
To: NZSki
Cc: Mitchell Daysh
From: Mark Hamer
Date: 28/8/2026
Subject: Covering Memo - Rastus Burn Wastewater Freshwater Ecological Impact Assessment - Reviewer Comments Response

1 Introduction

The Rastus Burn Wastewater Discharge Impact Assessment (e3Scientific, 2026a) and Rastus Burn Wastewater Freshwater Ecological Impact Assessment (e3Scientific, 2026) form part of the NZSki Remarkables Upgrade and Doolans Expansion fast track application. The application includes an increased discharge volume of treated wastewater to a dispersal field near the Rastus Burn.

The key issues raised by reviewers, for the "Rastus Burn Wastewater Freshwater Ecological Impact Assessment" along with responses, are provided below.

2 26/5/2026 Torlesse Freshwater Ecology Review

The following questions were raised by Torlesse on 26 May 2026, with e3s responses provided below.

1. *One recurring issue throughout the report is that the wording is often vague. Phrases such as "it is considered" and "it has been assessed that" make it unclear whether the statements represent the author's opinion and, if so, what evidence or reasoning underpins those conclusions.*

Response: Statements are based on evidence in the associated text within the report. However, minor edits have been made throughout the report to attempt to make it clearer when basing statements from experience, knowledge and opinion rather than referencing conclusions from others previous scientific studies.

2. The report relies heavily on earlier reports and references their conclusions as though they are definitive. It would be helpful for these reports to be appended so that reviewers can independently assess the context and validity of those conclusions. Examples include:

a. Ludgate et al. (2014);

b. SLR (2026).

Response: The monitoring reports have been appended to the updated Rastus Burn Wastewater Discharge Impact Assessment (e3Scientific, 2026a). These reports are primarily monitoring reports for ORC, therefore it is assumed that the reviewer on behalf of ORC would have access these reports if required and would have confidence in ORC compliance and monitoring programmes. To this end, they are discussed and relied upon within this report to present factual and correct information.

3. The summary notes that there is some “seasonal timing [of the discharge] that avoids sensitive low-flow periods”. Additional context would be helpful here, as the Wastewater Discharge Impact Assessment indicates that discharges occur year-round, including during winter low-flow periods and autumn, when ecological sensitivity is likely to be highest.

Response: The activity requiring the increased wastewater volume is a ski field, therefore the discharge in summer and autumn is greatly reduced, i.e. when there is no skiing and visitors significantly decline. The Executive Summary and Section 3.1 of e3Scientific (2026a) provides additional context to clarify that this is primarily a winter/spring discharge with 2 to 3 times the wastewater volume (Table 6; e3Scientific, 2026a) and 17 times the total nitrogen concentrations (Table 7; e3Scientific, 2026a) contributed to the wastewater infiltration field in winter/spring than summer/autumn.

4. There would be value in expanding Section 4.1 to provide a more complete summary of the findings of the Wastewater Discharge Impact Assessment. In the context of wastewater discharges, key parameters of interest include ammonia, nitrate, DIN, DRP, and sCBOD5. The report would be strengthened by including a dedicated discussion of each of these attributes so it can more effectively stand on its own. In contrast, one-off spot field measurements of water quality, such as those presented in Table 2, are of limited value in assessing wastewater effects and may not warrant presentation.

Response: Further text is added in Section 4.1.2 to summarise the relevant water quality parameters.

Table 2 is retained within the report as it demonstrates high DO levels are present and therefore aids in the discussion regarding reviewer point 10 below in relation to BOD5.

5. Overall, I do not consider that sufficient evidence has been provided to support the conclusion in Section 4.3 that "the current discharge of wastewater to land has been considered to maintain a low cover of periphyton near baseline levels". In particular:
a. The relevance of Figure 6 to periphyton growth in an alpine river receiving a year-round wastewater discharge is unclear.

Response: Figure 6 illustrates the peak periphyton growth potential in alpine streams, which differs to lowland streams, as an example for those who are not familiar with the substantive differences between the two stream types. However, to help with reviewer clarity, additional text in Section 4.3 has been provided relating to spring and summer periphyton peaks.

5b. The periphyton monitoring data used in the report does not provide a complete picture of the risk of adverse effects. Monitoring has been undertaken during winter and spring, when the risk of excessive periphyton growth is lowest. The Wastewater Discharge Impact Assessment indicates that the discharge results in increased nitrogen concentrations in Rastus Burn during late summer, potentially to a greater extent than is apparent from the available monitoring data, which coincides with the period when the risk of periphyton blooms is highest. Given this, it is unclear why periphyton assessments were not undertaken during the April 2025 or February 2026 site visits.

