sector”</i> – It should be spelled out how this figure of 1620 was determined.

Table 3 Identified Issues with FEMP

Issue	Discussion
Emergency Management during Overland Flooding Events	Water levels can rise rapidly due to local rainfall (Figure 2-12), overtopping the road and could cause several hours of inundation of the subject property and the adjacent road, preventing evacuation. How will these types of events be managed, noting that Shelter in Place is precluded (p42). What is the timeframe for overland flow events and how and when will evacuation be managed in these events. How might behaviour during these events interact with subsequent riverine flooding?
More review may be required	I haven't reviewed the entirety of the FEMP as there are key questions that need to be answered regarding the basis for calculating evacuation capacities as presented in the previous table. I note however that evacuation is planned to rely on a warning be issued by the SES.

Table 4 Identified Issues with Flood Compliance Report

Issue	Discussion
Attachment 1	Maps provided are not at a useful scale to interpret conditions at the site. Can these be replotted using the GIS data (model outputs) that is available from Infrastructure NSW, at a closer scale (say east to The Northern Rd, South to cover Penrith, West to cover Regatta Centre. I think water surface elevation contours at 0.5m intervals will help to interpret the “backwater” behaviour from the Penrith Lakes described in Section 2.1.
Section 2.1 – Additional Pipe	Is it possible that this additional pipe will exacerbate flooding on the site for regional events more frequent than the 0.2%, with more water from the north entering. Provision of better maps in Attachment 1 will help assess this.
Table 3, Clause 3.1(4)	In the flood assessment, there was some indication that inundation within the Old Castlereagh Road corridor would increase marginally (Appendix C, e.g., 1% & 2% afflux maps). Can you confirm whether the second pipe eliminates these impacts.
Table 3, Clause 3.1(5)	The <i>“The impacts of the proposed development on riverine flood levels would not impact flood levels”</i> – This statement seems to be contradicted in the following paragraph, where it says <i>“It is possible for the proposed development to impact riverine flood behaviour”</i>
Table 3, Clause 3.1(5)	<i>“floodwaters would flow though this area without any real change in flow paths,”</i> however, the next paragraph notes that there is 250 m of wall, which would seemingly be perpendicular to floodway flows through the site (the site frontage is ~290m). Similarly, the statement that <i>“flow channels to the east and west of the site would convey more of the flow in a PMF”</i> seems to overemphasise the contribution of these pathways when the site would be significantly inundated during extreme events. In that scenario discharge through this area is potentially overwhelmingly governed by overflow of the embankment to the north.
Table 3, Clause 3.1(6)(a)	Notes that flood hazard and flood risk are discussed under 3.1(5), but I can’t see reference to either under 3.1(5).
Table 3, Clause 3.1(6)(b)	Just a note – the governing scenario for this will likely be the Regional PMF, so at some stage, more detailed modelling will be required here to determine forces from floodwater.
Table 3, Clause 3.1(6)(d)	<i>“Therefore the evacuation route would be trafficable in overland events up to and including the 0.2% AEP flood”</i> While true for overland flows, (based on the provided model results) It seems likely this is not the case for regional flooding, where most of Old Castlereagh Rd to the east of the site is seemingly classified as floodway in the 0.2% event.
Table 3, Clause 3.1(6)(e)	<i>“It would only be in overland flow events larger than the 0.2% with probabilities approaching that of the PMF.... that the evacuation route would be cut by H2 or greater floodwaters”</i> Comment is as for 3.1(6)(d)
Table 3, Clause 3.1(6)(e)	It is indicated that shelter in place would be used as a last resort. While discouraged in the FEMP, and seemingly highly unlikely over the life of the development, some thought should be given to how that scenario might be managed.