Before the Expert Panel appointed under the Fast-track Approvals Act 2024

Under	the Fast-track Approvals Act 2024
And	
In the Matter of	an application for approvals by NZSki Limited to upgrade existing infrastructure at the Remarkables Ski Area, including a new passenger transport lift, carparking areas, and expanding the ski field into the adjacent Doolans Basin

Statement of Evidence of **Simon Henry Bloomberg** on behalf of NZSki Limited in response to Section 53 Comments

Wastewater

Dated: 3 November 2026

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INTRODUCTION

1. My name is Simon Henry Bloomberg.

2. I hold a BSc in Geology and Geography (endorsed in environmental science) and a MSc (Hons) in Geology from the University of Canterbury. I am a member of the Australasian Land and Groundwater Association, The New Zealand Hydrological Society, the Waste Management Institute of New Zealand, and I am a Certified Environmental Practitioner (no. 1395) under the CEnvP Scheme. I am currently employed by e3Scientific Limited (**e3s**) as a Senior Environmental Scientist, based in Christchurch.

3. I have worked for e3s since May 2017 as a Senior Environmental Scientist. At e3s, I have been involved with groundwater and surface water risk assessments to support consenting of discharges of contaminants to land and water. I have also provided technical reviews of onsite wastewater discharge consent applications for ORC.

4. This statement is given as part of NZSki Limited's (**NZSki**) response to comments on the Remarkables Ski Area Upgrade and Doolans Expansion (**Project**) made under Section 53 of the Fast-track Approvals Act 2024 (**FTA**). This statement responds to specific comments raised by:

   (a) Dr Christopher Ronald James Kavazos, Department of Conservation (**DOC**) s51 response, Appendix B – Expert Statement Freshwater in paragraphs 175-179.

   (b) Dr Michael Greer, Otago Regional Council (**ORC**) s53 Response, Appendix 2: Surface water ecology and water quality technical expert advice in Section 3.1, Section 3.4.2.4, Section 3.4.3, Section 3.7.3.1, and 3.7.3.2.

   (c) Dr Rowan Dixon, Statement of Evidence (Climate Change) on behalf of Kā Rūnaka (s53 Response) in paragraphs 14 & 39.

   (d) Queenstown Park Limited (**QPL**). Invitation to comment: Reference FTAA-2605-1236. Wastewater Page 2.

   (e) Shane Ellison, statement of Evidence (Transport and Infrastructure) on behalf of Kā Rūnaka in paragraphs 35 to 39.

5. My original findings are provided in full in:

   (a) B-11 - Wastewater Discharge Impact Assessment (**B-11**).

6. This Report was updated following review and feedback from the ORC's technical consultants. The updated report (V3, dated August 2026) was provided with a cover letter which set out the responses and the location of any changes to the impact assessment report.

7. My colleague Mark Hamer's report (B-10 Rastus Burn Wastewater Freshwater Ecological Impact Assessment) relied on parts of my assessment to inform his assessment of the effects of the discharge on freshwater ecology. During the workshops and feedback response process, Mark and I discussed, reviewed, and provided additional evidence regarding water quality and freshwater ecological matters.

8. I relied on the report of Derek Chinn (Stantec) submitted as B-17 - Doolans Wastewater Concept Report (**B-17**) and the report of Marc Jensen (Stantec) submitted as B-18 - Wastewater Treatment and Disposal Feasibility Report (**B-18**) and Appendix A Doolans' Expansion Wastewater – Confirming Wastewater Design Year V3 therein. Specifically, for the current and forecasted wastewater flows, proposed design discharge criteria, and the assessment of alternative treatment options.

9. Although this is not an Environment Court proceeding my confirmation of compliance with the Code of Conduct for Expert Witnesses in the Environment Court Practice Note 2023 is included in section 1.3 of B-11 submitted as part of the substantive application.

10. **Attached** to this evidence is:

    (a) **Appendix A:** Conservative Assessment of Flow and Contaminant Concentrations in the Rastus Burn.

    (b) **Appendix B:** NZSki Wastewater Conditions Attachment I.

    (c) **Appendix C:** Recommending report for AUTH-20158595.

    (d) **Appendix D:** High-Level Microbial Risk Assessment.

SPECIFIC RESPONSE TO COMMENTS

Wastewater – Uncertainty over Annual Load Limits for Total Nitrogen and Total Phosphorus

11. Both of the reviews from DOC (Dr Chris Kavazos) and ORC technical consultants (Dr Michael Greer) discussed the setting of the total nitrogen and total phosphorus

annual limits for the discharge. Uncertainty with the estimation of the annual nutrient limits was discussed in section 6 (Ongoing Investigations) in B-11 and in section 3.4 of B-18 (Stantec Wastewater Treatment and Disposal Feasibility Study).

12. Dr Kavazos identifies an issue with the proposed total nitrogen limit being higher than what was referenced in B-11 but does not acknowledge the uncertainty of the historical measured total nitrogen discharge which is well canvassed in reports B-11 and B-18. Dr Kavazos did not comment on the identified uncertainty, or the conditions proposed to address the uncertainty. It is my opinion that there is a robust understanding of the effects of the discharge but that the additional investigations will allow for confidence in setting the nutrient limits.

13. The evidence of Marc Jensen provides a summary of the uncertainties for both proposed nutrient limit values and how they were arrived at which summarises the position articulated in B-18 section 3.4 and Appendix A Doolans' Expansion Wastewater – Confirming Wastewater Design Year V3 section 2.2.

14. The proposed conditions (WW.37A and WW.38A) allow for the further investigation of the discharge during the 2026 ski season to determine the extent of that uncertainty and how it could affect the proposed total nitrogen and total phosphorus limits. The water quality sampling has been completed with only the groundwater aquifer investigation and Rastus Burn flow gauging yet to be completed. The assessment of TN and TP loads based on the 2026 ski season is underway and will be completed by 28 February 2027.

15. Therefore, my position is that the uncertainty identified in B-11 and B-18 is understood and will be reviewed in the nutrient load review report (as per condition WW.37A). Until that report is delivered, I agree with the findings of section 3.4 in report B-18 and the evidence of Marc Jensen that the proposed annual limits of 750 kg N/year and 100 kg P/year are likely to be at or below historic loads, and under the proposed consented conditions for the discharge of wastewater to land required for the Project they will be sufficient for maintaining the historic water quality.

16. Table 4 and Table 5 of B-18 report the annual load as max, mean, and minimum for both TN and TP as calculated by e3s and Stantec. The e3scientific numbers overlap with the Stantec numbers indicating general agreement on the order of magnitude, however the e3s numbers are much lower, for reasons discussed in both B-11 and B-18 and the evidence of Marc Jensen it is expected that the e3s calculations result in an underestimation of the annual load.

17. The proposed conditions (e.g. WW.37A & WW.38A) provide for a potential lowering of the annual nutrient limits should the further investigations provide robust evidence that the proposed annual limits of 750 kg N/year and 100 kg P/year are too high. An

example of that would be if the assessment of flow weighted discharge wastewater quality from the autosampler was not significantly higher than the single monthly grab sample. It is my opinion that these conditions (WW.37A and WW.38A) coupled with instream DIN and DRP triggers, and a newly proposed instream Ammoniacal-N limit are sufficient to resolve the issues identified by Dr Kavazos (para. 175 – para. 179).

18. Dr Kavazos has noted the decline in ecological health indicators from 2016 to 2023 but has not acknowledged the improvement in 2025 (See also paragraph 28 of the evidence of Mark Hamer). Dr Michael Greer on behalf of ORC states that "*… the existing evidence supports the conclusion that the current wastewater discharge is not causing significant adverse effects.*"[1] I agree with this conclusion and it is consistent with my assessment in B-11 that historical monitoring (2015 – 2026) shows that while the discharge contributes to detectable nutrient and microbial signals in groundwater and surface water during the ski season, the impacts are acceptable with biological monitoring reporting good to excellent ecological health. Dr Michael Greer proposes some options to address the uncertainty of the load limits while not unnecessarily constraining the discharge nor permitting materially greater loads without supporting evidence. The following two options have been adopted by NZSki:

    (a) Requiring the limit to be amended if subsequent investigations identify a discrepancy (see paragraph 14 above); and

    (b) Adopting an instream ammoniacal limit (See below section on mass balance and ammoniacal nitrogen risk).

19. Therefore, I consider that the matters raised by Dr Kavazos and Dr Greer regarding nutrient loads have been resolved.

Wastewater – Mass Balance and Ammoniacal Nitrogen Risks

20. In September 2026, ORC reiterated its request for a quantitative mass balance to assess the risk of theoretically high values of ammonia in the Rastus Burn under the consented future wastewater discharge conditions. Due to timing and capacity constraints, NZSki was unable to provide a mass balance assessment to ORC for review prior to the s53 response deadline, however, the requested conservative mass balance is presented in **Appendix A**.

21. The historic monthly and conservative future scenario mass balance assessments for total ammoniacal nitrogen provide further evidence to that included in B-11, indicating that there is very low risk of ammonia toxicity in the Rastus Burn during

[1] Section 53 comments from Dr Michael Greer at [3.1].

the ski season and when Rastus Burn flows are higher due to snow melt, due to the dilution and attenuation occurring in the system. The highest ecological risk period for ammonia toxicity is when low-flows occur and water temperatures are higher in the Rastus Burn (e.g. February). However, no guideline exceedances were modelled during this risk period under the most realistic, but still very conservative mass balance assessment scenario (Scenario 4).

22. As part of Dr Michael Greer's s53 evidence he has also completed a conservative quantitative mass balance for ammonia. The findings of Dr Greer's mass balance assessment are generally similar to that presented in my assessment in **Appendix A**.

23. In summary, the conservative mass balance assessments both calculate theoretically possible concentrations of ammonia that are at times above the temperature and pH adjusted ammoniacal guidelines. Therefore, the consented future discharge could result in periods where ammonia concentrations exceed a guideline if no dilution or attenuation occurs in the groundwater system and all the nitrogen is discharged as ammonia.

24. Thus, while I do not consider the scenario of no dilution or attenuation to be realistic I accept that adopting an instream limit for ammonia would be a suitable solution to addressing the residual uncertainty associated with the measurement of the historical nutrient loads (and subsequent impacts on the Rastus Burn water quality) in order to maintain the existing low level of effects on water quality.

25. Dr Greer suggests that an annual 95%ile instream concentration should be compared to the ammoniacal nitrogen 99% species protection DGV (ANZG, 2026). I agree that the 99% species protection guideline for ammoniacal nitrogen should be adopted. The guideline should be adjusted for the temperature and pH at the time of sampling. This would require adding temperature to the required monitoring parameters in WW.16 (e.g. the condition discussing the parameters for analysis in the water samples). A proposed consent condition (WW.8G) has been added to secure this proposed ammonia limit which relies on **Appendix B** or Attachment I to the proposed conditions.

26. Due to the practicalities of comparing an annual 95%ile to a specific month's conditions, I recommend a quotient approach which allows for normalising of the annual 95%ile concentration to the monthly temperature and pH adjusted guideline limits while also preserving the statistical benefits of 95%ile for comparison. The quotient approach has precedent in other discharges of wastewater e.g. Environment Southland discharge consent AUTH-20158595-01 (**Appendix C**).

27. Therefore, my view is that the matter of ammonia toxicity has been suitably resolved.

Wastewater - Microbial Risk Assessment

28. Dr Greer's statement of evidence section 3.4.1 states that during their pre-engagement review of draft versions of the report B-11 that Dr Greer identified a number of key issues. Those key issues were generally communicated to NZSki (e.g. TELNZ report dated 26/05/2026 and subsequent workshops) except for issue 8, regarding the potential microbial risk to contact recreation in the Kawarau River.

29. B-11 included an assessment of microbial risk using *E. coli* as a proxy for the microbial contaminant load, however in Dr Greer's opinion this was insufficient as the sole basis for assessing risks associated with *"… a wastewater discharge where the microbial characteristics of the effluent reflected those of raw wastewater*". Dr Greer's statement in 3.4.1.8 indicates that the applicant needs to provide clear justification for why a Quantitative Microbial Risk Assessment (**QMRA**) is not needed.

30. Under the existing wastewater discharge, *E. coli* concentrations have rarely been detected in the Rastus Burn above the limit of reporting as discussed in section 4.3.3 of B-11. The Project requires an improvement to the level of treatment to meet the annual nutrient limits and it is reasonable to expect that there may be incidental reductions in pathogen concentration (above that provided for by the current primary septic tank system) through mechanisms such as improved solids removal or predation by protozoa.

31. A high-level risk assessment was completed using the desktop Microbial Risk Assessment (**MRA**) tool (PHF, 2026). The tool allows the assessment of the potential concentration of Norovirus, E. coli, and Campylobacter for a generic wastewater discharge characteristic scenario which was calibrated (as far as possible) to the situation at the Rastus Burn under the expected conditions of the consented discharge (e.g. secondary treatment). The results of the MRA are presented in **Appendix D**.

32. The results of the MRA for Norovirus indicate that only the 100th percentile concentration exceeded the maximum acceptable concentration of 1x10-6 per litre for drinking water at the point of discharge to the Rastus Burn (200m downstream from the discharge to land). The probability of exceedance was 0.007% or 1 in 14,300, demonstrating that exceedance is extremely rare. The maximum acceptable concentration is the concentration expected to result in the tolerable annual infection probability (1 in 10,000 per year).

33. As there is no recreational contact guideline for Norovirus, the maximum acceptable concentration for drinking water could be conservatively applied as a recreation contact guideline as intentional ingestion poses a higher risk than incidental ingestion. This is consistent with the approach for other contaminants where the New Zealand Drinking Water Standard is diluted by 10 times. This accounts for a reduction in exposure assuming a swimmer accidentally swallows about 100-200 mL of water per session rather than 2 litres of drinking water per day (e.g. Guidelines for Managing Risks in Recreational Water (NHMRC, 2008)) .

34. As noted in the MRA, further log reductions in concentration occur during transport. Therefore, Once the impacted groundwater discharges to the Rastus Burn, the water steeply descends over 5km down to the Kawarau River. During this transport, attenuation and dilution processes would further reduce the concentration of pathogens at the point of discharge into the Kawarau River. It is therefore considered that the microbial risk to the Kawarau River is negligible, and a more detailed QMRA is not required.

35. Therefore, based on the MRA assessment for the Project, a secondary treated discharge without disinfection would be sufficient for the risk to human health from water-borne pathogens to be acceptably low.

Wastewater – Servicing and Infrastructure

36. Dr Greer states in 3.7.3.1 that the five-year rolling statistics for TSS and BOD5 are inappropriate "… as they could mean that compliance is not assessed until up to seven years after a relevant exceedance occurs". This is not NZSki's planned approach for these statistical measures. To provide enough data for the five-year rolling mean, the existing dataset will continue to be used as is already proposed in Condition WW.8A. This is appropriate as the statistics were derived from the existing dataset, so compliance is considered achievable.

Climate Change – Changes to Discharge Conditions from Climate Change

37. In paragraph 39 of Dr Dixon evidence, it states that "... However, they should demonstrate whether the adopted thresholds, dilution assumptions, and treatment and receiving-environment conclusions remain valid under plausible future low-flow and warmer-water conditions and the proposed peak visitor loading. To the extent those conclusions have not been explicitly climate-tested, their long-term robustness remains uncertain."

38. While B-11 does consider some long-term effects from climate change in sections 3.2 and 7.6, including improved treatment efficiency due to warmer air and water temperatures, it does not address the effects to the level of detail assessed as relevant by Dr Dixon.

39. Based on the Assessment of Dr Cullen, under the most common and likely climate change scenarios, anticipated effects are unlikely to have a significant impact until beyond the life of the consent (e.g. after 2060). At that time the snow line is likely to begin receding above the Base Building at an elevation of 1600m ASL. In that scenario the upper catchment snow cover is expected to remain largely the same although with a sustained reduction in total snow cover.

40. The elevation of the dispersal field in the Rastus Burn is approximately at 1400m ASL. Figure 1 of Dr Cullens report presents a proxy representation of the Remarkables snow line, under three climate change scenarios. The snowline starts from an elevation of 1,300m ASL for the 1995-2014 baseline, and by 2041-2060 modelled scenario, the snowline has receded and ranges from 1,450m ASL to 1,600m ASL depending on the climate scenario.

41. Therefore, for the last 20 years of the consenting period, the dispersal field is likely to be free from snow for large parts of the winter. It is therefore expected that the water temperature in winter may slightly increase and flows may be slightly higher than typical for that time. In addition, the duration of snow-melt induced high flows would likely shorten so that the Rastus Burn Basin was largely snow free before Christmas.

42. What this means for the periphyton growth risk period is that it is likely to be extended to some extent. Soil temperature at the dispersal field will also likely be cooler without the insulating effect from snow cover. Perhaps reducing the survival of soil bacteria through winter. Water temperatures will increase above 10°C possibly as early as late spring and persist for longer into Autumn.

43. Thus, NZSki are required to mitigate the potential for adverse effects on the Rastus Burn from a slow but sustained change to the ambient / background environmental conditions. For ammonia toxicity, the adoption of the temperature and pH adjusted ammonia toxicity allows for an adaptive management approach. For DIN and DRP, the discharged contaminants which promote periphyton growth, the adaptive management process using trigger levels is sufficient to manage for changing conditions. Mark Hamer's evidence provides more detailed discussion of this matter

Climate Change – Natural Hazards and Climate Change

44. The evidence of Dr Rowan James Dixon states in paragraph 14 that the wastewater assessment did not consider "… climate-related risks or where climate change can alter the frequency, severity, and interaction of hazards and environmental pressures that affect infrastructure, operational continuity, and biodiversity compensation outcomes".

45. Dr Cullen does not address natural hazards and alteration to the frequency, severity, and interaction of hazards and environmental pressures.

46. B-11 section 3.9 briefly considered natural hazards and climate change, finding that the site was likely to experience a higher total rainfall, and increase in the number of high rainfall days. However, I consider any more detailed assessments to be outside of my expertise.

47. As Derek Chinn authored the Natural Hazards report, he has provided a response to Dr Dixons comments.

Kawarau Water Quality

48. QPL evidence states that they are a user of the Rastus Burn water with a water take somewhere along the 1.4 km reach beyond the DOC estate, but before the Rastus Burn discharges into the Kawarau River. Currently the water is used for on-farm purposes such as stock supply, however they state that in the future they may require it for domestic supply.

49. Based on the MRA analysis and assessment presented in my evidence in paragraphs 27 – 34, the concentration of pathogens after 5km of transport from the discharge point are unlikely to exceed the drinking water standards. The water is also suitable for consumption with respect to other contaminants as well (e.g. nitrate).