5c. In the absence of summer/autumn periphyton data, the report should include a desktop assessment of the risk of summer/autumn periphyton growth. That assessment should consider both measured and predicted nutrient concentrations (see Point 1(b) in Section 2.1) and compare them against established periphyton growth criteria, such as those developed by Fleur Matheson, Barry Biggs, and Ton Snelder.

Response to 5b and 5c:

Further information has been added to Section 4.3 pg 21 – 24 to outline why spring is the time of year when wastewater discharge effects on periphyton growth would be highest, as per findings consistent with the previous wastewater discharge consent. During the April 2025 site visit this activity had not yet been defined and periphyton was not within the requested scope of works. This was also the case with the February 2026

site visit which was scoped to provide an understanding of the likelihood of fish within the reaches. However, despite a targeted periphyton assessment not being completed at this time; site photos from 25 February 2026 illustrate the condition of the Rastus Burn during the later summer and lack of visible periphyton at the monitored sites.

It should also be noted that the periphyton "summer sampling season" runs from November to April (inclusive) (Matheson, *et al.*, 2016) and that the periphyton assessments utilised to inform this assessment were carried out in March 2014 (Ludgate, *et al.*, 2014), December 2016 (Ludgate, 2017), November 2022 (SLR, 2023) and November 2025 (SLR, 2026) within the 'summer sampling season'. Further information has been added to the report to compare against established growth criteria and thresholds and the Rastus Burn is assigned a low risk periphyton category.

Additional Rastus Burn site photos from 25 February 2026, demonstrating a lack of periphyton growth in summer.



Figure 1: Upstream Site (looking upstream)



Figure 2: Upstream Site (looking downstream)



Figure 3: 50 m Downstream Site



Figure 4: 200 m Downstream Site



Figure 5: 1500 m Downstream Site

5d. The comparison against the Biggs guideline values also appears to require review, potentially due to a misunderstanding of the units used (i.e. mg/L rather than $\mu\text{g}/\text{m}^3$). The report states that the Biggs nutrient guidelines for the protection of benthic biodiversity are significantly higher than current water quality concentrations. However, the figures presented in the Wastewater Discharge Impact Assessment appear to indicate that these guideline values are already exceeded upstream of the wastewater discharge.

Response: Upon review, the statement “these levels are considerably higher than what is currently present at this low nutrient alpine location” within the FEClA is incorrect. Therefore, the reviewer is correct that current nutrient concentrations exceed that predicted to promote periphyton growth beyond good benthic biodiversity levels (50 mg/m² of *Chl a*) in the Periphyton Guidelines (Biggs, 2000). However, the assessment of effects remains valid, based on e3s’ experience and understanding of alpine environments and specifically this area. The Rastus Burn is atypical to the lower altitude examples utilised within these guidelines in that the cold water temperatures limit periphyton growth even in the presence of sufficient nutrients for algal growth. The local environment does not demonstrate prolific algal growth in spring or summer conditions. However, to further support this statement, the nutrient and periphyton assessments are further reviewed within Section 4.3 of the FEClA and summarised below.

More recent modelling by Snelder *et al.*, (2022) in relation to water ways with a cold, wet and mountain source suggest an upper limit of 35 mg/m³ TN would be sufficient to protect benthic biodiversity 80% of the time. This 35 mg/m³ TN concentration has been modelled to be the threshold for periphyton cover/biomass levels (50 mg/m²) required to maintain benthic biodiversity (Biggs, 2000). However, as this TN value is based on a small dataset (Matheson *et al.*, 2012) and modelled data (Biggs 2000). This modelling has limitations when applying it to an alpine environment with large variations in sunlight hours (due to the steep topography and incision of the stream) and variable flows from snow melt and the flashy steep incised catchment.

Further to this, the relationship between nutrients and algal biomass is often outweighed by other variables such as light, temperature, grazing pressure and flood regime, therefore it is the opinion of e3s, that it is more prudent to assess the periphyton cover and biomass directly, as measured by *Chl a*, rather than setting a TN limit to meet guidelines developed for larger, lower altitude waterways. This is also evidenced by the lack of periphyton cover observed during the February 2026 site visit. While the potential

for excessive periphyton growth is low, periphyton monitoring is recommended in Section 6.2.1 of the FEcIA and is to include spring and autumn surveys.

