Lauren Christie
Waterfall Park Developments Limited
Sent via email

23 July 2025

Dear Lauren,

RE: Ayrburn Film Hub Peer Review

Storm Environmental Ltd (**Storm**) has been engaged to provide an independent peer review of the stormwater and flood risk assessment documents for the Ayrburn Screen Hub for Waterfall Park Development Ltd.

In preparing this peer review, we abide by the Environment Court of New Zealand's *Code of Conduct for Expert Witnesses Practice Note 2023*. The primary author, Peter Christensen, holds a Master's Degree in Natural Resources Engineering from Lincoln University and is a Chartered Professional Engineer, and brings over 25 years of specialised stormwater and flood management experience. Where this report relies on information provided by other experts, this is outlined within the report.

The review is based on the following documents:

1. Stormwater Management Plan (**SMP**) by **CKL** (Revision 3, 18 July 2025)
2. Flood Model Report, Ayburn Screen Hub (**Flood Report**) by CKL (Revision 2, 18 July 2025)
3. Ayrburn Screen Hub Consent Drawings (**Plans**) by Paterson Pitts

The agreed scope was a specific peer review, as per Engineering New Zealand Guidelines[1], to cover:

1. Review of reports supplied by the client and their designer which are considered to be necessary for this review
2. Review of treatment philosophy and assumptions made as to contaminant loading and removal efficiency
3. Review of the outputs of flood models, including change in flood depth, pre- and post-development flow rates and volumes
4. Consideration of whether the effects identified are consistent with the analysis

The agreed scope of the review did not cover:

1. Peer review of the base flood model used to inform the analysis – we understand this has already been peer reviewed
2. Opening the flood model to review the model build, parameters used, or assumptions that are not explicitly described outside of the model report
3. Review of calculations, apart from limited cross-checking if deemed necessary
4. The sediment trap, as this is a previously agreed design and approach which has previously been consented

We also did not review the stormwater pipe network, focusing rather on a system level review.

The peer review has been an iterative process, with the applicant's consultant responding to and adjusting the design in response to queries, as well as providing additional calculations and evidence where requested. This review is based on the final versions of the SMP and Flood Report submitted for review.

This report considers flooding matters first and then stormwater quality matters.

Flooding Effects

The flood assessment relies on inputs from a wider catchment model, which includes consented infrastructure, and is called the Northbrook Waterfall Park Flood Model (**NWP model**). In the Flood Report it states that this model was developed by Fluent Infrastructure Solutions and peer reviewed by CKL, Stantec and Awa. The NWP model has been used as the baseline for the flood assessment and we agree with this approach. Due to the previous peer reviews, and

[1] https://d2rjvl4n5h2b61.cloudfront.net/media/documents/Peer_Review_Practice_Note_-_Version_2.pdf

acceptance in previous consenting processes, we have not queried this model apart from reading the reports contained in the appendices of the Flood Report.

To assess the impacts of the Ayrburn Screen Hub development, a 2D rain on grid model was created by CKL for the development area and contributing catchment. The NWP model was used as an inflow at the upper end of this catchment to allow for assessment of the impacts of the development. Two storm durations were used in the comparison: one for the 2-hour storm which was deemed critical for the development catchment, and a 9-hour storm which was critical for the wider catchment. We agree with this modelling approach to assess the effects of the development.

The hydrological parameters of the NWP model were used for the local model. We have not sought to independently verify whether these are appropriate or not. We consider the use of HIRDS v4 and the RCP8.5 (2081-2100) future scenario to be appropriate. The infiltration parameters are relatively high, but given that these are consistent with the previous model we have not reviewed the appropriateness of these, either broadly or in the local site context.

The Flood Report provides results for the 2-year, 20-year and 100-year average recurrence interval (ARI) scenarios. Depth, velocity and difference plots for both are provided for the site extent. Velocity difference plots were requested in an earlier review to provide clarity of any changes resulting from the works that could give rise to changes in erosion patterns at and downstream of the site.

The site itself is largely elevated and is shown in the modelling to be largely free of surface flooding. This shows that the stormwater network and shaping of the site is working as intended. At the request of an earlier draft peer review a section on upstream flow diversions was added. The concern primarily relates to the potential for any diversion channel upstream of the site, if it were to block or fail, to cause significant overland flow onto the site, particularly the film studios. The section on upstream flow diversions identifies that this issue has been considered and potential mitigations identified. We consider that this matter will require further attention during detailed design, but do not consider that any proposed mitigation will worsen off-site effects from the development, particularly since no increase in velocity is identified in the western channel from diverted flows.