50. QPL have suggested an expensive alternative of piping the wastewater to Lake Hayes Estate, when the risk profile does not support such an action. This is covered in more detail in the evidence of Marc Jensen. I suggest that if the assessed risk profile is not acceptable to QPL then they should consider more cost-effective options (such as rainwater collection tanks or cartridges and UV filters) which also deal with the potential impacts from wildlife or stock access to the Rastus Burn. A

51. Considering the use of Rastus Burn waters for domestic supply is currently a long-term plan, the above proposed options are considered appropriate for the life of the consent under application. The existing monitoring conditions are considered suitable for downgradient water users.

Kā Rūnaka Statement on Wastewater

52. Shane Ellison's evidence on traffic and infrastructure includes an assessment of the wastewater information (Paragraphs 35 – 39). Shane Ellison did not state that my report was read as part of his evidence assessment, however he has identified that the substantive application including the wastewater discharge impact assessment was silent on cultural matters, including what effect the increased discharge to water

bodies may have on cultural values or how these might be managed with Mana Whenua.

53. I agree with Shane Ellison's evidence, but it is outside of my expertise to comment on the cultural values.



Simon Henry Bloomberg

3 November 2026

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NHMRC. (2008). *Guidelines for Managing Risks in Recrational Water.* Australian Government.

PHF. (2026). *Microbial Risk Assessment tool*. Retrieved from https://mra-tool-nz.streamlit.app/

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Appendix A: Conservative Assessment of Flow and Contaminant Concentrations in the Rastus Burn.

MEMO

To:	NZSki Limited	Ref:	25047.3.5A
Cc:			
From:	E3Scientific		
Date:	30/10/2026		
Subject:	Simon Bloomberg Statement of Evidence Appendix A - Conservative Assessment of Flow and Contaminant Concentrations in the Rastus Burn		

1 Introduction

On 18th September 2026, ORC provided feedback to NZSki on the wastewater discharge impact assessment. The following statement was made:

"The remaining freshwater ecology concern is the absence of a quantitative mass-balance assessment for the Rastus Burn. The view of our freshwater ecologist is that a conservative assessment can be undertaken now, without needing to wait for the winter hydrological investigations, and should demonstrate the potential ammonia concentrations and confirm that DIN and DRP remain within the guideline values relied upon in the ecological assessment across the relevant range of flows, particularly summer low flows. We are of the view that this would help support the conclusions of the existing ecological assessment rather than requiring substantial further ecological work."

1.1 Scope of Work

This technical memo was drafted to respond to the request from ORC and includes a steady-state mass balance based on historic flows and concentrations, and a conservative mass balance for the proposed future scenario under the Doolans Expansion Project. Further assessment was completed to address concerns about the relationship between flows and concentrations and the suitability of the monthly compliance monitoring programme for assessing the effects of the wastewater discharge.

2 Mass Balance for NH_4-N

A conservative steady-state mass balance equation is:

$$pC_{ds} = \frac{(Q_{us} \times mC_{us}) + (Q_{ww} \times mC_{ww})}{Q_{us} + Q_{ww}}$$

where:

- pC_{ds} = predicted downstream concentration (mg/L)
- Q_{us} = upstream stream flow (L/s)
- mC_{us} = Measured upstream stream concentration (mg/L)
- Q_{ww} = wastewater flow (L/s)
- mC_{ww} = Measured wastewater concentration (mg/L)

2.1 Assumptions

The equation generates an extremely conservative assessment because it assumes that:

- All NH_4-N discharged at the infiltration basins ultimately reaches Rastus Burn as NH_4-N. This assumption is unrealistic based on historic monitoring as nitrate is the dominant N-species in the Rastus Burn.
- No nitrification in the groundwater system. This assumption is somewhat unrealistic as based on observed nitrate concentrations in the Rastus Burn, nitrification is occurring.
- No sorption or attenuation in the groundwater system. It is not known how much sorption or attenuation occurs in the groundwater system, however as there is limited to no soil profile this assumption is considered conservative.
- No dilution in the groundwater system. This assumption is unrealistic as there is a known groundwater system beneath the dispersal basins with low concentrations of nutrients measured at the upstream borehole.
- No plant uptake in wetland seeps along the riparian margin. This assumption is conservative, while there are some wetlands present it is not fully understood how these interact with the groundwater-surface water system.

Other assumptions of the model are as follows:

- The Rastus Burn is well mixed with respect to NH_4-N concentration at the time of sampling. This assumption is considered to be generally appropriate for the Rastus Burn due to the steepness of the gradient and many short falls and riffles resulting in a well-mixed water body.

- Flows in Doolans Creek above the water level monitoring point of DC3 can be used as a proxy for flows in the Rastus Burn. Doolans Creek catchment is adjacent to the Rastus Burn, receives similar rainfall, has the same source mountain range, is at the same elevations, gradients, vegetation, geology, and roughly similar upstream catchment area (568 ha for the Doolans vs 581 ha for the Rastus Burn). While the relationship is yet to be quantifiably defined, it is expected that there is a reasonably high linear correlation between the two sites which provides for a reasonable level of certainty for this assessment.

2.2 NH4-N Mass Balance for Historic Flows (2025-2026)

The NH_4-N mass balance was assessed for 2025-2026 as these are the years with available flow data for Doolans Creek.

The worst case ammonia concentration in the Rastus Burn (pC_{ds}) was calculated using the mass balance equation and compared with the historic monthly measured instream concentration from June 2025 to May 2026 (Table 1). The mass balance uses the following data sources:

- Q_{US} = The Doolans Creek stream flow on the day of sampling (L/s). To be replaced with Rastus Burn Flow data once available (c. December 2026).
- mC_{US} = The concentration of NH_4-N in the Rastus Burn at the upstream monitoring site (mg/L). When the upstream result was <0.01mg/L, a value of 0.01 mg/L was substituted for the upstream value (e.g. the LOD). This is considered a reasonable value to use in place of left-censored data for the purpose of a conservative assessment.
- Q_{ww} = The median monthly wastewater discharge (L/s). For three months the median value was 0 L/s, thus for the calculation, the lowest monthly median value of 0.001 L/s (December) was substituted.
- mC_{ww} = The measured monthly concentration of NH_4-N in the wastewater discharge (mg/L).

The monthly predicted downstream concentrations ranged from <LOD to 0.36 mg/L, whereas the measured downstream concentrations ranged from <LOD to 0.1 mg/L. All of the predicted downstream concentrations exceeded the maximum measured downstream concentration value for each month.

Of the 12 months from June 2025 to May 2026:

- Only one month had an upstream concentration above the LOD (February 2026). However, the measured downstream concentrations were all less than the upstream concentration, indicating that no wastewater impacts were evident at that time. The predicted downstream concentration was the same as the measured upstream concentration, so exceeded the measured downstream concentration.
- The 11 other months had a measured upstream concentration below the limit of detection. To calculate a predicted downstream concentration for those months a value of 0.01 mg/L (e.g. the LOD) was substituted. Of those 11 months:
    - Seven months had predicted concentrations that were greater than the LOD, and thus the measured downstream concentrations.
    - Three months had a predicted downstream concentration of 0.01, so were considered to represent downstream concentrations less than the LOD, the same as reported in the measured downstream concentrations.
    - Only one month (August 2025) had a measured downstream concentration above the limit of detection[i]. The predicted downstream concentration for this month was an order of magnitude above the measured concentration (0.04 mg/L vs 0.36 mg/L).

Comparison of the predicted concentrations with the measured concentrations supports the current conceptual site model that includes dilution and attenuation processes in the groundwater and surface water system. The amount of dilution required to reduce the predicted downstream concentration to the highest measured downstream concentration is in the range of 24.4:1 to 1:1 (note that for required dilutions of 1:1 the measured and predicted samples were both <LOD so dilution is not required).

Overall, the mass balance for historic flows supports the existing conceptual site model where attenuation and dilution of the wastewater discharge occur in the groundwater system prior to discharge to the Rastus Burn. There is still uncertainty regarding the dilution and attenuation occurring in the groundwater system, including the transport time in the groundwater prior to recharging surface water (and hence lag between discharge and stream sampling). This aspect is to be investigated further by completing

[i] This is the only month where impacts from the wastewater discharge were evident based on elevated downstream ammoniacal nitrogen concentrations, i.e. the downstream concentration was greater than the upstream concentration indicating another source of ammoniacal nitrogen. At this time the concentration of ammonia was 0.04 mg/L which met the seasonally adjusted 99% ammonia DGV for winter (0.33 mg/L; as reported in e3s, 2026c).

a chloride mass balance assessment, slug testing, and analysis of the aquifer properties around the disposal basin (Condition WW.28).

Table 1: Conservative Mass Balance Assessment for Total Ammoniacal Nitrogen (mg NH_4-N/L): Predicted Downstream Concentration for 2025-2026 Doolans Ck Flows

Month-Year	Q_{ww} (L/s)	mC_{ww}	Q_{us} (L/s)	RB Upstream, mC_{us}	Predicted RB DS, pC_{ds}	RB DS 50m mC_{ds}	RB DS 200M mC_{ds}	RB DS 1.5KM mC_{ds}	Dilution of pC_{ds} Required to Equal Highest mC_{ds}#
Jun-25	0.369	37.4	66	**<0.01**	0.22	<0.01	<0.01	<0.01	> 21.8
Jul-25	0.539	119	273	**<0.01**	0.24	<0.01	<0.01	X	> 24.4
Aug-25	0.491	153	213	**<0.01**	0.36	0.04	0.04	X	> 9
Sept-25	0.491	14.7	725	**<0.01**	0.02	<0.01	<0.01	X	> 2
Oct-25	0.808	5.52	924	**<0.01**	0.015	<0.01	X	X	> 1.5
Nov-25	0.745	1.39	901	**<0.01**	0.011	<0.01	<0.01	X	>1.1
Dec-25	0.001	8.23	836	**<0.01**	<0.01	<0.01	<0.01	<0.01	Not required
Jan-26	0.011	4.53	386	**<0.01**	<0.01	<0.01	<0.01	<0.01	Not required
Feb-26	0	7.8	98	0.12	0.12	0.1	<0.01	0.06	1.2
Mar-26	0	6.38	52	**<0.01**	<0.010	<0.01	<0.01	<0.01	Not required
Apr-26	0	5.84	417	**<0.01**	<0.01	<0.01	<0.01	<0.01	Not required
May-26	0.317	4.89	86	**<0.01**	0.028	<0.01	<0.01	<0.01	>2.8

Brown Highlighted Cells = Months where the median daily flow was 0m^3/day; Clearly there was flow or a sample could not have been taken however in general very little flow occurred for that month (off-season). A value of 0.001 was used for the calculation (lowest median flow, December 2025).

Grey highlighted months are the low flow risk period (January to April).

Bold-highlighted months are where measured upstream results were <LOD, the LOD was used for the calculation (e.g. 0.01 mg/L).

Underlined predicted C_{ds} concentrations are below the LOD.

X = No result reported

When the highest mC_{ds} was <LOD, the dilution was calculated using a value of 0.01 mg/L.

2.3 Conservative Future NH_4-N Mass Balance Assessment

To assess the future discharge scenario a conservative mass balance assessment can be completed which predicts the ammonia concentration in the Rastus Burn compared to the instream concentration. The mass balance uses the following data sources:

- Q_{US} =
    - The consented residual flow for the Rastus Burn (15 L/s). This is considered an unrealistic scenario; and
    - the Doolans monthly minimum flow (L/s). This is a conservative worst-case scenario as the monthly minimum flow was considered to represent a MALF year in the Doolans.
- mC_{US} =
    - The maximum measured upstream concentration of NH_4-N in the Rastus Burn (0.12 mg/L). Unrealistic worst-case scenario[ii]; and
    - The 95%ile measured upstream concentration of NH4-N in the Rastus Burn (0.056 mg/L). Conservative worst-case scenario.
- Q_{ww} =
    - The consented maximum daily wastewater discharge during the ski season (June to October) for a predicted 6,000 skiers on the peak day (2.36 L/s); and
    - The occupant-adjusted wastewater flow (0.16 L/s) for the shoulder seasons (November, March, April, May) where a maximum of 400 occupants per day is predicted; and
    - The occupant-adjusted wastewater flow (0.49 L/s) for the peak summer season (December to February) where a maximum of 1250 occupants per day is predicted.
- mC_{ww} = Potential treated effluent concentration of TN in the wastewater discharge required to meet the total nitrogen annual nutrient load limit (e.g. 40 mg TN/L expressed as 100% NH_4-N). This is considered extremely conservative as compared to the current septic tank system which discharges almost 100% of TN as ammonia, a modern system may discharge a much lower proportion of TN as ammonia.

[ii] The maximum mC_{US} of 0.12 mg NH_4-N/L is two thirds of the seasonally adjusted guideline value of 0.18 mg/L for spring conditions and is around a third to a quarter of the other seasonally adjusted guidelines.

Table 2 presented the four scenarios that were considered for the future discharge mass balance assessment. It is considered that scenario 4 represents the most realistic conservative scenario.

Table 2. Future Discharge Mass Balance Scenarios

Data	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Consented Rastus Burn Residual Flow	✓		✓	
Doolans Minimum Monthly Flow		✓		✓
Potential median discharge concentration	✓	✓	✓	✓
Consented Maximum Flow and occupant adjusted flows for off-season	✓	✓	✓	✓
Upstream maximum concentration	✓	✓		
Upstream 95%ile concentration			✓	✓

To assess the predicted downstream concentration (pC_{ds}) against the seasonally adjusted guideline values the following classification was used:

- Meets guideline = Guideline ≥ Predicted
- Exceeds Guideline = Guideline < Predicted

The seasonally adjusted guidelines reported in e3s (2026c) are reproduced in Table 3.

Table 3. Maximum Seasonal Total Ammoniacal Nitrogen and pH, for all monthly samples (2015-2026); and Estimated Seasonal Maximum Water Temperature.

Maximum Value	Summer	Autumn	Winter	Spring
Upstream	0.12	0.02	0.09	0.03
50m Downstream	0.1	0.03	0.19	0.03
200m Downstream	0.04	0.03	0.19	0.04
1.5km downstream	0.06	0.06	0.01	0.02
Maximum pH of Downstream 50m and 200m	7.4	7.5	7.8	8.2
Estimated Maximum Seasonal Water Temp [1]	14	7	3	9
Freshwater 99% species-protection guideline values for total ammonia (mg/L N) at different pH and temperature (ANZG, 2026)	**0.36**	**0.45** [2]	**0.33** [2]	**0.18** [2]
[1]Estimated temperature based on field measurements from February, March, June, July 2026 [2]Guideline values minimum temperature of 10 °C				

Note that the guidelines are considered to be conservative for winter conditions where temperatures are far colder than 10°C; it is likely a low temperature toxicity guideline value would be higher than 0.33 mg/L.

Results are presented in Table 4.

Table 4: Seasonal and Monthly Conservative Steady State Mass Balance Assessment for Predicted Total Ammoniacal Nitrogen (NH_4-N)

Mass Balance Scenario	Month	Q_{ww} (L/s)	mC_{ww} (mg NH_4-N/L)	Q_{us} (L/s)	mC_{us} (mg NH_4-N/L)	pC_{ds} - Predicted Downstream NH4-N (mg/L)	Seasonally-adjusted NH_4-N Toxicity Guideline (mg/L)	C_{ds} Prediction vs Guideline	Dilution of pC_{ds} Required to Meet Guideline
1. Consented Maximum: Consented maximum flow, Advanced secondary nutrient reduction, Consented residual flow Maximum historic upstream concentration	Jan	0.49	40	15	0.12	1.38	0.36	Exceeds Guideline	3.8
	Feb	0.49	40	15	0.12	1.38	0.36	Exceeds Guideline	3.8
	Mar	0.16	40	15	0.12	0.54	0.45	Exceeds Guideline	1.2
	Apr	0.16	40	15	0.12	0.54	0.45	Exceeds Guideline	1.2
	May	0.16	40	15	0.12	0.54	0.45	Exceeds Guideline	1.2
	Jun	2.36	40	15	0.12	5.54	0.33	Exceeds Guideline	16.8
	Jul	2.36	40	15	0.12	5.54	0.33	Exceeds Guideline	16.8
	Aug	2.36	40	15	0.12	5.54	0.33	Exceeds Guideline	16.8
	Sept	2.36	40	15	0.12	5.54	0.18	Exceeds Guideline	30.8
	Oct	2.36	40	15	0.12	5.54	0.18	Exceeds Guideline	30.8
	Nov	0.16	40	15	0.12	0.54	0.18	Exceeds Guideline	3.0
	Dec	0.49	40	15	0.12	1.38	0.36	Exceeds Guideline	3.8
2. Conservative Maximum: Consented maximum flow, Advanced secondary nutrient reduction, Doolans minimum monthly flow Maximum historic upstream concentration	Jan	0.49	40	98	0.12	0.32	0.36	Meets Guideline	Not required
	Feb	0.49	40	64	0.12	0.42	0.36	Exceeds Guideline	1.2
	Mar	0.16	40	51	0.12	0.24	0.45	Meets Guideline	Not required
	Apr	0.16	40	59	0.12	0.23	0.45	Meets Guideline	Not required
	May	0.16	40	65	0.12	0.22	0.45	Meets Guideline	Not required
	Jun	2.36	40	66	0.12	1.5	0.33	Exceeds Guideline	4.5
	Jul	2.36	40	156	0.12	0.71	0.33	Exceeds Guideline	2.2
	Aug	2.36	40	143	0.12	0.77	0.33	Exceeds Guideline	2.3
	Sept	2.36	40	113	0.12	0.94	0.18	Exceeds Guideline	5.2
	Oct	2.36	40	486	0.12	0.31	0.18	Exceeds Guideline	1.7
	Nov	0.16	40	716	0.12	0.13	0.18	Meets Guideline	Not required
	Dec	0.49	40	638	0.12	0.15	0.36	Meets Guideline	Not required
3. Consented 95%ile: Consented maximum flow, Advanced secondary nutrient reduction, Consented residual flow 95%ile historic upstream concentration	Jan	0.49	40	15	0.06	1.32	0.36	Exceeds Guideline	3.7
	Feb	0.49	40	15	0.06	1.32	0.36	Exceeds Guideline	3.7
	Mar	0.16	40	15	0.06	0.48	0.45	Exceeds Guideline	1.1
	Apr	0.16	40	15	0.06	0.48	0.45	Exceeds Guideline	1.1
	May	0.16	40	15	0.06	0.48	0.45	Exceeds Guideline	1.1
	Jun	2.36	40	15	0.06	5.49	0.33	Exceeds Guideline	16.6
	Jul	2.36	40	15	0.06	5.49	0.33	Exceeds Guideline	16.6
	Aug	2.36	40	15	0.06	5.49	0.33	Exceeds Guideline	16.6
	Sept	2.36	40	15	0.06	5.49	0.18	Exceeds Guideline	30.5
	Oct	2.36	40	15	0.06	5.49	0.18	Exceeds Guideline	30.5
	Nov	0.16	40	15	0.06	0.48	0.18	Exceeds Guideline	2.7
	Dec	0.49	40	15	0.06	1.32	0.36	Exceeds Guideline	3.7
4. Conservative 95%ile: Consented maximum flow, Advanced secondary nutrient reduction, Doolans minimum monthly flow 95%ile historic upstream concentration	Jan	0.49	40	98	0.06	0.26	0.36	Meets Guideline	Not required
	Feb	0.49	40	64	0.06	0.36	0.36	Meets Guideline	Not required
	Mar	0.16	40	51	0.06	0.18	0.45	Meets Guideline	Not required
	Apr	0.16	40	59	0.06	0.17	0.45	Meets Guideline	Not required
	May	0.16	40	65	0.06	0.16	0.45	Meets Guideline	Not required
	Jun	2.36	40	66	0.06	1.44	0.33	Exceeds Guideline	4.4
	Jul	2.36	40	156	0.06	0.66	0.33	Exceeds Guideline	2.0
	Aug	2.36	40	143	0.06	0.71	0.33	Exceeds Guideline	2.2
	Sept	2.36	40	113	0.06	0.88	0.18	Exceeds Guideline	4.9
	Oct	2.36	40	486	0.06	0.25	0.18	Exceeds Guideline	1.4
	Nov	0.16	40	716	0.06	0.07	0.18	Meets Guideline	Not required
	Dec	0.49	40	638	0.06	0.09	0.36	Meets Guideline	Not required

Grey highlighted months represent the low-flow risk period (January to April)

For the unrealistic residual flow scenarios 1 and 3, the highest predicted downstream concentrations occurred during the ski season and over summer peak from December to February. Peak pC_{ds} ranged from 1.32 to 1.38 mg/L over the summer peak and 5.49 to 5.54 mg/L over the ski season. The largest exceedance occurred during the spring months of the ski season when the seasonally adjusted guideline is the lowest.