6. Similarly, I do not consider that sufficient evidence has been presented to support the conclusion in Section 4.4 that "the current discharge of wastewater to land is considered to maintain a macroinvertebrate community indicative of 'excellent' health". In particular: a. No summertime macroinvertebrate monitoring data are available to confirm that macroinvertebrate communities are not adversely affected during periods when the risk of ammonia toxicity and periphyton growth is highest due to elevated temperature and light conditions.

Response: The ORC compliance monitoring results within the Rastus Burn utilised and discussed in the report provide evidence that the current wastewater discharge to land maintains a macroinvertebrate community indicative of excellent health (excluding spill events). The bulk of the wastewater discharge and nutrient load is contributed to land infiltration and the Rastus Burn in winter/spring (See Table 6 & Table 7; e3Scientific, 2026a). The regular water quality monitoring of ammoniacal nitrogen has demonstrated no exceedances of the 99% DGV within the Rastus Burn at any time of year (excluding one spill event in 2023) (See Figure 12; e3Scientific, 2026a). Also, macroinvertebrates sampled at the time of year when nutrients are applied to land and soak through to the Rastus Burn (winter/spring) demonstrate high macroinvertebrate metric scores (Table 5; e3Scientific, 2026). The reviewer suggests that because no summer macroinvertebrate samples have been collected (when temperatures and instream conditions are typically at their highest risk) sufficient evidence has not been provided. However, the alpine stream has cool clear water with summer water temperatures below ~12 °C which reduces the risk of ammonia toxicity due to water temperatures, which could be expected in other non-alpine environments. Summer periphyton growths were not obvious or prolific during a site visit in February 2026 (See response to 5b and 5c) and the naturally low diversity macroinvertebrate community will shift seasonally in summer to a community with more grazers, utilising summer light and some algal growth. However, the cold water will continue to limit the algal growth rates. Therefore, the associated macroinvertebrate community will be similar to the spring community in structure and composition, which was found to be a community indicative of 'excellent' health" as described in the FEcIA.

6b. This assessment should be updated to incorporate the requested periphyton risk assessment and consideration of off-season peak ammonia concentrations (see Point 1(b) in Section 2.1).

Response: See the above responses.

7. It would be helpful for Section 4.5 to provide additional information on the location and height of the waterfalls referenced, and to further explain why it is considered “very unlikely” that koaro could access these reaches, given that the species has been recorded at elevations up to approximately 1400 m ASL. References to specific NZFFD and eDNA results would also assist, as it is currently unclear whether these data sources confirm koaro absence or whether there are simply no records available for the area.

Response:

Within the freshwater fish database there are only 47 South Island records for kōaro above 1000 m above sea level (A.S.L.). The majority of records above 1000 m A.S.L. are from locations further north in the Clarence or Takaka catchments where winter conditions are not as cold and snow covered for as long as the Remarkables Range (Figure 6 below). There is 1 record from within the Clutha River catchment in a tributary of the Cardona River. The Rastus Burn Stream adjacent/below the infiltration fields is 1400 m A.S.L. The FECLA report demonstrates in Figure 4 (e3Scientific, 2026) a typical chute waterfall these are numerous between 600 and 900 m A.S.L. within the Rastus Burn as observed when reviewing aerial imagery (Figure 7). No kōaro have been found in electric fishing surveys or eDNA samples above the waterfall and chute zone. Therefore, there is sufficient information provided to evidence that it is “very unlikely” that kōaro could or will access these Rastus Burn reaches near the wastewater inputs.



Figure 6: Location of kōaro in the South Island recorded above 1000 m A.S.L.