Off-site effects are limited, with positive effects (reduced flood depths) shown in the more frequent events. This is expected due to the attenuation through the treatment infrastructure provided on the site. There is some increase in flood depth and extent downstream of the Ayr Avenue bridge. This is due to the excavation for the in-line sediment pond, as well as the earthworks for the infiltration basin or tertiary pond. It is our understanding that these effects are on the applicant's land and therefore do not affect other parties. There is some increase in velocities as a result of channel works downstream of Ayr Avenue, but this is largely dissipated within the sediment pond and immediately downstream. We agree with the assessment that this is minor and localised, but the area downstream of the culvert will need to be adequately protected to prevent erosion.

Table 1 of the Flood Report provides pre- and post-development peak flows at the downstream site boundary for a 9-hour duration event, which we consider most important for assessing the impacts of the development. These show a reduction in flow rates for all through ARIs assessed. We requested hydrographs to be displayed and change in volume to be calculated so that both flow and volume changes could be evaluated. These show that there is a change in overall flood volume , but that this is relatively minor and principally occurs near the end of the event as the attenuated volume within the stormwater system is released. Unless the downstream receiving environment is particularly sensitive to a change in volume, then the volume change would be considered minor. The duration of higher flows (and hence higher velocities) is also not extended for the 2- and 20-year ARI events, and therefore the likelihood of exacerbating downstream erosion is low.

The Flood Report includes a review of the Queenstown Lakes District Council (QLDC) freeboard requirements and notes that there is one building which cannot meet these requirements. This will be a matter for QLDC to consider as it relates to a departure from their standards.

Overall, we consider that the methodology is appropriate and is appropriate to be used to assess the effects of the development.

Stormwater Quality

The primary impacts on water quality from the development result from the increase in contaminants generated by traffic on sealed roads and parking areas, building materials, and any change in stream hydrology. We note that the downstream receiving environment, Lake Hayes, is stated by the applicant as particularly sensitive to an increase in contaminants.

Sub-catchment assessment

We have reviewed the plans provided showing the stormwater treatment infrastructure and how CKL has broken the site into several sub-catchments for treatment and stormwater management. While we have not independently re-measured the areas, the sub-catchment delineation is appropriate and the areas sum correctly.

Water quality design rainfall

The devices are sized based on a water quality flow (WQF) rate from runoff from a rainfall intensity of 10 mm/hr and for volume-based devices a water quality volume (WQV) is based on runoff from rainfall of 16.2 mm, which is stated as being one third of a 2-year ARI 24-hour event (48.3 mm) taken from the NIWA HIRDS v4.

The WQF is conservative, as this is the rate commonly used in Auckland. Christchurch and Canterbury use a rate of 5 mm/hr. However, 10 mm/hr will provide a higher rate of treatment and we support its use.

We also support the use of one third of a 2-year ARI 24-hour event for the WQV as this is a standard approach.

Treatment train approach

We agree that the adopted treatment train approach is appropriate in order to reduce the contaminant load discharge from the site as a result of the development. We make the following comments regarding individual parts of the treatment train.

Roofs are noted as being clad in low contaminant generating materials. We agree with this classification, as while the materials will have a lower contaminant load than some surfaces, it will still result in zinc and plastic runoff (from the coating), as well as increased runoff from dust falling on it (which in pasture would not normally be mobilised). We agree with the approach of runoff from roofs is treated through the infiltration basin prior to discharge and consider that the effects from this runoff are adequately covered in the assessment.

Treatment device design

Use of proprietary treatment devices for Catchment B (Filming Hub Backlot parking) is appropriate given the constraints in that area. It is recommended that a minimum performance standard be specified for these devices, and maintenance according to the supplier's recommendations is essential to their ongoing performance.

The rain garden design is based on Auckland Council's *Stormwater Management Devices in the Auckland Region* (**GD01**).[2] We agree with the method followed, except for the infiltration rate used, which is 750 mm/hr. This is very high and more appropriate for proprietary media. Rain garden media will clog over time, and the infiltration rate will reduce accordingly. Setting a high infiltration rate at this stage will not only result in more rapid clogging (as too much flow will be directed to the rain gardens), it will also make compliance difficult. In response to feedback the applicant undertook sensitivity testing on an infiltration rate of 300 mm/hr, which we still consider to be at the upper limit of what is typically achieved. The sensitivity testing shows a reduction in treatment (due to more frequent overflows), but demonstrates that sufficient treatment is undertaken to remain below pre-development rates. We note that using a high infiltration rate will require careful construction techniques, protection from sediment runoff (particularly during building), and ongoing maintenance and monitoring requirements to ensure that the design rate is maintained over time.