The conservative minimum monthly flow scenarios 2 and 4 had much lower peak predicted downstream concentrations with only June exceeding 1 mg/L due to low flows. However, guidelines are still exceeded under these scenarios during the ski season for scenario 2 and 4, and also in February under scenario 2 (Q_{us} = residual flows).

Based on the observed difference between the maximum upstream concentration and the 95%ile upstream concentration, the upstream concentration has less of an impact on the predicted concentration compared to the large volume of wastewater discharged.

2.4 Mass Balance Summary

The 'Conservative 95%ile' Scenario 4 is considered most representative of the potential changes to the discharge conditions required to support the Doolans Expansion Project while still being extremely conservative for the reasons outlined in section 2.1 and 2.3. The predicted instream concentrations were highest during the ski-season and lowest during the off-season, including the low flow risk period. The seasonally adjusted guideline values were not exceeded during the off-season.

During the ski-season, the predicted monthly instream concentrations exceeded the adopted guidelines, however actual ammonia toxicity within the stream is considered extremely unlikely for the following reasons:

- The guidelines are considered to be conservative for winter conditions where temperatures are far colder than 10°C; it is likely a low temperature toxicity guideline value would be higher than 0.33 mg/L.
- The exceedances are within 1 to 5 times the conservative adopted 10°C guideline, so a dilution attenuation factor of five would be all that is required to achieve acceptable instream NH_4-N concentrations. This was shown to be very likely to occur even in a low flow year based on the historic assessment in Section 2.2.
- The calculation assumes that all the TN is ammoniacal nitrogen which is unlikely in oxidising conditions, and isn't supported by the historical data.

Based on this assessment, there is likely to always be sufficient capacity to dilute and attenuate the wastewater discharge in the groundwater and surface water system such that NH_4-N toxicity is not a risk in the Rastus Burn (if the total nutrient load is maintained at the historically acceptable levels by improving the treatment system to account for increased wastewater flows).

Based on the future discharge mass balance it may be appropriate to adopt a temperature and pH adjusted guideline value; particularly when temperatures exceed 10°C in the Rastus Burn and low flows occur (e.g. February).

3 Assessment of representativeness of samples

To determine whether this assessment can be considered representative, further review of the sampling conditions is discussed in this section.

e3scientific undertook an assessment of the Doolans Creek flow rating curve which found that the flow conditions during 2025 were representative of a low flow year for the Doolans (e3s, 2026a). Therefore, the use of the monthly minimum flow was considered suitable for the conservative mass balance assessments.

For the monthly sampling events in the Rastus Burn to be considered generally representative of flow conditions during that month, the flow at the time of sampling should be near to the median flow. Likewise for the low flow risk months, the low flows should be near to the median flow for the month. To make this assessment, the median flow on the day of sampling and the monthly minimum flows were compared to the monthly median flow in Table 5.

Based on Table 5, for the key risk period for periphyton growth (post-snow melt; January to April) the samples were generally at or about the minimum monthly flow, and the minimum monthly flow was generally consistent with the median conditions for the month. The exceptions are the January 2026 and April 2026 samples where the samples were each taken on the falling limb of a flood event, and so is unlikely to be representative of baseflow / low flow conditions, however the January sampling event was representative of median flows which were elevated due to snow-melt for the first part of that month.

Table 5: Assessment of flow (L/s) conditions in the Doolans Creek on the day of sampling in the Rastus Burn

Month	Monthly Median Flow	Monthly Minimum Flow	Flow on day of sampling	Minimum as a % of Median	Sampled as a % of Minimum	Sampled as a % of Median
Jun-25	77	66	66	86%	100%	86%
Jul-25	286	156	273	55%	175%	95%
Aug-25	200	143	213	72%	149%	107%
Sept-25	629	113	725	18%	642%	115%
Oct-25	896	486	924	54%	190%	103%
Nov-25	1233	716	901	58%	126%	73%
Dec-25	801	638	836	80%	131%	104%
Jan-26	382	98	386	26%	394%	101%
Feb-26	84	64	98	76%	153%	117%
Mar-26	62	51	52	82%	102%	84%
Apr-26	74	59	417	80%	707%	564%
May-26	76	65	86	86%	132%	113%

Purple cells are the wastewater discharge peak period (Ski-season)
Orange cells are the low-flow risk period for periphyton growth

With respect to the relationship between flow and concentration, this assessment (see Appendix A) did not find any clear links between Doolans Creek flow and the contaminant concentrations (DIN, DRP, NH_4-N) in the Rastus Burn. Weak relationships are observed with some dilution at higher flows; conversely however, lower flows did not necessarily lead to higher concentrations. Other factors such as seasonality may thus be a more important factor in determining the concentration of the contaminants in the waterway; particularly around low flows during the wastewater discharge period from June to October compared to the off-season low-flow high-risk period for periphyton growth from January to April.

Overall, the assessment of a year's worth of paired flow-concentration data (Appendix A) is constrained by the concentration data's monthly interval, to generate a reliable relationship at least 24 months of paired flow-concentration data points would be required.

However, a review of the flow and concentration data was worthwhile as it did provide additional evidence that concentrations of contaminants (e.g. DIN, DRP, NH_4-N) are currently meeting the adopted limits during the low-flow key risk period (January to April) and that the monthly sampling could generally be considered to be representative of low flows during the key risk period. The complete flow and concentration analysis is found in Appendix A.

4 Conclusions and Recommendations

The historic monthly and conservative future scenario mass balance assessments for total ammoniacal nitrogen provide further evidence indicating that there is a less than minor risk of ammonia toxicity in the Rastus Burn during the ski season and when Rastus Burn flows are higher due to snow melt. The highest risk period is when low flows occur, and water temperatures are higher in the Rastus Burn (e.g. February). However, under the most realistic, but still extremely conservative mass balance assessment scenario (Scenario 4), no guideline exceedance occurs during this risk period.

These scenarios are considered unrealistically conservative as:

- the guidelines are considered to be conservative for winter conditions where temperatures are far colder than 10°C; it is likely a low temperature toxicity guideline value would be higher than 0.33 mg/L.
- The exceedances are within 1 to 5 times the conservative adopted 10°C guideline, so a dilution attenuation factor of five would be all that is required to result in acceptable instream NH_4-N concentrations. This was shown to be very likely to occur even in a low flow year based on the historic assessment in Section 2.2.
- The calculation assumes that all the TN is ammoniacal nitrogen which isn't supported by the historical data and is unlikely to occur in the future Doolans Expansion scenario with an upgraded treatment plant with nutrient reduction and where oxidising conditions persist in the aquifer.

The likelihood of ammonia exceeding the temperature and pH adjusted toxicity guideline is therefore considered acceptably low; as long as the nutrient loads are maintained at historically acceptable levels there should always be sufficient dilution in the system to reduce the concentrations of nutrients below any guideline limit.

An assessment of the representativeness of the samples indicates that overall, the monthly concentration samples are most likely to be collected during representative flow conditions for the month (e.g. near median flow). However, it is noted from the 2025/2026 period that samples are occasionally collected while flows are still receding following a flood. The standard operating procedures for the water quality monitoring should be reviewed to ensure sampling occurs during stable flow conditions, on the understanding that during the snow-melt period this may not be as achievable.

In terms of flow and concentration, the analysis included in Appendix A and discussed in section 3 was based on a partially complete dataset. However, the preliminary

findings are that seasonality was considered to be more of a determining factor than flow itself. While historically measured concentrations of DIN and DRP did exceed the adopted periphyton growth limits of 0.15 mg/L DIN and 0.006 mg/L DRP these were considered to be infrequent and/or isolated instances. As described in the periphyton risk assessment (Appendix D of the Rastus Burn Wastewater Ecological Impact Assessment (e3s, 2026b)) – "While measured nutrient concentrations may exceed proposed threshold values at times, the actual risk of periphyton growth exceeding the proposed 50 mg/m^2 biomass limit is low due to the environment and the timing of the exceedance." The trigger and response adaptive management framework for periphyton growth risk has been developed to address this issue.

The assessment of Doolans Creek flows and water quality monitoring dates for the Rastus Burn generally indicates that the monthly compliance monitoring data is representative of water quality during the low flow risk period. Ammonia concentrations in the Rastus Burn have not exceeded the temperature and pH adjusted chronic toxicity guideline values in the historic monthly compliance dataset.

4.1 Recommendations

To reduce the uncertainty regarding contaminant transport within the Rastus Burn, the following recommendations for future work are provided:

- More site-specific data will be available shortly following the retrieval of the Doolans Creek level logger which will extend the Doolans Creek dataset from June 2025 to October 2026 (providing 17 months of paired flow-concentration data points).
- At the same time the Rastus Burn flow rating curve will be generated which will allow direct comparison of Rastus Burn flows to the Doolans Creek flows so that Rastus Burn flows can be synthesised to June 2025 (assuming there is a high correlation between the two creek flows).
- Chloride concentrations will be available for both the discharge and the Rastus Burn improving the assessment of solute transport.
- Slug testing of the dispersal field boreholes will provide estimates of aquifer properties such as hydraulic conductivity, which will allow for the assessment of solute transport times and refinement of the groundwater conceptual site model.
- The mass balance will be updated with the above dataset to allow for a more accurate prediction of concentrations for key contaminants in the Rastus Burn.

- If an NH_4-N instream limit is required, then the temperature will need to be added into the monitoring parameters at the Rastus Burn sites.

If you have any questions regarding the information provided in this letter, please contact Simon Bloomberg on 03 409 8664 or via email at [redacted]

Yours sincerely,



Simon Bloomberg
Senior Environmental Scientist

Appendix A: Assessment of Historical Concentration and Assumed Flows in the Rastus Burn

5 References

e3s. (2026a). *Remarkables Ski Area Upgrade and Doolans Expansion - Doolans Creek Water Take Assessment of Effects.* NZSki Limited.

e3s. (2026b). *Rastus Burn Wastewater Ecological Impact Assessment.*

e3s. (2026c). *Remarkables Ski Area Upgrade and Doolans Expansion - Wastewater Discharge Impact Assessment.* Prepared for NZSki Limited.

Whitehead, A. a. (2020). *NZ River Maps: An interactive online tool for mapping predicted freshwater variables across New Zealand.* Retrieved from NIWA: https://shiny.niwa.co.nz/nzrivermaps/

Appendix A: Assessment of Historical Concentration and Assumed Flows in the Rastus Burn

1 Purpose

In addition to the mass balance assessment, a more detailed assessment of the relationship between flow and concentration was undertaken to determine if the monthly monitoring dataset was suitably conservative for the mass balance assessment, and whether monthly sampling was suitable for assessing potential compliance with the potential DIN, DRP, and NH_4-N instream limits.

2 Assessment of DIN, NH_4-N, and DRP under different flow regimes in the Rastus Burn

2.1 Stream Flow Data

The flow rating curve for the Doolans Creek (right branch) has been reviewed. The curve was developed using multiple flow gauging events and hourly stream levels from Jun 2025 to May 2026. In place of a flow rating curve for the Rastus Burn, the Doolans Creek flow rating curve was adopted as the best proxy for use in the mass balance assessments. This is because the Doolans Creek catchment is the next catchment over, receives similar rainfall, has the same source mountain range, is at the same elevations, gradients, vegetation, geology, and roughly similar upstream catchment area (568 ha for the Doolans vs 581 ha for the Rastus Burn). While the relationship is yet to be quantifiably defined, it's expected that there is a reasonably high linear correlation between the two sites which provides for a reasonable level of certainty for this assessment. Flow results for Doolans Creek are reported in Table A. 1.

Table A. 1: Doolans Creek, Median Daily Flow on Day Sampled (L/s)

Date	Flow (L/s)
18/06/2025	66
14/07/2025	273
5/08/2025	213
22/09/2025	725
15/10/2025	924
24/11/2025	901
16/12/2025	836
27/01/2026	386
26/02/2026	98
24/03/2026	52
28/04/2026	417
21/05/2026	86

2.2 Contaminant Concentration Data

NZSki monitors the Rastus Burn at monthly intervals year on year as part of its discharge consent compliance. The contaminant concentration data for the same period (June 2025 to May 2026) as the Doolans flow monitoring was extracted from the dataset.

Concentration data was extracted for Dissolved Inorganic Nitrogen (TON and Total Ammoniacal-Nitrogen), Total Ammoniacal Nitrogen, and DRP and presented here (Table A. 2, Table A. 3, and Table A. 4)

Table A. 2: Dissolved Inorganic Nitrogen Concentrations (calculated from TON + Total Ammoniacal Nitrogen) (mg/L)(LOD=<0.02)

Date	Upstream	50m Downstream	200m Downstream	1.5km downstream
18/06/2025	0.11	0.11	0.1	
14/07/2025	0.12	0.15	0.15	
5/08/2025	0.11	0.12	0.12	
22/09/2025	0.09	0.09		
15/10/2025	0.06	0.06	0.07	
24/11/2025	0.04	0.04	0.05	0.04
16/12/2025	0.02	0.02	0.03	0.03
27/01/2026	0.13	0.11	0.02	0.08
26/02/2026	0.03	0.09	0.11	0.08
24/03/2026	0.05	0.05	0.05	0.05
28/04/2026	0.04	0.04	0.04	0.02
21/05/2026	0.07	0.07	0.07	0.07

Table A. 3: Total Ammoniacal Nitrogen (NH_4-N)(mg/L)(LOD=<0.01)

Date	Upstream	50m Downstream	200m Downstream	1.5km downstream
18/06/2025	0.01	0.01	0.01	
14/07/2025	0.01	0.04	0.04	
5/08/2025	0.01	0.01	0.01	
22/09/2025	0.01	0.01		
15/10/2025	0.01	0.01	0.01	
24/11/2025	0.01	0.01	0.01	0.01
16/12/2025	0.01	0.01	0.01	0.01
27/01/2026	0.12	0.1	0.01	0.06
26/02/2026	0.01	0.01	0.01	0.01
24/03/2026	0.01	0.01	0.01	0.01
28/04/2026	0.01	0.01	0.01	0.01
21/05/2026	0.01	0.01	0.01	0.01

Table A. 4: Dissolved Reactive Phosphorus (mg/L) (LOD=<0.002)

Date	Upstream	50m Downstream	200m Downstream	1.5km downstream
18/06/2025	0.004	0.004	0.004	
14/07/2025	0.004	0.005	0.004	
5/08/2025	0.003	0.003	0.003	
22/09/2025	0.003	0.002		
15/10/2025	0.002	0.002	0.002	
24/11/2025	0.021	0.003	0.003	0.003
16/12/2025	0.004	0.003	0.002	0.003
27/01/2026	0.0025	0.0025	0.0025	0.005
26/02/2026	0.002	0.002	0.002	0.002
24/03/2026	0.004	0.006	0.004	0.005
28/04/2026	0.002	0.002	0.002	0.002
21/05/2026	0.007	0.002	0.002	0.002

2.3 Spearman Rank Correlation for Flow and Concentration Data

Table A. 5 presents the Spearman rank correlation values for flow and concentration at each monitoring site for the requested analytes. The results are considered to be relatively weak given the dataset (n=12) is underpowered for meaningful statistical analysis.

Table A. 5: Spearman Rank Correlation (rs) between Flow and Concentrations

Analyte	Upstream	50m Downstream	200m Downstream	1.5km downstream
Sample Size	12	12	11	7
DIN	-0.253	-0.404	-0.352	-0.523
NH4-N	-0.20	-0.37	-0.45	-0.04
DRP	0.04	0.01	0.0	0.0

DIN concentrations were all generally above the limit of detection (Table A. 2) and exhibited weak to moderate negative correlations with flow (rs = -0.25 to -0.52)(Table 5). This suggests that concentrations may decline with increasing flow. The strongest relationship occurred at the 1.5 km downstream site (rs = -0.52).

Total Ammoniacal Nitrogen concentrations are at or below the limit of detection (<0.01 mg/L) for most sample events and locations (Table A. 3). Thus, the Spearman rank correlation is unable to detect a relationship between flow and NH_4-N when samples are non-detects; the data is considered 'left-censored'.

DRP results are generally above the limit of detection (<0.002)(Table A. 4), allowing assessment using the Spearman rank correlation. The results indicate that DRP concentrations are not correlated with flow, with most results being consistent across sampling events (and thus flows).

In general, the R^2 values reported are similar to the Spearman rank correlation, which show that Doolans Creek flow is a weak predictor of the concentration for the given analytes in the Rastus Burn. The strongest contribution was at 1.5km downstream for DIN, however this dataset only has 7 samples.

2.4 Linear regression analysis for Flow-Concentration Relationship

Scatter plots are presented for each analyte and the given median daily flow (Figure 1, Figure 2, Figure 3).