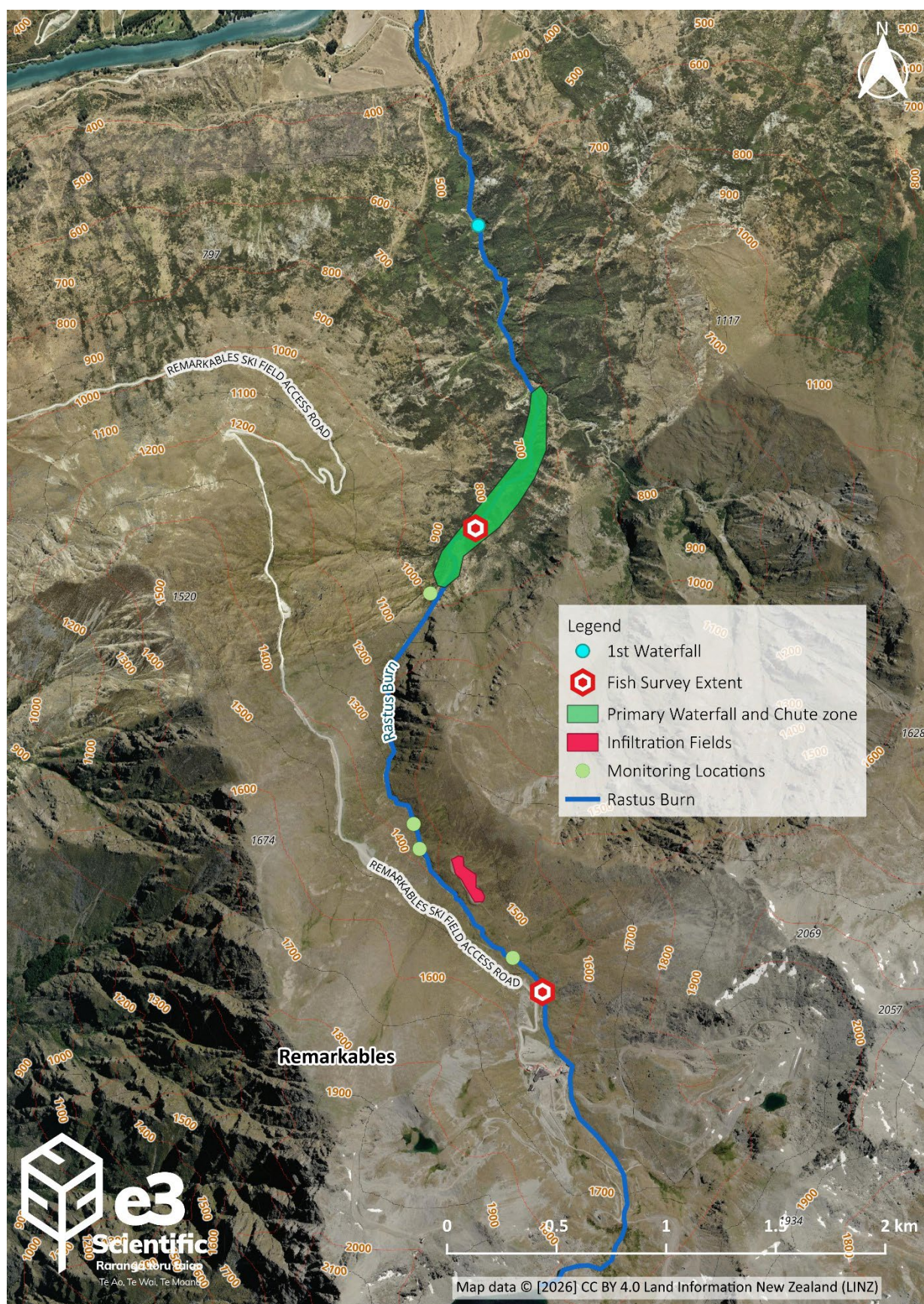


Figure 7: Location of primary Rastus Burn waterfall and chute zone.

8. Section 6.2.1 does not address ammonia toxicity risk, despite this being one of the principal ecological risks associated with wastewater discharges. A dedicated subsection addressing ammonia and nitrate toxicity effects should be included. This assessment should consider not only observed monitoring data, but also the requested modelled estimates of concentrations that could occur under the proposed consent conditions.

Response: Text has been added to the report in a new subheading 6.2.2

9. In my view, the assessment of periphyton growth risk in Section 6.2.1 is subject to the same sources of uncertainty outlined under Point 6 above.

Response: See text added to Section 4.3 of the report.

10. The discussion of BOD5 currently focuses solely on deoxygenation effects. However, elevated BOD5 can also contribute to sewage fungus growth, which should also be considered. This assessment should incorporate the additional soluble CBOD5 information requested under Point 5 in Section 2.1.

Response: Text added to updated report in Section 4.1 pg 17. This text is as follows "The turbulence within the stream and well oxygenated water with a high dissolved oxygen content will be resilient to dissolved oxygen reductions or sewage fungus growth that can occur downstream of wastewater discharges in situations where high organic loads, low velocity and low dissolved oxygen zones. These are not the conditions found within the Rastus Burn and therefore sewage fungus is not considered further".