[2] https://www.aucklanddesignmanual.co.nz/content/dam/adm/adm-website/developing-infrastructure/infrastructure-technical-guides/gd01-stormwater-management-devices/GD01_Stormwater_Management_Devices.pdf

The wetland volumetric design appears to be designed according to GD01, although there are deviations from this standard in other parameters. There are issues with the application of GD01 to areas outside of Auckland, but in this instance given the relatively low contaminant load, and being part of a treatment train, we do not have concerns over the methodology used in the design and consider that these will make a highly beneficial contribution to treatment overall.

An infiltration basin ('tertiary pond' in the SMP) is situated before the discharge from the site. The soakage rate appears appropriate, and while it is normally typical to allow 1.0 m separation from the underside of the soakage media to high groundwater level, in high infiltration situations such as this the lower separation of 0.5 m is considered acceptable.

Quantification of contaminant concentrations and loads

The SMP uses the Auckland Contaminant Load Model (CLM) to assess the change in contaminants from pre- to post-development. While there are more sophisticated tools available, we agree that this is an appropriate method to use for this site.

The assessment for contaminant load uses an area of 23.4 Ha, although the majority of that area is unchanged. It would be more typical to assess the pre- and post-contaminant load based only on the affected area, which is closer to 5 Ha. While this will not alter the absolute change in contaminant load, it does affect the percentage change, and makes the changes more explicit.

The SMP states that the baseline contaminant load should be assessed based on nitrogen and phosphorus from sheep and beef on high producing exotic grassland. We disagree with this baseline, as we understand that the site has not been actively grazed recently, and that the baseline land use is likely more accurately described as 'lifestyle' using the classification in Table 4 of the SMP. Likewise, for total suspended solids (TSS) and heavy metals, we do not agree with the use of 'farmed pasture' as the baseline, and instead consider it more likely to be 'retired pasture'. The selection of these alternative baselines would result in a lower baseline contaminant load overall. In response to this feedback the SMP was updated to include these alternative baselines in the sensitivity analysis, which are discussed further below.

The developed scenario parameters used are appropriate, although we consider that the unchanged catchment area should not be included in the assessment. Notwithstanding the comments above, we agree that the change in site use will likely reduce TSS, nitrogen and phosphorus, and will increase zinc and potentially copper.

The estimated contaminant removal rates used are based on a combination of guidance from the New Zealand Transport Agency (NZTA) and Christchurch City Council (CCC). We agree that these are appropriate sources to consider, but also note that the NZTA reference is somewhat dated, and some of the rates used are at the higher end of what might be achieved. In particular we note that:

1. The proprietary device removal rates are relatively high for copper, but overall we consider that the rates provided by the supplier can be used
2. The rates for the infiltration basin (pond) are acceptable, particularly given the depth of infiltration media provided (0.5m)
3. The wetland removal rates are acceptable, using the lower end of the CCC rates
4. The raingarden removal rates (or bioretention in Table 9) are high for zinc and copper, but consistent with published information

The sensitivity analysis shows that across a range of assumptions there will be a reduction in annual contaminant load. We agree with this conclusion and consider it a robust approach to assessing potential water quality changes.

Conclusion

Overall, we agree with the conclusions of the Flood Report and flood hazard assessment, although note we have some concerns about the diversion channel above the film studios which can be addressed during detailed design.

We agree that the treatment train approach used is appropriate, though have some residual concern regarding the high infiltration rate used for the rain garden media which will require careful selection, placement and maintenance of media.

The contaminant load model used is appropriate, but we disagree with the pre-development parameters used and consider that a lower intensity land use should form the baseline. However, sensitivity analysis has shown that even with different assumptions for the baseline state, as well as rain garden permeability, it is still likely that contaminant loads will reduce, providing that the proposed facilities perform as expected and are maintained appropriately over time.

As noted in our scope, we have not reviewed the design of the inline sediment ponds.

Please do not hesitate to contact me with any questions that you may have regarding the above and to discuss any follow up that you require.

Yours Sincerely,

[redacted]

Peter Christensen
CMEngNZ IntPE(NZ)
Technical Director
Storm Environmental Ltd

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