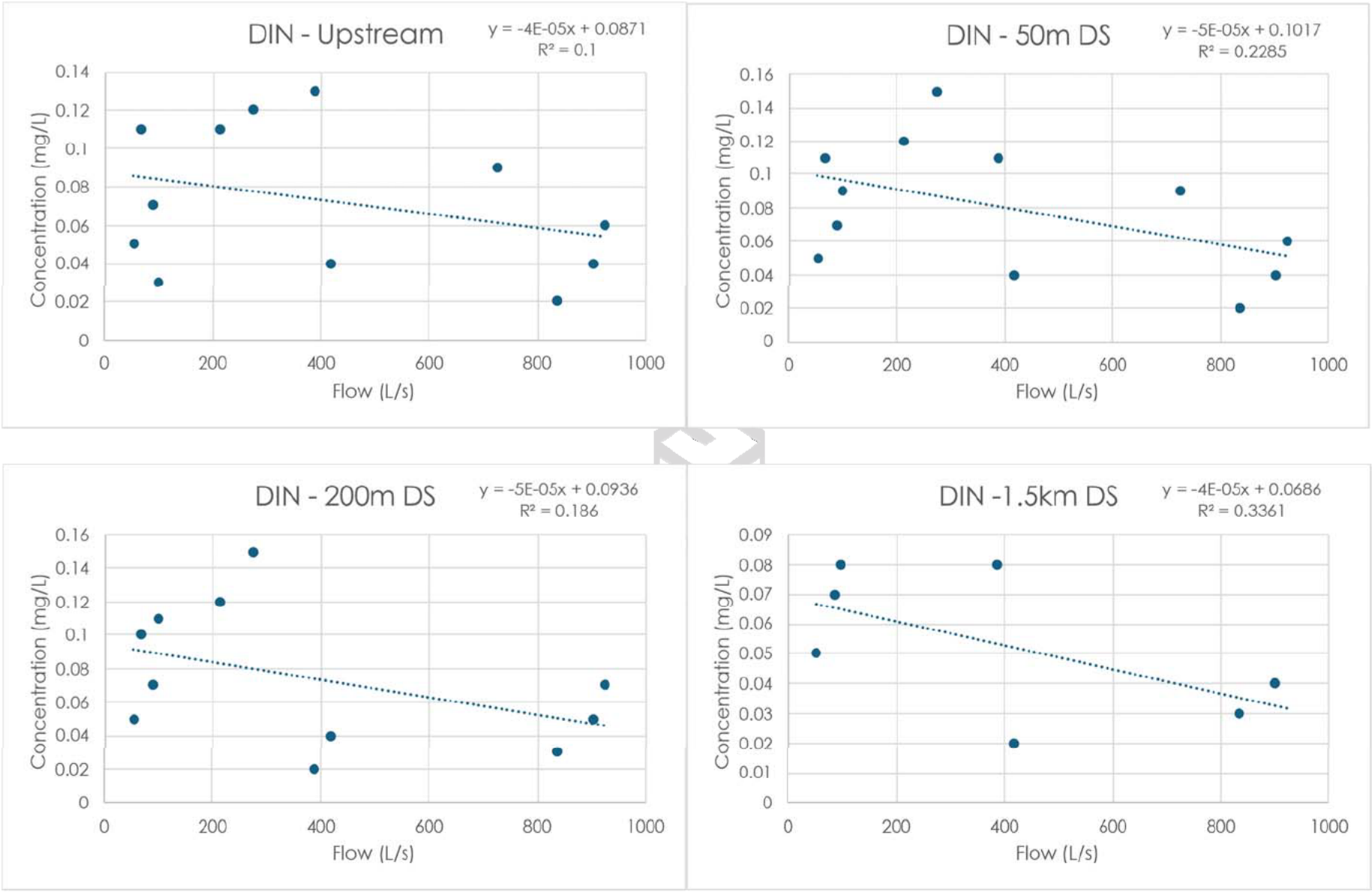


Figure 1. Scatter plots / linear regression analysis for DIN vs. Doolans Creek median daily flow on the day sampled in the Rastus Burn.

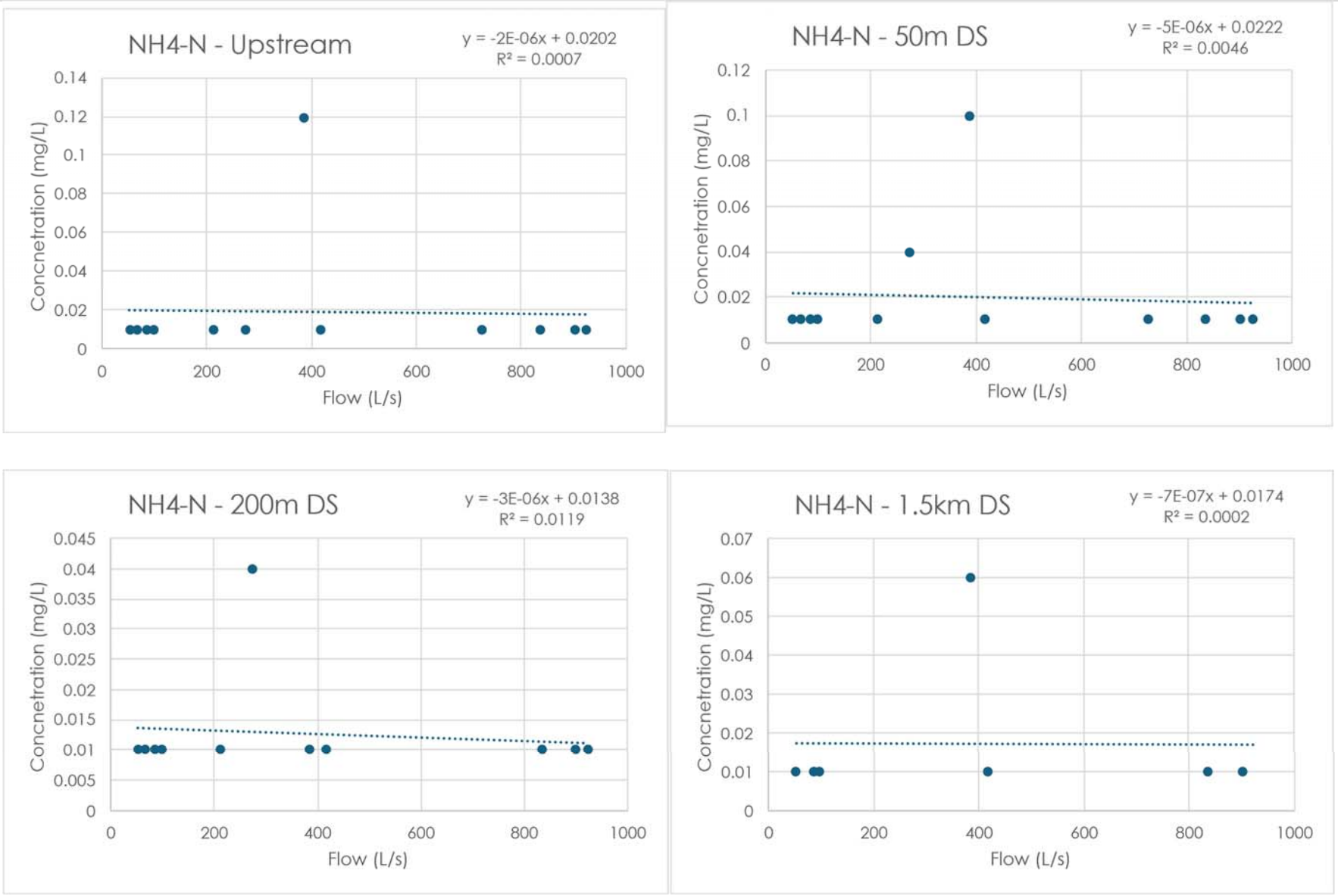


Figure 2. Scatter plots/linear regression analysis for NH4-N vs. Doolans Creek median daily flow on the day sampled in the Rastus Burn.

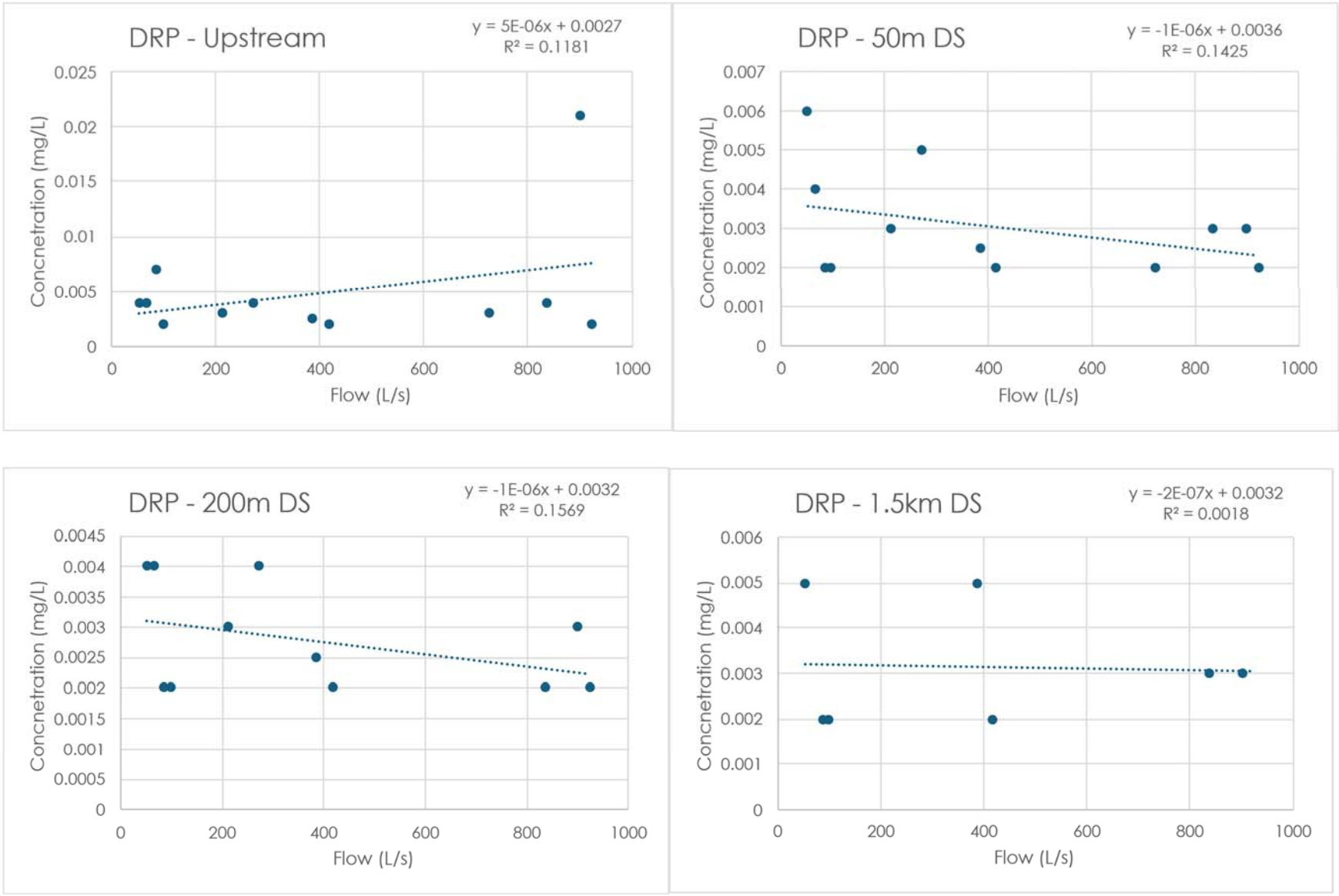


Figure 3. Scatter plots / linear regression analysis for DRP vs. Doolans Creek median daily flow on the day sampled in the Rastus Burn.

The DIN scatter plots all show the same trend of decreasing concentration with increasing flow, the strongest relationship was at 1.5km DS however this site has the smallest sample size so there is less confidence in the results from this site.

There are no clear relationships with flow and NH4-N.

DRP concentration is generally decreasing with increasing flow, the upstream sample site appears to be influenced by one isolated high concentration at high flows which does not fit with the other data, if this sample is removed then the same trends are observed as at the downstream site (e.g. R^2=0.188).

Overall, the linear regression analysis indicates that there are weak relationships with flow for DIN, no clear relationship for NH4-N, and weak relationships for DRP. Thus, flow is considered a minor factor for predicting the instream concentrations of the contaminants.

2.5 Graphical Analysis of Flows and Concentrations

While a relationship between flow and concentration could not reliably be calculated for the Rastus Burn for DIN, Ammoniacal Nitrogen, and DRP, one aspect of that relationship can be observed, which is the nature of the flow in the periods between each sampling event. The following graphs present the full year of Doolans Creek flow data with the sampling events highlighted. It's clear that there are some seasonal effects which are more important than flow in terms of concentration (e.g. the impact from the wastewater discharge).

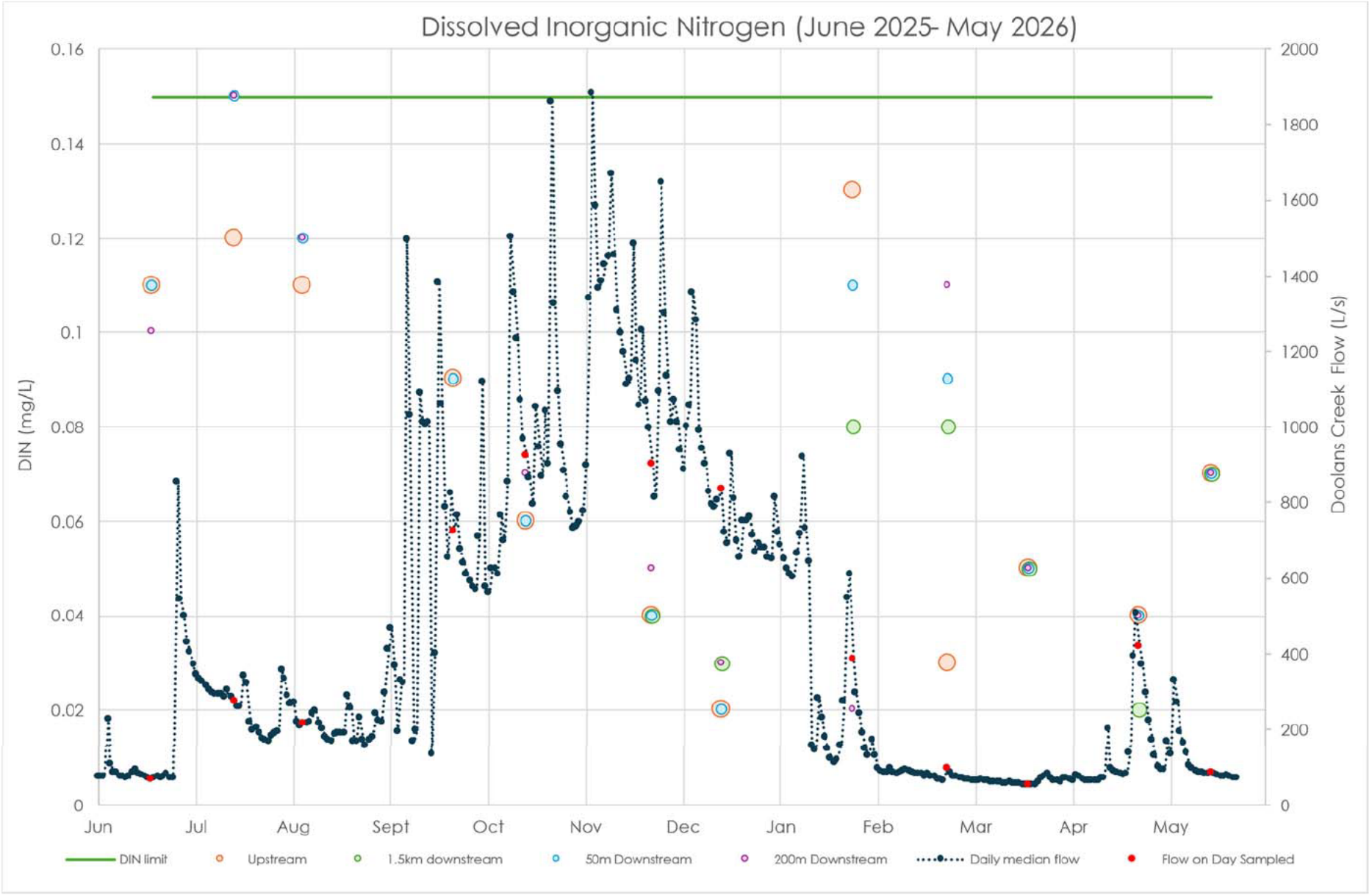


Figure 4: Doolans Creek Median Daily Flow and Concentrations of DIN at Rastus Burn Monitoring Locations.

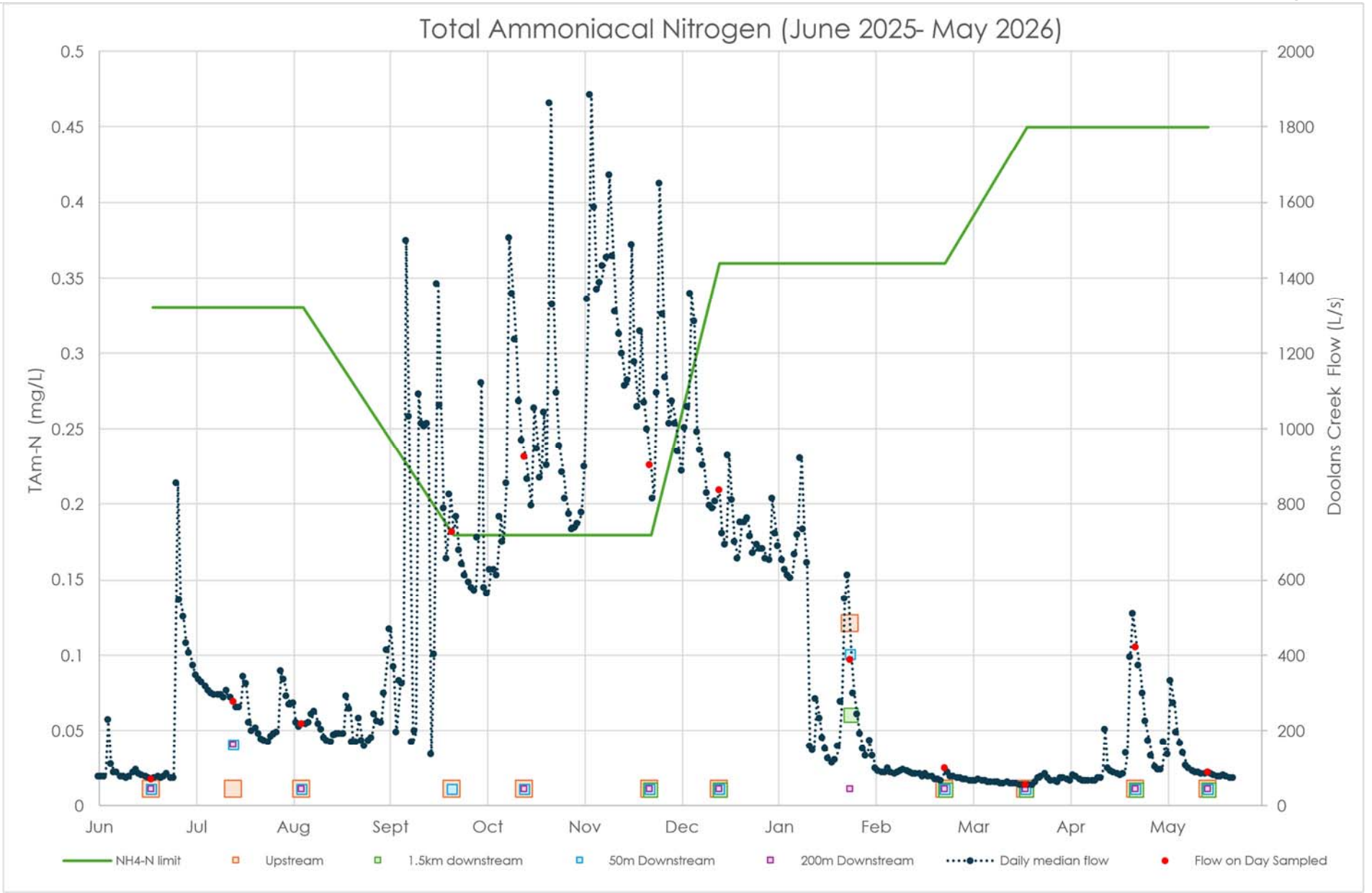


Figure 5: Doolans Creek Median Daily Flow and NH_4-Nitrogen Concentration at Rastus Burn Monitoring Locations.

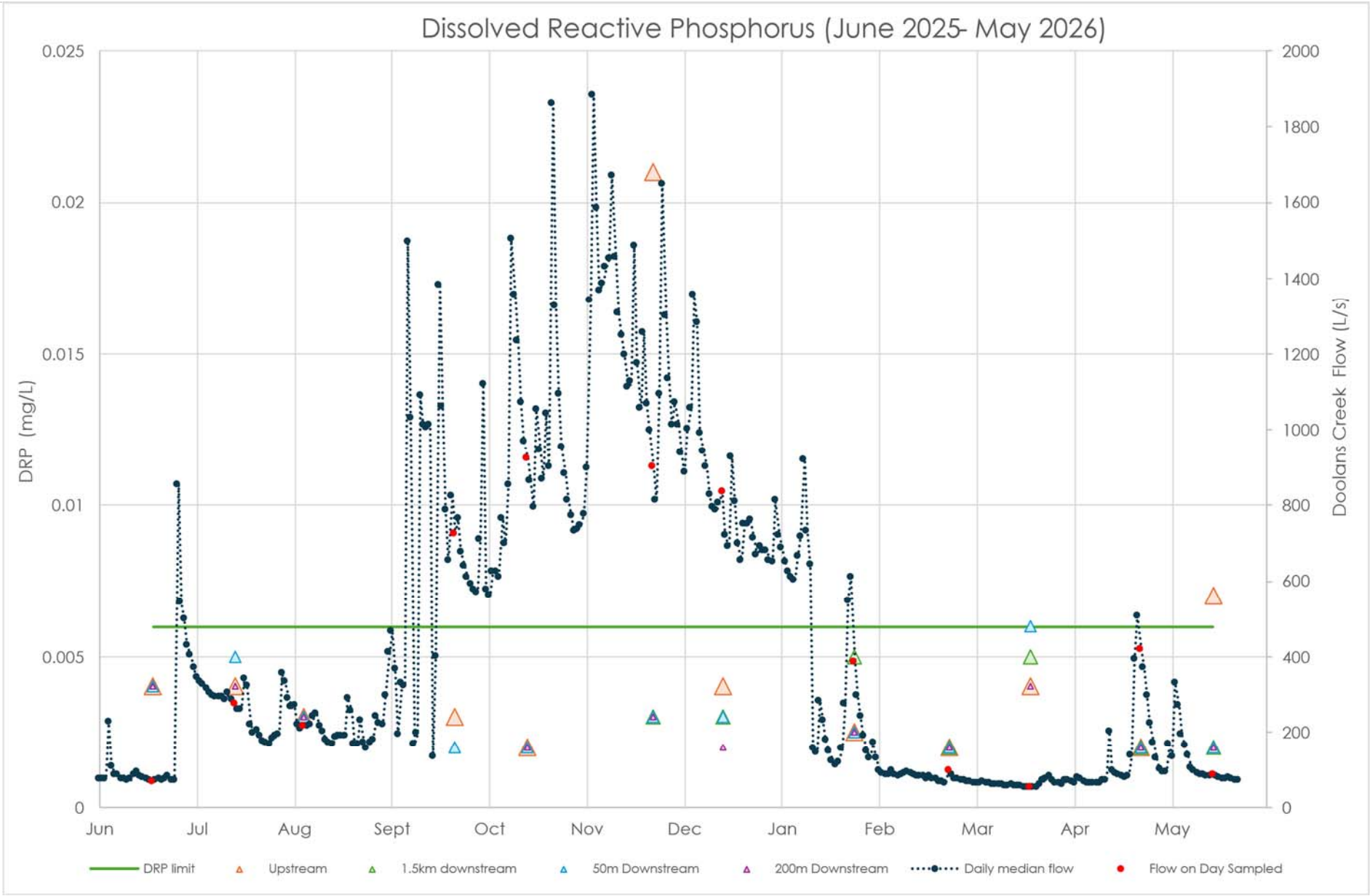


Figure 6: Doolans Creek Median Daily Flow and DRP Concentration at Rastus Burn Monitoring Locations

2.5.1 DIN (Primarily Nitrate-Nitrogen)

Figure 4 shows there are observable seasonal effects on concentration from the ski-season, snow melt, and low flows. Despite that, the DIN limit of 0.15 mg/L was met in the ski-season when concentrations are highest, but water temperatures are lowest and periphyton are unlikely to be able to grow in any significant manner.

The transition from snow-melt dominated flow to baseflow low flow conditions is the key risk period for the Rastus Burn from excess DIN. However, DIN concentrations are unlikely to exceed the adopted limit at these times as the nutrient load is much lower at that time. Spring snow melt delivers large quantities of nutrients, but water temperatures remain low also limiting periphyton growth. When temperatures do increase in December, DIN concentrations were low.

2.5.2 Total Ammoniacal Nitrogen (as NH_4-N)

For the most part, NH_4-N is reported below the detection limit of <0.01 mg/L across all seasons irrespective of high or low flow. The detection limit was only exceeded on two occasions in the year of monitoring (June 2025 – May 2026). These were in July 2025 and January 2026.

Overall, concentrations of NH_4-N are consistently low during spring snow melt high flows and Autumn low flows. NH_4-N concentrations do not appear to be strongly influenced by flow. All concentrations met the seasonally adjusted toxicity guideline values (e3s, 2026c).

2.5.3 DRP

Concentrations of DRP show little apparent relationship with flow. Figure 6 shows the flow and concentrations from 2025/2026 including winter ski season, spring melt, and autumn low flows.

During the summer/autumn key risk period (January to April), concentrations of DRP were variable but generally met the 0.006 mg/L periphyton growth limit. Of note is that there appears to be little seasonal variation at all, even during the ski season. This is the same relationship as previously reported in Appendix A of the discharge impact assessment (further statistical analysis memo).

Appendix B: NZSki Wastewater Conditions Attachment I.

Attachment I – Total Ammoniacal Nitrogen Concentration (g/m^3) – Annual 95th %ile (0.15 g/m^3 @ pH 8.0 and 18°C)

Temperature																					
pH	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
6	0.67	0.62	0.57	0.53	0.51	0.48	0.45	0.42	0.4	0.38	0.34	0.33	0.31	0.29	0.27	0.25	0.23	0.22	0.2	0.18	0.67
6.1	0.66	0.61	0.57	0.53	0.51	0.47	0.44	0.42	0.4	0.37	0.34	0.33	0.31	0.29	0.27	0.25	0.23	0.22	0.2	0.18	0.66
6.2	0.66	0.61	0.56	0.53	0.5	0.47	0.44	0.42	0.4	0.37	0.34	0.33	0.31	0.28	0.27	0.25	0.23	0.22	0.2	0.18	0.66
6.3	0.65	0.61	0.56	0.52	0.5	0.47	0.44	0.42	0.39	0.37	0.34	0.33	0.3	0.28	0.26	0.25	0.23	0.21	0.2	0.18	0.65
6.4	0.65	0.6	0.56	0.52	0.49	0.46	0.43	0.41	0.39	0.37	0.33	0.32	0.3	0.28	0.26	0.24	0.23	0.21	0.2	0.18	0.65
6.5	0.64	0.59	0.55	0.51	0.49	0.46	0.43	0.41	0.39	0.36	0.33	0.32	0.3	0.28	0.26	0.24	0.22	0.21	0.19	0.18	0.64
6.6	0.63	0.58	0.54	0.5	0.48	0.45	0.42	0.4	0.38	0.36	0.33	0.31	0.29	0.27	0.25	0.24	0.22	0.21	0.19	0.17	0.63
6.7	0.62	0.57	0.53	0.49	0.47	0.44	0.41	0.39	0.37	0.35	0.32	0.31	0.29	0.27	0.25	0.23	0.22	0.2	0.19	0.17	0.62
6.8	0.6	0.56	0.52	0.48	0.46	0.43	0.4	0.38	0.36	0.34	0.31	0.3	0.28	0.26	0.24	0.23	0.21	0.2	0.18	0.17	0.6
6.9	0.59	0.54	0.5	0.47	0.45	0.42	0.39	0.37	0.35	0.33	0.3	0.29	0.27	0.25	0.24	0.22	0.21	0.19	0.18	0.16	0.59
7	0.57	0.53	0.49	0.45	0.43	0.4	0.38	0.36	0.34	0.32	0.29	0.28	0.26	0.24	0.23	0.21	0.2	0.19	0.17	0.16	0.57
7.1	0.54	0.5	0.47	0.44	0.41	0.39	0.36	0.35	0.33	0.31	0.28	0.27	0.25	0.23	0.22	0.21	0.19	0.18	0.16	0.15	0.54
7.2	0.52	0.48	0.44	0.41	0.39	0.37	0.35	0.33	0.31	0.29	0.27	0.26	0.24	0.22	0.21	0.2	0.18	0.17	0.16	0.14	0.52
7.3	0.49	0.45	0.42	0.39	0.37	0.35	0.33	0.31	0.29	0.27	0.25	0.24	0.23	0.21	0.2	0.18	0.17	0.16	0.15	0.13	0.49
7.4	0.45	0.42	0.39	0.36	0.35	0.32	0.3	0.29	0.27	0.26	0.23	0.23	0.21	0.2	0.18	0.17	0.16	0.15	0.14	0.13	0.45
7.5	0.42	0.39	0.36	0.34	0.32	0.3	0.28	0.27	0.25	0.24	0.22	0.21	0.19	0.18	0.17	0.16	0.15	0.14	0.13	0.12	0.42
7.6	0.38	0.35	0.33	0.31	0.29	0.27	0.26	0.24	0.23	0.22	0.2	0.19	0.18	0.16	0.15	0.14	0.13	0.13	0.12	0.11	0.38
7.7	0.34	0.32	0.29	0.27	0.26	0.24	0.23	0.22	0.21	0.19	0.18	0.17	0.16	0.15	0.14	0.13	0.12	0.11	0.1	0.095	0.34
7.8	0.31	0.28	0.26	0.24	0.23	0.22	0.2	0.19	0.18	0.17	0.16	0.15	0.14	0.13	0.12	0.12	0.11	0.1	0.093	0.085	0.31
7.9	0.27	0.25	0.23	0.21	0.2	0.19	0.18	0.17	0.16	0.15	0.14	0.13	0.125	0.12	0.11	0.1	0.094	0.088	0.081	0.074	0.27
8	0.23	0.22	0.2	0.19	0.18	0.17	0.16	0.15	0.14	0.13	0.12	0.12	0.11	0.1	0.094	0.088	0.082	0.077	0.071	0.065	0.23
8.1	0.2	0.19	0.17	0.16	0.15	0.14	0.13	0.13	0.12	0.11	0.1	0.1	0.093	0.087	0.081	0.076	0.071	0.066	0.061	0.056	0.2
8.2	0.17	0.16	0.15	0.14	0.13	0.12	0.12	0.11	0.1	0.097	0.089	0.086	0.08	0.074	0.069	0.065	0.06	0.056	0.052	0.048	0.17
8.3	0.15	0.14	0.13	0.12	0.11	0.1	0.098	0.093	0.088	0.083	0.076	0.073	0.068	0.063	0.059	0.055	0.051	0.048	0.044	0.04	0.15
8.4	0.12	0.11	0.11	0.099	0.094	0.088	0.083	0.079	0.075	0.07	0.064	0.062	0.057	0.053	0.05	0.047	0.043	0.041	0.038	0.034	0.12
8.5	0.1	0.097	0.09	0.084	0.08	0.074	0.07	0.066	0.063	0.059	0.054	0.052	0.048	0.045	0.042	0.039	0.037	0.034	0.032	0.029	0.1
8.6	0.088	0.082	0.076	0.071	0.067	0.063	0.059	0.056	0.053	0.05	0.046	0.044	0.041	0.038	0.036	0.033	0.031	0.029	0.027	0.024	0.088
8.7	0.075	0.069	0.064	0.06	0.057	0.053	0.05	0.047	0.045	0.042	0.039	0.037	0.035	0.032	0.03	0.028	0.026	0.024	0.023	0.021	0.075
8.8	0.063	0.059	0.054	0.051	0.048	0.045	0.042	0.04	0.038	0.036	0.033	0.032	0.029	0.027	0.026	0.024	0.022	0.021	0.019	0.018	0.063
8.9	0.054	0.05	0.046	0.043	0.041	0.039	0.036	0.034	0.033	0.031	0.028	0.027	0.025	0.023	0.022	0.02	0.019	0.018	0.016	0.015	0.054
9	0.047	0.043	0.04	0.037	0.036	0.033	0.031	0.03	0.028	0.026	0.024	0.023	0.022	0.02	0.019	0.018	0.016	0.015	0.014	0.013	0.047

Appendix C: Recommending report for AUTH-20158595.

environment SOUTHLAND
REGIONAL COUNCIL
Te Taiao Tonga

IN THE MATTER OF:	**the Resource Management Act 1991**
AND	the hearing of application APP-20158595 by **Alliance Group Limited** for resource consents to Discharge treated wastewater to the Makarewa River; to discharge treated wastewater to land via spray irrigation; to discharge treated wastewater to land for temporary storage purposes; to discharge biosolids to land at an on-site monofill; a discharge permit to discharge contaminants and odour to air; a water permit to take water from the Oreti River; a consent to undertake maintenance works (channel clearance) associated with the water take from Oreti River, at Lorneville.

Decision of the Hearing Panel

1 Appointment

The Southland Regional Council (the Council), also known as Environment Southland, pursuant to Section 34A of the Resource Management Act (RMA) appointed Cr Neville Cook (Chair), Ms Yvette Couch-Lewis and Dr Rob Lieffering to conduct a hearing into the application lodged by Alliance Group Limited (the Applicant) for various resource consents associated with the continued operation of the Lorneville Meat Processing Plant (the Plant).

2 Description of the Proposal and Consents Sought

The nature of the activities for which resource consents have been applied was well described in the application documents, the report prepared by the Council's reporting officers under Section 42A of the RMA (the Section 42A report), and the Applicant's opening legal submissions and evidence. The application is for four resource consents to 'replace'[1] existing resource consents that expire on 7 August 2016. In addition, the application seeks an early replacement water permit to take water from the Oreti River with this consent not expiring until 2027.

[1] The RMA does not use the words 'replacement' or 'renewal' in terms of consents that are due to expire and under section 124 of the RMA any such application is referred to as a 'new consent for the same activity'. However, these consent applications are commonly referred to as replacement or renewal applications.

There was some confusion regarding the application for land use consent to disturb the bed of the Oreti River to maintain the intake channel. The Section 42A report states that this is a 'new consent' (not a replacement consent) and while the application states that such a consent is being applied for, the Applicant already has a consent (AUTH-201227) to maintain the water intake channel and this consent doesn't expire until 2027. Mr Kyle, the Applicant's planner, advised us that the land use consent being applied for would not be exercised until AUTH-201227 was surrendered[2]. The final set of conditions that we received appears to confirm that this application, like the water permit to take water from the Oreti River, is an early application for replacement of AUTH-201227.

The proposal comprises the following key elements:

- a discharge permit to discharge treated wastewater to the Makarewa River. The wastewater that enters the wastewater treatment system consists of various liquid wastes produced within the Plant and also untreated municipal wastewater from Wallacetown;
- a discharge permit to discharge treated wastewater to land by way of irrigation – this permit would be surrendered once the Applicant commences the application of solids to land following the upgrade of the wastewater treatment plant;
- a discharge permit to discharge solids from a Biological Nitrogen Reduction (BNR) treatment plant which is proposed to be installed as part of the upgrade of the wastewater treatment system;
- a discharge permit to discharge contaminants to air. The contaminants include chemicals and particulate matter from two coal fired boiler stacks and also odour from various sources within the Plant and the wastewater treatment system;
- a water permit to take water from the Oreti River for use within the Plant;
- a land use consent to disturb the bed of the Oreti River associated with maintenance of the water intake.

Both planning witnesses, Ms Smith for the Council and Mr Kyle for the Applicant, agreed which rules of the relevant regional plans were applicable and that the activities for which resource consents are sought, when 'bundled', have a discretionary activity status. We agree with their assessment and adopt it for the purpose of this decision.[3]

Whilst the application seeks 'replacement' consents, the Applicant has implemented a number of upgrades to its wastewater treatment system as well as one of its coal fired boilers under its existing consents. Further, the Applicant has committed to further upgrades as follows:

- additional upgrades to the wastewater treatment system over the next 15 years;
- improvements to the coal fired boilers to further reduce emissions over the next 5 years; and
- improvements to the water intake screen on the Oreti River over the next two years[4] to minimise the likelihood of fish entrainment and impingement.

The timing of these upgrades formed the basis of a lot of the evidence we heard and we posed a number of questions regarding these timeframes. We discuss these issues later in this decision document.

[2] Kyle, EIC, para 2.17
[3] Section 42A report, section 2.2; and Kyle, EIC, paras 2.3 to 2.20
[4] The Applicant initially proposed a five year period to upgrade the screen but has now volunteered a two year period.

3 Hearing and Appearances

The hearing was held in the Council Chambers, Environment Southland, Invercargill on Monday, 18 July and Tuesday, 19 July 2016. We undertook a site visit the following day, Wednesday, 20 April 2016, accompanied by Mr D Richardson (Environmental Advisor) and Mr Brian Henderson (Engineering Manager), both are employees at the Plant but who did not appear in front of us at the hearing. We record here that neither Mr Richardson nor Mr Henderson proffered any opinion on any matter during the site visit. We visited the following:

- the upstream aquatic biological monitoring site near Wallacetown (referred to as 'U1');
- the water intake on the Oreti River;
- the location where the ambient air quality monitoring instrument was located (Steel Road);
- the land where some wastewater is irrigated to the south of the Plant;
- the wastewater treatment system;
- the Boiler Ditch;
- the Makarewa River downstream of where the Boiler Ditch discharges into it (we walked along the river to the proposed '350 m' compliance point;
- the coal storage bunker and the outside of the coal fired boilers within the boundary of the Plant

In accordance with Section 103B of the RMA we pre-read the section 42A report, which included three attached reports prepared by Dr G Ryder, Mr J Iseli, and Mr R Potts, and the briefs of evidence that were circulated to us before the hearing commenced - these briefs being from:

1. Mr P Callender – for the Applicant
2. Mr A Khan – for the Applicant
3. Mr D Hailes – for the Applicant
4. Mrs F Wise – for the Applicant
5. Dr M James – for the Applicant
6. Mr M Copeland – for the Applicant
7. Dr M Fitzpatrick – for the Applicant
8. Mr T Dons – for the Applicant
9. Mr R Montgomerie – for the Applicant
10. Mr J Kyle – for the Applicant
11. Mr R Cudmore – for the Applicant
12. Mr J Smyth – for Fish and Game New Zealand (submitter)
13. Mr D Whaanga[5] – for Te Ao Marama Incorporated (submitter)

We had no questions of Mr T Dons, for the Applicant, and he was excused from attending the hearing. The Applicant did table an additional statement of rebuttal evidence from Mr Dons which we have read.

In addition, as discussed in Section 4 of this decision, we also received a report from Dr E Wilton on air quality as it relates to human health, following the formal part of the hearing. We did not consider it necessary to reconvene the hearing following receipt of her report and therefore she did not appear in front of us in these proceedings.

[5] Mr Whaanga did not appear at the hearing to speak to his evidence, however Ms S Blair and Ms A Cain appeared on his behalf.

A list of the parties who appeared at the hearing is provided in Appendix 1 of this decision report. These parties included the experts who prepared pre-circulated briefs (listed above) and a number of them tabled and spoke to summary statements.

Representatives from the Southland District Council and the New Zealand Meat Workers Union – Alliance Lorneville Sub-Branch, being submitters who wished to be heard but who did not have any expert evidence pre-circulated, also appeared at the hearing.

We received legal submissions from Mr S Christensen, for the Applicant, and Ms L de Latour, for the Council. Mr Christensen also submitted the Applicant's right of reply, and supplementary reply in writing following the close of the formal part of the hearing.

We have not attempted to summarise the written and verbal submissions, statements or evidence received during the course of the hearing as that would result in an unnecessarily lengthy decision. Copies of the written material, including material tabled during the hearing, are held by the Council. We took our own notes of the verbal statements and evidence presented and answers to our questions. However, we have referred to, summarised or quoted from relevant elements of some of the submissions, statements, and evidence in the balance of this decision report.

We record that some of the evidence presented at the hearing by the Applicant refined and updated matters dealt with in the application and AEE – this includes the material contained in the Applicant's right of reply.

4 Procedural and Process Issues

4.1 Directions, Further Information, and Further Evidence

At the end of the formal part of the hearing we issued Directions which outlined the actions the Applicant and reporting officers were to complete and a timetable for these to be completed. These actions were verbally summarised by the Applicant before the hearing was adjourned and confirmed our request that a 'final' set of conditions be prepared and that these be circulated to the Council reporting officers who would identify any areas of disagreement (and reasons). In addition, we requested further information from Mr Iseli and Dr Ryder (for the Council).

We received the further information requested from Mr Iseli on 22 July 2016 and the information from Dr Ryder on 5 August 2016. We also received a set of conditions which reflected the final recommendations of the Council reporting officers, including a table which outlined the reasons behind a number of the changes to conditions being recommended. We understand that meetings were held between the Applicant, its experts, and the Council reporting officers to further discuss the conditions.

We received the Applicant's right of reply on 8 September 2016 (having been received by the Council on 7 September 2016), which included a set of conditions that the Applicant would 'accept'. The right of reply presented details of new conditions and areas of disagreement with the Council reporting officers.

However, the right of reply also included a supplementary statement of evidence from Mr Cudmore which itself included a memorandum from a Mr John Frangos, a toxicologist from whom we had not received any previous evidence. Both Mr Cudmore's and

Mr Frangos's written material clearly contained new evidence – something that a right of reply must not introduce. On 9 September 2016 we also received a memorandum from Ms L de Latour, for the Council, which confirmed that new evidence had been provided by the Applicant in its right of reply and that if this was to be considered then the Council reporting officers should be provided an opportunity to review the new evidence and to provide advice to us on it .

We record here that we could have made our decision without considering the new evidence introduced by Mr Cudmore (and Mr Frangos), however we did not consider that any other person would be prejudiced by our consideration of the evidence and we also considered that our decision should be based on the best available information. However, we did agree with Ms de Latour that the relevant Council reporting officers, in this case Mr Iseli and Ms Smith, should be given the opportunity to prepare a response to the new evidence.

As it transpired, Mr Iseli's expertise did not extend to the matters covered in Mr Frangos's memorandum and we therefore commissioned Dr Emily Wilton to provide advice to us on those matters. We received Dr Wilton's advice on 17 October 2016. In addition, Mr Iseli provided advice on Mr Cudmore's new evidence and we received this advice on 24 October 2016 (although his supplementary statement is dated 20 October 2016). We were advised, through Ms Gilroy, that Ms Smith had no further comments to make and would not be providing a written statement.

Lastly, we offered the Applicant the opportunity to provide a supplementary right of reply, which we received on 28 October 2016.

We record here that there has been a lengthy period of time since the end of the formal part of the hearing and this decision. Whilst some of this time has been as a result of the agreed process which we directed on the final day of the hearing, a significant amount of the additional time is as a direct result of the new evidence in the Applicant's right of reply.

4.2 Formal Close of Hearing

Following receipt of the Applicant's supplementary reply we met in person on 11 November 2016 to consider the material that we had in front of us. We determined that we had sufficient information to make our decision and that we did not need to reconvene the hearing to question those experts who had presented additional evidence and statements following the end of the formal part of the hearing.

We formally closed the hearing on 11 November 2016 and, through Ms Gilroy, advised the parties of the closing.

4.3 Section 113 of the RMA

Section 113(3) of the RMA states:

A decision prepared under subsection (1) may, -

(a) instead of repeating material, cross-refer to all or a part of -
  (i) the assessment of environmental effects provided by the applicant concerned:
  (ii) any report prepared under section 41 C, 42A, or 92; or

(b) adopt all or a part of the assessment or report, and cross-refer to the material accordingly.

In the interests of brevity and economy, we intend to make full use of section 113 of the RMA and will not dwell on matters that were not in contention. That is not to say we have glossed over or ignored any matters that were not clearly in contention. We have carefully reviewed the documentation relating to those matters and are satisfied that the outcomes are appropriate. We discuss this later in this decision report.

5 Notification, Submissions, and Written Approvals

The application was notified on 16 April 2016 and six submissions were received by the Council. Three submissions were in support, one neutral, and two in opposition. The section 42A report provides a useful summary of the contents of these submissions[6] and we adopt that summary for the purpose of this decision.

No written approvals were provided with the application.

6 Matters not in Contention

Having considered the application, section 42A report, submissions, the pre-circulated evidence, evidence presented at the hearing, and the material we received following the formal part of the hearing, we consider that the following matters were not in contention:

- the taking of water from the Oreti River, except the timeframe by which the intake screen upgrade should occur;
- the disturbance of the bed of the Oreti River associated with the maintenance and clearance of debris in and around the water intake structure;
- the discharge of treated wastewater to land and associated monitoring;
- the discharge of BNR solids to land and associated monitoring;
- the discharge of BNR solids and stockyard solids to land within an on-site monofill and associated monitoring;
- the discharges to land within the temporary wastewater storage areas and associated monitoring;
- the discharge of odour to air from sources within the Plant and also the wastewater treatment system, including possible mitigation measures;
- the positive effects associated with the presence and operation of the Plant in providing for the social and economic wellbeing of the local communities and the wider Southland region.

We record here that there were some areas of disagreement between the Applicant and the Council's reporting officers, however these were generally resolved during and following the formal part of hearing. The major outstanding area of difference pertained to the duration of the consents – a matter which we discuss in greater detail later in this decision.

The fact that we have concluded the above matters were not in contention does not mean that they are in any way insignificant in scale of effect – what it means is that we heard no conflicting evidence regarding the scale of the effects or appropriate conditions of consent.

[6] Section 42A report, Section 2.4

7 Principal Issues in Contention

The principal issues that were in contention relate to:

1. the discharge of contaminants, in particular particulate matter and sulphur dioxide, into the air from the two coal fired boilers (CFBs), including the proposed timeframe to undertake proposed upgrades to one of the boilers, the adequacy of the emission control measures at the Plant, and monitoring requirements;

2. the following matters relating to water quality effects within the Makarewa River:

   (a) the location of the downstream compliance point;
   (b) total ammoniacal nitrogen effects, including appropriate discharge and receiving water standards;
   (c) the appropriate compliance requirements for visual clarity within the receiving water;
   (d) whether further reductions in bacteriological indicator bacteria are warranted;

3. the proposed timeframe to upgrade the wastewater treatment system.

4. the duration of the consents.

In this section of the decision we consider these matters of contention except item 4 (Duration) which is discussed in Section 9 of this decision report.

We record here that one matter that was in contention at the close of the formal part of the hearing, namely the proposed timeframe to upgrade the water intake screen in the Oreti River, has been resolved as a result of discussions between the Applicant and the Council reporting officers. We were pleased to read that the Applicant has now volunteered to upgrade the intake screen within two years, instead of the five years that it sought in the application.

7.1 Discharge of Contaminants into the Air from the Coal Fired Boilers

7.1.1 Introduction

The Plant has two coal fired boilers (CFBs) which provide heat for a variety of purposes and processes. The operation of the boilers results in the emission of a variety of contaminants into the air via two stacks within the Plant site. Of the contaminants discharged, it is particulate matter and sulphur dioxide which were the principal air quality matters in contention. These matters are discussed in greater detail in the following sections.

7.1.2 Particulate Matter

The main issue relating to the operation of the boilers is the discharge of particulate matter into the air. These particles range in size but it is the fine particulate matter which poses a health risk to residents who live around the Plant, the particulate matter with aerodynamic radii less than 10 micrometres (μm) being referred to as PM_{10} and for which there are national air quality standards (the NES Air Quality)[7]. Three of the air quality experts we

[7] Resource Management (National Environmental Standards for Air Quality) Regulations 2004

received evidence from (Mr Cudmore, Mr Iseli, and Dr Wilton) confirmed that there was no 'safe' PM_{10} exposure level – that is, there is no 'no effects threshold'.

The Applicant advised that it has recently undertaken upgrades to CFB2[8] which has resulted in a reduction in the concentration of PM_{10} discharged via its stack. In addition, the Applicant is proposing to undertake further upgrades to the operation of the boilers and, if necessary, install additional mitigation measures (a multi-cyclone on CFB1[9]) to further reduce the cumulative PM_{10} emissions from the site. The Applicant's proposed conditions include a PM_{10} emission rate limit of 300 mg/Nm^3 reducing to 250 mg/Nm^3 no later than five years after the commencement of the new consent. Mr Iseli considered that this upgrade should be undertaken within two years.

The Applicant has undertaken ambient monitoring for PM_{10} and $PM_{2.5}$ (the latter being referred to as 'fine respirable particulate') and also modelled the CFB discharges in terms of PM_{10}. Mr Iseli advised that the ambient monitoring undertaken was only undertaken over a brief period and that the modelling is likely to under predict actual effects.

The Applicant's modelling suggests that the maximum ground level concentration (GLC) for PM_{10} at the nearest affected dwelling is 32 μg/m^3 (24 hour average) being less than the NES Air Quality limit of 50 μg/m^3. The modelling also suggest that the annual average PM_{10} at the most affected dwelling is 12 μg/m^3, this being less than the New Zealand Ambient Air Quality Guideline (MfE/MoH, 2002) value of 20 μg/m^3.

Ambient monitoring undertaken by the Applicant at the most affected residence recorded a maximum 24 hour average PM_{10} concentration of 48 μg/m^3, however this was during a period when the CFBs may well have had short periods of discharging PM_{10} well above 375 mg/Nm^3. Mr Cudmore advised that the ambient monitoring since the recent upgrades to CFB1 demonstrates that 24 hour average PM_{10} concentrations are below 30 μg/m^3.

The Applicant considers that the current boiler set-up and operation (including the proposed upgrades to CFB2) constitutes the best practicable option (BPO) and proposes conditions which would require a BPO assessment to be undertaken after 10 years and every five years thereafter. Mr Iseli, for the Council, considers that the recent upgrades and the proposed upgrades do not constitute the BPO and that a PM_{10} emission rate limit of 50 mg/Nm^3 '…..*is in line with emission limits imposed on numerous large scale boilers throughout Southland and New Zealand that are fitted with bag filtration technology*'[10]. Mr Iseli considers that additional emission controls for the CFBs would be needed before the discharge could be considered the BPO.

Mr Frangos concludes that there is no toxicological or epidemiological evidence to suggest that further reductions in PM_{10} and $PM_{2.5}$ concentrations at the nearest residence would be associated with a health benefit (being a reduced risk of adverse health effect due to particulate exposure)[11]. Dr Wilton's advice to us confirms that particulate matter is a 'no threshold' contaminant, meaning that there is no 'safe' concentration. This is a matter which both Mr Cudmore and Mr Iseli also agree. Dr Wilton's advice is that there is ample evidence in the literature that reductions in PM_{10} and $PM_{2.5}$ concentrations, irrespective of

[8] Wise, EIC, para 25
[9] AEE, section 8.7.1
[10] Iseli, Response to Fifth Minute (20 October 2016), Para 20
[11] Frangos, Memorandum, section 3

baseline concentrations, reduces the risk of adverse health effects. There is clearly a difference of opinion on this matter between Dr Wilton and Mr Frangos.

The Applicant is proposing to undertake ambient monitoring at the most affected residence and that if certain PM_{10} limits are exceeded then in-stack monitoring will be undertaken to determine if the proposed PM_{10} discharge limits are being met and remedial measures would be implemented to prevent future exceedances of the ambient limits. Mr Iseli is supportive of this approach but has recommended that annual in-stack PM_{10} monitoring also be undertaken, something which the Applicant is opposed to.

We have carefully considered the evidence presented and consider that the Applicant's proposed PM_{10} discharge limits of 300 mg/Nm^3 reducing to 250 mg/Nm^3, after the upgrades to CFB1 and other improvements are completed, are appropriate. We are satisfied that these discharge limits will ensure that the ambient air quality at the most affected residence, in terms of PM_{10}, will be comfortably below the NES Air Quality limit of 50 $\mu g/m^3$ (24 hour average). We heard no counter evidence to suggest that any lower discharge limit for PM_{10}, for example the 50 mg/Nm^3 recommended by Mr Iseli, is necessary or warranted at this stage. Whilst we acknowledge and agree with Dr Wilton's evidence that health risks reduce with reducing particulate matter concentration, in this case we consider that the NES Air Quality provides the appropriate effects threshold for decision making under the RMA. We were advised that the Government is currently reviewing the NES Air Quality and may be introducing a $PM_{2.5}$ standard. In the event that such a standard is set, the Council has the ability under section 128 of the RMA to review this consent accordingly. Such a review may result in the imposition of stricter discharge limits which the Applicant would need to meet, which may require additional emission controls to be implemented.

We do not agree with the Applicant's proposed timeframe of five years to undertake upgrades to the CFBs to ensure the PM_{10} discharge limit is reduced from 300 mg/Nm^3 to 250 mg/m3. We consider that this lower discharge standard must be achieved within three years, which is longer than the two years recommended by Mr Iseli but earlier than the five years requested by the Applicant. Our determination on the reduced discharge limit timeframe is influenced by our decision on the duration of this consent, which we discuss in greater detail later in our decision.

Further, and also related to the question of duration of this consent, we agree with the approach proposed by the Applicant in undertaking a BPO review every five years. However, we do not agree with the Applicant's proposed timeframe for the first such review, being 10 years from date of commencement of the consent. We consider that the first BPO review should be undertaken no later than five years of the date of commencement of the consent, and then five yearly thereafter. We also consider it appropriate that the independent air quality expert who reviews the BPO assessment report is a person agreed to by the Council in writing beforehand– our reasons are presented in the Conditions section of our decision.

We agree with the Applicant and Mr Iseli that ambient PM_{10} and $PM_{2.5}$ concentrations at the most affected residence should be measured undertaken and limits specified which would trigger further monitoring including in-stack testing. We also agree with Mr Iseli that in-stack PM_{10} monitoring should be undertaken at least annually on each stack. The discharge of particulate matter from the stacks is entirely under the control of the applicant and it is fundamentally important that compliance with the volunteered PM_{10} discharge

limits is assessed at least annually. Monitoring of the quality of the source of contaminants in a discharge (in this case the stacks) as well as the receiving environment (in this case that is the ambient monitoring) is common practice. We note that this approach is exactly what is proposed for the discharges to the Makarewa River where routine discharge and receiving water monitoring is proposed – we see the discharges of contaminants to air as being no different. This determination is also influenced by our decision on the duration of this consent, which we discuss in greater detail later in our decision.

7.1.3 Sulphur Dioxide

The Applicant assessed the effects of the discharges on sulphur dioxide concentrations around the plant based on ambient monitoring undertaken as well as modelling. The modelling predicts the sulphur dioxide GLCs at the most affected residence are 174 $\mu g/m^3$ (1 hour maximum), 148 $\mu g/m^3$ (1 hour 99th%ile), 67 $\mu g/m^3$ (24 hour average), and 10 $\mu g/m^3$ (annual average), these being well below the respective air Air Quality NES standards – being 570 $\mu g/m^3$ (1 hour maximum) and 350 $\mu g/m^3$ (1 hour 99th%ile) – and the New Zealand Ambient Air Quality Guideline values – being 120 $\mu g/m^3$ (24 hour average) and 30 $\mu g/m^3$ (annual average)[12]. Ambient monitoring has shown that sulphur dioxide concentrations at the most affected residence are typically around 30 $\mu g/m^3$ with occasional spikes between 60 and 90 $\mu g/m^3$. Mr Cudmore concludes that the potential for sulphur dioxide emissions from the CFBs to cause health effects is 'very minor'[13].

Mr Iseli expressed some concerns about the outputs of the sulphur dioxide modelling and considered that the actual ground level concentrations (GLCs) could be 44% greater than those modelled if the Applicant consistently used coal with a sulphur content at the maximum volunteered value of 0.5%wt. Mr Iseli concludes that, based on the modelling and ambient monitoring, sulphur dioxide discharged from the CFBs are 'unlikely to cause adverse effects at locations where people are likely to be present on a regular basis'[14]. He does, however, note that higher concentrations may be experienced at locations where there currently are no dwellings and that the discharges from the CFBs may limit the development of this land as there are areas where sulphur dioxide concentrations are predicted to exceed the New Zealand Ambient Air Quality Guideline value of 120 $\mu g/m^3$. Mr Iseli also compared the results to the more restricted World Health Organisation (WHO) guideline values but notes that these have not been formally adopted in New Zealand.

Mr Iseli recommended that the Applicant should be required to undertake continuous in-stack monitoring for sulphur dioxide within two years and that the sulphur emission rate should be limited to 78 kg/hr, this being the emission rate modelled by the Applicant and is less than the theoretical maximum emission rate of 112 kg/hr if all the coal used had a sulphur content of 0.5%wt (the maximum coal concentration volunteered by the Applicant). He also recommended that the sulphur content of the coal be set at 0.45%wt within a two year period.

We find that the discharges from the CFB will not result in adverse health effects in respect to sulphur dioxide. Like PM_{10}, we consider that the NES Air Quality and New Zealand Ambient Air Quality Guidelines provide the appropriate effects thresholds for decision making under the RMA. In the event that either the Air Quality NES or the New

[12] Cudmore, EIC, para 203
[13] Cudmore, EIC, para 206
[14] Iseli, EIC, para 5.3

Zealand Ambient Air Quality Guidelines are reviewed in respect of sulphur dioxide and stricter ambient air quality limits are set then the Council has the ability under section 128 of the RMA to review this consent accordingly. Such a review may result in the imposition of discharge limits for sulphur dioxide to ensure any stricter ambient limits are achieved and may mean that the Applicant has to then implement additional emission controls or use coal with a lower sulphur content.

We do not consider that the evidence presented to us warrants the requirement to continuously monitor sulphur dioxide within the stack – we consider that the money that would be required for such monitoring would be better spent on the annual PM_{10} stack testing which we are requiring to be undertaken.

7.2 Water Quality within the Makarewa River

7.2.1 Introduction

The discharge of treated wastewater to the Makarewa River has the greatest potential to cause adverse environmental effects and much of the hearing and evidence presented related to this activity. The Applicant is proposing significant upgrades to the wastewater treatment system to improve its quality and therefore reduce potential and actual adverse effects within the receiving waters.

The matters in contention in relation to the discharge of treated wastewater to the Makarewa River are presented in the following sections.

7.2.2 Downstream Compliance Point

Treated wastewater from the Plant is discharged to the Boiler Ditch, which in turn discharges to the Makarewa River on its true left bank. The Makarewa River at this point is influenced by a strong tidal flushing effect but the river does not become saline. The tide has an effect on the flows within the Makarewa River and over parts of the tidal cycle the river flows in an upstream direction. This tidal effect, coupled with the fact that river flows vary with rainfall in the catchment, leads to a complex mixing zone regime.

Mr Montgomerie confirmed that the discharge is 'well mixed' transversely at a point 200 m downstream of the Boiler Ditch at low tide and low river flows. At high tide the discharge remains well mixed from 200 m downstream of the Boiler Ditch but is not fully mixed at the river surface at a point 200 m upstream of the Boiler Ditch.[15] The Applicant's proposed conditions attached to Mr Kyle's evidence sought to have the water quality compliance site located 350 m downstream of the discharge.[16] The final set of conditions included in the right of reply also specified a downstream compliance point 350 m downstream of the discharge.

Some confusion exists in respect of the downstream monitoring and compliance site. The AEE states that the Applicant currently collects samples from a site referred to as 200 m downstream of the discharge but that this site is actually located 350 m downstream of the discharge.[17] However, Dr James stated that a point 350 m downstream of the Boiler Ditch has been selected by the Applicant for compliance purposes for 'practical purposes' but

[15] Montgomerie, EIC, para 79
[16] Condition 9 of the discharge to water consent
[17] AEE, Section 8.3.2

confirmed that the discharge was 'fully mixed' at 200 m [18]. In answers to questions Mrs Wise confirmed collecting samples 200 m downstream of the discharge was not practical or safe due to the nature of the river bank at this point. Dr Ryder stated that, in his opinion, the zone of reasonable mixing proposed by the Applicant is 'a considerable distance' and referred to two mixing zone distances that were in place for the Finegand meat works discharge into the Clutha River[19]. In answers to questions he was not able to provide a recommended distance in this case but did state that, in his opinion, collecting samples from the 200 m location was practical if a sampling stick (pole) was utilised.

Whilst there are no additional surface water inputs between the 200 and 350 m downstream points, Mr Callendar did confirm that shallow groundwater will enter the Makarewa River between these two points. In answers to questions he estimated the groundwater inflow to be in the order of 5-6 L/s from both sides of the river, which would provide 'insignificant' additional dilution compared to flows in the river which, even during summer low flow periods, are in the order of 1,750 L/s (7 day Mean Annual Low Flow)[20].

During our site visit we walked along the true left bank of the Makarewa River from the point where the Boiler Ditch enters it down to a marker stake which identified the 350 m sampling site, and en route we passed a monitoring stake which identified the 200 m point. It was clear from our visit that no significant impediments exist to collect samples from the 200 m point and agree with Dr Ryder that using a sampling stick (pole) would enable the required samples to be collected here.

The zone of reasonable mixing is the zone within which significant adverse effects may occur but beyond which any adverse effects need to be acceptable. The length of such zones can be anywhere from the point of discharge through to the point where full mixing occurs and should be kept as small as is practicably possible. However, the zone of reasonable mixing does not automatically equate to full mixing. In this case the evidence provided to us confirms that the discharge is well mixed (fully mixed according to Dr James) at the 200 m point. We see no practical constraints which would prevent water samples being collected from this point and therefore find that the receiving water quality compliance point should be no more than 200 m downstream of where the Boiler Ditch discharges into the Makarewa River.

7.2.3 Total Ammoniacal Nitrogen Effects

Dr Fitzpatrick provided evidence on total ammoniacal nitrogen [21] effects within the Makarewa River, a compound which can be toxic to aquatic organisms. He advised that many of the trigger values presented in the Australia and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC) were flawed because they are based on either incomplete data, inappropriate data, and estimated no observable effects concentrations (NOECs). He advised us to exercise caution in using any ANZECC trigger values and guidelines derived by the ANZECC methodology[22].

[18] James, EIC, para 150
[19] Ryder, EIC, para 5.40
[20] Montgomerie, EIC, para 37
[21] We use the unambiguous term 'total ammoniacal nitrogen' (which is the sum of both ammonia nitrogen and ammonium nitrogen) but was variously referred in the application and in evidence as 'ammonia nitrogen', 'total ammonia nitrogen', 'total ammonia', and just 'ammonia'
[22] Fitzpatrick, EIC, paras 21 and 22

Dr Fitzpatrick also advised that the National Policy Statement for Freshwater Management (Freshwater NPS) total ammoniacal limits are based on a non-peer reviewed memorandum to the Ministry for the Environment (MfE) authored by Dr Chris Hickey of NIWA. Dr Fitzpatrick stated that Dr Hickey's derivation of the limits was based on a data set containing 20 species, including one (the rainbow mussel) which is not based on empirical NOEC data, but rather a NOEC estimate. In Dr Fitzpatrick's opinion this is not a trivial error and it has a significant bearing on the guideline (limit) derivations[23], which in his opinion are overly conservative. Like the ANZECC triggers, he advised us to exercise caution in respect of the Freshwater NPS total ammoniacal nitrogen limits and considered that they are not reliable[24]. We heard no evidence to suggest that Dr Fitzpatrick's opinion on the derivation of the Freshwater NPS limits was incorrect.

We record here, as Commissioner Lieffering verbally stated at the hearing, that this evidence is alarming, to say the least, as the Freshwater NPS is required to be implemented by regional councils throughout New Zealand, including the use of the total ammoniacal nitrogen limits that it contains. We recommend that the Council, if it has not already done so, raise this matter directly with the MfE so that it can be further examined – we understand that the Government is currently reviewing the Freshwater NPS so any necessary corrections could possibly be made.

Because of the concerns that Dr Fitzpatrick expressed with the use of the ANZECC triggers and Freshwater NPS limits for total ammoniacal nitrogen, he instead calculated site specific chronic exposure limits based on the aquatic species that are known to be present in the Makarewa River. His calculations are reflected in the volunteered conditions, which include 30-day, 4-day, and annual 95%ile (all varying with pH) receiving water limits. Dr Fitzpatrick did not calculate any limits to protect against acute toxicity effects and in answers to questions advised us that acute calculations were not made as he was not asked to so. When asked whether an acute limit should be considered, he stated that acute exposure to total ammoniacal nitrogen was not an issue from a toxicological perspective and that any effect would be behavioural – fish would avoid any areas of high total ammoniacal nitrogen concentration. He also advised that the 4-day average limits that are being volunteered are close to the border between acute and chronic effects.

Dr Ryder, for the Council, advised that he largely agreed with Dr Fitzpatrick and that the proposed receiving water standards for total ammoniacal nitrogen in the volunteered conditions were appropriate to protect aquatic organisms[25]. Following the hearing, at our request, Dr Ryder presented calculations for a possible discharge standard for total ammoniacal nitrogen to protect against acute effects. The Applicant, in its right of reply, reiterated that it did not consider a discharge standard for total ammoniacal nitrogen as being necessary and that Dr Ryder's calculations were conservative[26]. We disagree but accept the Applicant's suggested 'alternative' conditions (those suggested by the Applicant in the event that we determined that an acute limit should be imposed) included in its final set of volunteered conditions which includes a post-upgrade discharge standard for total ammoniacal nitrogen of 39 g/m^3, this being higher than the 30 g/m^3 recommended by Dr Ryder. In addition, the Applicant is volunteering a daily load limit of total ammoniacal nitrogen of 200 kg/day when flows in the Makarewa River are below 2 m^3/s (low flow conditions).

[23] Fitzpatrick, EIC, para 24
[24] Fitzpatrick, EIC, para 26
[25] Ryder, Comments on Applicant's Evidence, para 2.16
[26] Right of reply, para 41

We are satisfied that the proposed conditions will protect aquatic organisms within the Makarewa River from chronic and acute total ammoniacal nitrogen toxicity effects.

7.2.4 Visual Clarity

The Applicant initially proposed conditions which would allow up to a 33% reduction in visual clarity within the Makarewa River at the downstream compliance point (compared to the upstream control site), both before and after the proposed upgrades to the wastewater treatment system. The Council reporting officers had concerns regarding this matter and considered that any reduction in visual clarity should not be more than 20% following the upgrades.

In its right of reply the Applicant advised that it is now proposing additional upgrades to the wastewater treatment system which involves disinfection for pathogens. For disinfection to be successful requires the total suspended solids concentration of the wastewater to also be improved, meaning that this additional treatment will result in lower concentrations of total suspended solids being discharged to the Makarewa River. Lower total suspended solids in the discharge will, in turn, reduce water clarity effects within the Makarewa River. Accordingly, the Applicant's final set of volunteered conditions now includes a condition which would require the discharge to not result in more than a 20% reduction in visual clarity following the upgrade and also a lower total suspended solids limit for the discharge (a reduction from 110 g/m^3 to 50 g/m^3). We welcome the Applicant's additional treatment which will result in less total suspended solids being discharged and consider that the effects on visual clarity following the upgrade are acceptable.

7.2.5 Indicator Bacteria

At the hearing the Applicant advised us that the proposed upgrades would not include any specific additional treatment to reduce the concentration of pathogens (as measured by indicator bacteria) that would be discharged to the Makarewa River – that is, the pre- and post-upgrade discharge limits for faecal coliforms were the same (45,000 cfu/100 mL).

As discussed in the previous section of this decision, the Applicant's right of reply outlined that it is now proposing to include disinfection as part of the proposed wastewater treatment plant upgrades, meaning that the bacterial indicator concentrations in the treated wastewater will be significantly lower. The indicator bacteria which would be monitored are also proposed to be changed from faecal coliforms to *Escherichia coli* (*E. coli*). We understand that *E. coli*, being a type of faecal coliform, is the more appropriate indicator to use but that in most wastewater samples the *E. coli* concentration is very similar (and in many cases the same) as the faecal coliform concentration. The post-upgrade discharge limits being proposed for *E. coli* are an annual median of 500 cfu/100 mL, a maximum of 10,000 cfu/100 mL, and 90% of samples required to be less than 5,000 cfu/100 mL. We agree with the Applicant that this is a significant improvement and we commend the Applicant for volunteering this extra treatment. We previously discussed the additional benefits of the introduction of disinfection in terms of reduced total suspended solids concentration in the discharge and the consequential improvement in water clarity effects within the Makarewa River.

7.2.6 Summary – Discharge to the Makarewa River

The Applicant is investing significantly to upgrade the wastewater treatment system over the next 15 years. The end result will be a discharge to the Makarewa River which contains significantly lower concentrations of contaminants than currently occurs. We are satisfied that, after a reasonable mixing zone of 200 m, the adverse effects of the discharge will be acceptable. We welcome the Applicant's later decision to provide disinfection of the wastewater, as this will also result in less total suspended solids being discharged and improved water clarity within the receiving environment.

We find that the interim and post-upgrade discharge limits and receiving water standards are appropriate and that the life-supporting capacity of the Makarewa River will be maintained and, over time, enhanced.

7.3 Timeframe to Upgrade Wastewater Treatment System

We heard evidence from the Applicant that a fifteen year timeframe will be required to ensure the proposed post-upgrade discharge standards are consistently met. Mr Khan advised that, from a pure engineering perspective, the upgrades could be completed within 10 years[27], but that additional time is necessary to be certain that the discharge standards will consistently be able to be met. We note that the 'Wastewater Treatment Plant Upgrade Design & Implementation Master Plan'[28] tabled by Mr Khan shows the construction of the upgrades finishing around the 12.5 year mark and that the next 2.5 years would involve commissioning and validation. What this means is that an improved quality of the treated wastewater will likely be discharged to the Makarewa River ahead of the 15 year 'requirement' of the conditions.

Mr Potts, for the Council, advised at the hearing that the proposed upgrades could be completed within an eight year period[29]. However, at the hearing he revised his recommendation to 10 years and we note that the conditions provided to us by the Council reporting officers following the hearing included a requirement for the upgrade to be completed within 10 years.

We consider that the upgrade should be undertaken as soon as practicably possible but we agree with the Applicant that sufficient time needs to be provided to ensure the design and the operation of the plant is such that the proposed discharge limits will be able to be met at all times. We note that the Applicant has, following the hearing, included additional disinfection treatment. We welcome this decision and understand including disinfection will require additional effort in design, construction, and commissioning, however the Applicant is still committing to complete all the upgrades within 15 years. We agree with the Applicant's proposed timeframe for the upgrade, especially as it now includes an additional treatment component.

[27] Khan, EIC, para 154
[28] Khan, EIC, Attachment E5
[29] Potts, section 42 memorandum, section 7

8 Statutory Considerations

8.1 Policy statements and plans

Under Sections 104(1)(b) of the RMA we are required to have regard to any relevant provisions of various national and regional documents. Section 104(1)(c) requires us to have regard to any other matter which we consider relevant.

The RMA planning instruments that provide the planning and policy framework for our consideration of the application are as follows:

- National Policy Statement for Freshwater Management 2014;
- New Zealand Coastal Policy Statement;
- Southland Regional Policy Statement;
- Proposed Southland Regional Policy Statement;
- Regional Water Plan;
- Proposed Southland Water and Land Plan;
- Regional Effluent Land Application Plan;
- Regional Air Quality Plan;
- Proposed Regional Air Plan for Southland;
- Regional Coastal Plan;
- Resource Management (National Environmental Standards for Air Quality) Regulations 2004;
- Resource Management (Measurement and Reporting of Water Takes) Regulations 2010; and
- Te Tangi a Tauria (Iwi Management Plan)

Mr Kyle and Ms Smith provided an analysis of the relevant provisions of these documents as they relate to the proposed activities. There was a significant disagreement between Mr Kyle and Ms Smith in respect of whether the activities are consistent with the relevant objectives and policies pertaining to water quality and air quality.

In terms of water quality, both the Freshwater NPS and the Proposed Southland Water and Land Plan seek to maintain and improve the quality of water in surface and groundwater resources to ensure their life-supporting capacities are safeguarded. We note that the Council will be implementing the limit setting requirements of the Freshwater NPS in a staged manner and intends to complete this work for the Oreti FMU (which includes the Makarewa River) by 2020[30].

Ms Smith was concerned about the lack of improvement in the receiving water after the proposed upgrades and that there is no certainty that water quality will be improved above 'bottom line' requirements[31]. She concludes that the discharge to the Makarewa River is not consistent with the relevant water quality provisions of the Regional Water Plan and Proposed Water and Land Plan. At the end of the formal part of the hearing Ms Smith advised us that the evidence that was presented by the Applicant at the hearing had addressed some of the uncertainties and as a result her recommended duration for the consent to discharge treated wastewater to the Makarewa River should be between 15 and 20 years. However, she still had concerns about the lack of certainty on whether the Applicant would be undertaking any additional actions to improve the quality of the discharge after the upgrades. Ms Smith considered the proposed upgrades to be a 'partial

[30] Section 42A report, section 3.6
[31] Section 42A report, section 4.1

upgrade' as the proposed discharge quality would still be 'average to poor'[32] (as noted by Mr Potts).

Ms Smith also considers that more than minor effects could occur as a result of the discharges from the CFBs, with the potential for human health impact, and therefore this activity is not consistent with Objective 5.2.1 and Policy 5.3.1 of the Regional Air Plan[33]. Mr Kyle disagrees with Ms Smith regarding her conclusions on these matters.

Despite Ms Smith's assessment that the discharge to the Makarewa River and the discharge of contaminants to air from the CFBs were not consistent with the relevant provisions of the relevant plans, her overall conclusion was that the proposed activities would have 'no more than minor adverse effects'[34].

We have carefully reviewed both Mr Kyle's and Ms Smith's planning analyses and where there are differences of opinion we agree more with Mr Kyle's assessment[35] and adopt it for the purposes of this decision. Accordingly we do not repeat or summarise it in this decision save to say that we find that the activities are generally consistent with the relevant provisions of the applicant planning documents.

8.2 Sections 105 and 107 of the RMA

We must have regard to sections 105 and 107 of the RMA as the application is for three discharge permits, noting that section 107 of the RMA is only relevant to those discharges that are directly to water.

Mr Kyle and Ms Smith provided an analysis of these two sections as they relate to this application. Both witnesses conclude that the proposal satisfies the matters set out in section 105 and that none of the effects described in section 107 will occur as a result of the discharges[36]. We agree with their assessment and we heard no evidence to the contrary.

8.3 Section 104(2A) of the RMA - Value of Investment of Consent Holder

Section 104(2A) of the RMA requires us to have regard to the value of investment of the existing consent holder, being the Applicant in this case, where applications for replacement consents are being sought. Mr Copeland advised that the value can be considered in terms of the replacement value of the plant, estimated to be $252 million[37], or the foregone future earnings of the plant if it were forced to close. By both these measures Mr Copeland stated that the value of the Plant is 'significant'[38] and we agree with that assessment.

We also note that the Applicant's proposed upgrades will cost a significant amount of money – Mrs Wise advised us[39] it would be around $23.4 million[40] for the wastewater treatment plant upgrades, $100,000 to upgrade the water intake screen, and $250,000[41] for improvements to the CFBs. These future investments are significant and we have had regard to them in considering the applications.

[32] Smith, Summary notes tabled at the end of the formal part of the hearing
[33] Section 42A report, section 3.7
[34] Section 42A report, section 3.13
[35] Kyle, EIC, section 4
[36] Section 42A report, paras 5.78 to 5.83
[37] Copeland, EIC, para 20
[38] Copeland, EIC, para 31
[39] Wise, EIC, para 48
[40] $19 million for the nutrient reduction and $4.4 million for disinfection
[41] Wise, response to questions

8.4 Part 2 RMA matters

8.4.1 Positive effects

The AEE provides a summary of the positive effects associated with the continued operation of the Plant. These relate to direct and indirect economic benefits through employment, goods and services provided to the Plant and its employees.[42] In addition, the AEE outlines a number of economic efficiency benefits that arise from the granting of these consents.[43]

Mr Copeland provided expert evidence on the economic benefits arising from continued operation of the Plant. We do not propose to repeat his summary findings here, save to say that the Plant is a major employer and provides local farmers with an important facility for their stock to be processed and the economic benefits that the Plant brings to the Southland Region are significant[44]. We heard no evidence which disputed Mr Copeland's assessment or the figures he presented in his evidence.

The wastewater treatment system also receives untreated municipal wastewater from the nearby township of Wallacetown. Mr Marshall (of the Southland District Council) stated that there was an agreement in place until 2041 which provided for the Wallacetown wastewater to enter the Plant's wastewater treatment system[45]. Mr Marshall stated that having this arrangement in place provides an affordable cost for the ratepayers of Southland District compared to the alternative which would involve the Southland District Council having to investigate, build, and operate an alternative treatment and disposal route for the wastewater produced by Wallacetown residents.[46]

8.4.2 Part 2 of the RMA

Part 2 of the RMA sets out the purpose and principles of general application in giving effect to the Act. The RMA has a single purpose, which calls for an overall broad judgement of potentially conflicting considerations, the scale or degree of them in terms of their relative significance or proportion in promoting the sustainable management of natural and physical resources. The enabling elements of section 5 of the RMA are not absolute or necessarily predominant and they must be able to co-exist with the purposes in paragraphs (a) to (c) of section 5.

Section 6 of the RMA identifies matters of national importance that we are required to recognise and provide for. Ms Smith advised that there were no matters of national importance relevant to the proposed activities. We disagree and concur with Mr Kyle's opinion that some of the matters are relevant[47], including section 6(e).

Section 6(e) of the RMA requires us to recognise and provide for the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga. We considered the 'Makarewa River Cultural Values Report (for the Alliance Group Limited Lorneville 2015 Reconsenting Project Plan)'[48], and the submission lodged

[42] AEE, Section 7.3
[43] AEE, Section 7.3.1
[44] Copeland, EIC, para 64(a)-(c)
[45] Marshall, Further Submission, para 7
[46] Marshall, Further Submission, para 8
[47] Kyle, EIC, para 7.4
[48] Makarewa River Cultural Values Report, pg16 Ngai Tahu Claims Settlement Act 1998

by Mr Whaanga for Te Ao Marama[49]. We agree with Te Ao Marama that section 6(e) of the RMA points out the importance for providing significantly strengthened safeguards for the cultural relationship of archaeological sites, sites of significance including wahi tapu and surrounding natural and physical resources within the takiwā of Te Ao Marama, in this case the Makarewa and Oreti River and the New River Estuary.

Section 7 of the RMA lists 'other matters' that we must have particular regard to. Ms Smith advised that the application was 'consistent' with section 7 of the RMA, but presented no further details of which of the section 7 matters were relevant to the application. On the other hand, Mr Kyle advised that the following section 7 matters are relevant to this application[50]:

(a) kaitiakitanga:
(aa) the ethic of stewardship:
(b) the efficient use and development of natural and physical resources;
(c) the maintenance and enhancement of amenity values:
(d) intrinsic values of ecosystems:
(f) maintenance and enhancement of the quality of the environment:

We have had regard to the above matters in considering this application.

The RMA defines kaitiakitanga as *"the exercise of guardianship by tangata whenua of an area in accordance with tikanga Māori in relationship to natural and physical resources, and includes the ethic of stewardship"*. In its original submission and conferred by Ms Blair, Ngā Rūnanga Murihiku takes its responsibility as kaitiaki seriously being a core value of Nga Rūnanga.[51] Te Ao Marama has given its support in principle for the proposal.

It is noted that the Applicant, in consultation with Te Ao Marama, are working towards mitigation practices to meet core iwi pillar values. This is through monitoring and improving wastewater treatment processes which will contribute to improving the quality of both the Makarewa and the Oreti Rivers and protecting the significant sites within the New River Estuary, thereby enabling iwi to fill full their role as kaitiaki.

Section 8 of the RMA directs us to take into account the principles of the Treaty of Waitangi (Te Tiriti o Waitangi). We have done so to the extent that those principles are consistent with the scheme of the RMA. We note that the Treaty of Waitangi is a partnership between the Crown and Maori. The RMA promotes sustainable management of natural and physical resources. In relation to Ngā Rūnanga Murihiku this is interpreted as enabling Ngā Rūnanga Murihiku to provide for their cultural wellbeing. It is our view that the Applicant has been respectful of the Treaty principles and has sought to reflect these principles in its consultation, kanohi ki te kanohi (face to face) with tangata whenua.

As outlined within Mr Dons evidence[52] iwi has been consulted whereby, Te Ao Marama submitted (through Ms Stevie-Rae Blair) that 'iwi have a clear understanding of the proposals within the Alliance Group application'. [53]

The Ngai Tahu Claim Settlement Act 1998 was enacted to redress[54], where possible, serious breaches of the treaty. This Act provides mechanisms to recognise and meet

[49] Whaanga, Submission
[50] Kyle, EIC, para 7.5
[51] Blair, response to questions
[52] Dons, EIC, para 16
[53] Blair, response to questions

concerns of importance to Ngāi Tahu, this being Ngā Rūnanga Murihiku, including recognition of mahinga kai values such as the Makarewa River and Oreti as a Statutory Acknowledgement area that provides for the historic, cultural, spiritual and traditional relationship Ngā Rūnanga has with this place and waterways.

We have sought to give effect to Part 2 of the RMA in making our decision on the application in light of the submissions received and the evidence in front of us. In this regard, we find that the proposal will, over time, sustain the potential of natural and physical resources to meet the reasonably foreseeable needs of future generations (Section 5(2)(a)). Conditions imposed on the consents will safe-guard the life-supporting capacity of air, water, soil, and ecosystems (Section 5(2)(b)). We are also satisfied that the comprehensive suite of conditions for the resource consents will ensure that potential adverse effects on neighbouring land and landowners, freshwater resources, and indigenous fauna will be avoided, remedied, or mitigated (Section 5(2)(c)).

In overall terms we are satisfied that granting the consents is consistent with Part 2 of the Act and that the purpose of the RMA will be achieved.

9 Duration and Lapsing

As mentioned in Section 7 of this decision, the duration of the various consents was one of the principal issues in contention by various parties. Ms Smith recommended that a number of the consents be granted for a 5-year period in her section 42A report. However, after hearing the evidence and our questioning at the hearing she changed her recommendation in respect to duration of the consents to between 15 and 20 years, except for the discharge of contaminants to air for which she was still recommending a 5 year term. The post-hearing discussions between the Council reporting officers and the Applicant led to a further change to the recommended term to 25 years, again with the exception of the consent to discharge contaminants to air, where a five year term was again recommended, based primarily on the advice of Mr Iseli.

The following table presents a summary of the durations requested by the Applicant, the terms recommended by Ms Smith (some based on advice from the other Council experts), and the terms sought by submitters.

Party	Duration Sought/Recommended			
	Discharge of treated wastewater to the Makarewa River	**Discharges of wastewater and BNR solids to land**	**Taking of water from the Oreti River and bed disturbance**	**Discharge of contaminants to air from boilers and also odour**
Applicant	35 years	35 years	35 years	35 years
Reporting officer (Ms Smith)	25 years	25 years	25 years	5 years
Te Ao Marama Inc	25 years	25 years	25 years	25 years
Southland District Council	'Closer to 35 years'[55]			
Fish and Game	20 years	15 years		

[54] Makarewa River Cultural Values Report, pg16 Ngai Tahu Claims Settlement Act 1998
[55] Marshall, EIC, para 9

Party	Duration Sought/Recommended			
	Discharge of treated wastewater to the Makarewa River	Discharges of wastewater and BNR solids to land	Taking of water from the Oreti River and bed disturbance	Discharge of contaminants to air from boilers and also odour
New Zealand Meat Workers Union	35 years	35 years	35 years	35 years

Having considered all the arguments regarding the duration of these consents, we find that a term of 25 years is, in this case, appropriate for all the consents. While this period is greater than that originally recommended by Ms Smith and greater than that suggested by Mr Smyth (for Fish and Game), it is less than the 35 years requested by the Applicant (35 years being maximum term allowed under the RMA).

We appreciate the arguments put forward by the Applicant in respect of certainty when significant expenditure is proposed at the Plant and recognise the investment which it is making in the Plant.[56] However, we consider that 25 years is still a lengthy term and provides the Applicant with a high degree of certainty in terms of the investments it has already made and those which it will be required to make to comply with the conditions of these consents.[57]

In reaching our decision on consent duration we have considered the direction provided by policies in the Operative Regional Water Plan[58] and the Tangi a Tauira Iwi Management Plan. Within the Te Tangi a Tauira Iwi Management Plan the key policies relate to consent terms not exceeding 25 years.[59] This is supported by the proposed Regional Policy Statement where policy direction is provided to decision makers that iwi management plans should be taken into account when making resource management decisions. In regards to the Proposed Southland Water and Land Plan, as we have only placed limited weight on the policies it contains that pertain to consent duration given that the hearings for this Proposed Plan have not yet been held. However, we do note that the wider planning context includes the impending Freshwater Management Unit (FMU) process to give effect to the Freshwater NPS, which granting a long term consent may undermine. As these plans and policy statements are matters to which we must have regard to in reaching our overall decision, we consider the direction provided by these to be relevant to setting the appropriate consent duration. We also hold the belief that the consent duration serves the purpose of the RMA.

We have reflected upon guidance provided from the Ministry of Environment[60] on consent duration, relevant case law, and the legal submissions presented by the Applicant and the Council's legal counsel.[61] One case we have considered is the PVL Proteins Ltd vs Auckland Council case and the basis on which the Court considered consent duration could be set.[62] Our determination that all of the consents be granted for 25 years is a reflection of the need for certainty of investment for the Applicant and balancing this with the actual and potential effects of the activities, the sensitivity of the receiving environment to adverse effects and the ability of consent conditions to be effective beyond 25 years.

[56] Section 104(2A)
[57] Ministry for the Environment guideline on consent duration (2000)
[58] Policy 14A of the Operative Regional Water Plan , January 2010, Page 19
[59] Policies 3.5.2.17; 3.5.3.13 and 3.5.14.17Te Tangi A Tauira
[60] Ministry for the Environment guideline on consent duration (2000)
[61] L de Latour and S Christensen, Opening Legal Submissions.
[62] PVL Proteins Ltd v Auckland RC EnvC A061/2001

The 25 year duration coincides with the remaining duration of the Applicant's agreement with the Southland District Council to receive and treat the wastewater from Wallacetown. It also aligns with Te Ao Marama Inc's requested term of consent. The upgrades to the wastewater treatment plant will have been completed for a period of 10 years by the time the consents are due to expire and monitoring over this period of time will provide important information on whether the upgrades have resulted in the environmental benefits which the Applicant has told us will occur.

In regards to the discharge to air permit the Applicant and the Council reporting officers had a significant difference of opinion on the appropriate duration. Ms Smith recommended a five year term, and it appeared to us that this recommendation is almost entirely based on the advice of Mr Iseli. As discussed earlier in this decision, Mr Iseli considers that the Applicant's emission control measures do not constitute the BPO and because it is not proposing to implement additional emission controls then a five year term is, in his opinion, appropriate to impose. Mr Iseli is an air quality expert and it is not his role to be recommending any duration for the consent. This is the role of a qualified planner as it involves consideration of a number of matters, many of which are clearly outside Mr Iseli's area of expertise. Despite this, we consider that a five year term is unjustified in this case as we heard no effects based reasons why such a short term is warranted. We agree with the Applicant that a longer term is appropriate (in particular a duration aligned with the other consents).

We consider that a 25 year term for the consent to discharge contaminants to air is appropriate provided:

1. the proposed upgrades to the CFBs – to ensure the PM_{10} discharge limit from the stacks is reduced from 300 mg/Nm^3 to 250 mg/Nm^3 – are undertaken within three years (not two years as recommended by Mr Iseli and not five years as proposed by the Applicant);

2. in-stack monitoring for PM_{10} emission rates is undertaken on each stack at least annually (for the reasons presented earlier in our decision); and

3. a BPO assessment review is undertaken within five years (not ten years as proposed by the Applicant), and at least every five years thereafter – with each BPO outcome report and recommendations reviewed by an independent air quality expert who has been agreed to by the Consent Authority in writing before their engagement. We consider the latter requirement (having an approved expert review the BPO report) is an important additional requirement because any recommendations in respect of additional emission control requirements, monitoring, and/or performance standards become binding both on the Consent Authority and the Applicant. It is therefore important that the Consent Authority is satisfied that the person undertaking the review is both qualified and independent – these sorts of 'prior agreement' conditions are not uncommon on resource consents and we note that there are already a number of conditions in the Applicant's volunteered set which include Consent Authority agreement clauses.

Most of the activities for which consents are sought are currently occurring and therefore the consents will effectively be exercised immediately upon granting of the replacement consents and therefore lapsing of the consents is not relevant. The exception to this is the temporary storage of wastewater consent. Because this consent is not anticipated to be exercised frequently a condition which confirms that it will not lapse until its expiry is considered appropriate to impose, otherwise (in the absence of such a condition) it would lapse after five years (the default specified in the section 125 of the RMA).

10 Conditions

The Section 42A report included a set of recommended conditions. The Applicant made changes to these conditions and these were attached to Mr Kyle's evidence. A final set of volunteered conditions was included in the Applicant's Right of Reply. The final set having been circulated to the Council's reporting officers who identified areas of disagreement and alternative wording for some of the conditions.

We have carefully reviewed the Applicant's final suite of conditions and find them to be generally appropriate and the changes made generally reflect the amendments which Commissioner Lieffering raised during the course of the hearing.

We have, however, made a number of changes to the Applicant's conditions. The nature of the changes to the conditions we have made include minor formatting, grammatical, and cross-references corrections and use of standard definitions for terms that are repeatedly used. However, some more substantial changes have also been made and we have discussed the reasons for most of these in earlier sections of this decision – a summary of the more substantive changes is presented below.

All references to condition numbers in the remainder of this section relate to the conditions attached as Appendix 2 to this decision report and not to any of the versions of conditions that have been provided to us.

General

Expiry	For all the consents a 25 year term has been granted with a common expiry date of 30 November 2041
Certification	We agree with the Applicant's proposed suite of conditions relating to certification of plans submitted to the Consent Authority.
Section 128 Reviews	Conditions have been amended to remove references to Section 129 of the RMA and also removal of clauses which cover the matters outlined in Sections 128(1)(b) and (ba) of the RMA. This is because the Consent Authority can undertake reviews of the conditions of the consent 'as of right' under the circumstances specified in Sections 128(1)(b) and (ba) (e.g. where the regional plan has changed and introduces new levels or limits, including when limits are set for the Oreti FMU, or when a NES comes into force) – there is therefore no need to include or repeat them in a condition of consent – it is only the matters in Section 128(1)(a) that need to be specified, if necessary, in a condition.

Discharge to Makarewa River

Condition 5(c)	The downstream compliance point is set at 200 m below the discharge outfall (not 300 m).
Condition 5	New text added requiring all monitoring to be undertaken using methods agreed to by the Consent Authority and samples collected using laboratory supplied containers. We note here that the Applicant will need

	to change the way it collects samples from the 200 m compliance point and that the samples will probably need to be collected using a sampling pole.
Condition 8(a)	Change to wording to remove 'such as tuna' and change of word order. It will be up to the Applicant, in consultation with Te Ao Marama to decide which fish species will be used. We consider that species more sensitive than tuna be included but this will ultimately need to be decided following consultation with Te Ao Marama.
Condition 12	Changes made to clarify the period when the pre-upgrade standards and limits apply.
Condition 33(a)	Changes made to include reference to receiving water standards and applicable conditions included.

Discharge of BNR Solids

Condition 1	Amendment to clarify that 'commence' refers to the legal meaning under section 116 of the RMA.

Discharge of Contaminants to Air

Condition 17(b)	Requirement for the discharge of PM_{10} to be no greater than 250 mg/Nm^3 within three years (not five years as proposed by the Applicant).
Condition 17	New text to clarify that if the BPO review results in a more restrictive discharge limit for PM_{10} or any other determinand then that new discharge limit(s) supersedes and replaces the PM_{10} limit specified in condition 17(b).
New Condition 17A	Condition inserted requiring at least annual in-stack PM_{10} monitoring – the wording is based on the condition recommended by Mr Iseli, however we have added extra text to confirm that if any stack testing is required to be undertaken in accordance with Condition 19 (where ambient air quality limits are exceeded) then that monitoring may be used as fulfilment of the annual stack testing requirement.
Condition 18	Table 1 changes to reflect upgrade timeframes required by Condition 17(b).
Condition 19(b)	Condition inserted as volunteered in the Applicant's supplementary reply.
Condition 21(d)	Clause simplified so that the results of any stack testing be included in the report.
Condition 24	New text added to require the independent air quality expert who reviews the BPO review report and recommendations must be agreed to by the Consent Authority in writing prior to their engagement.

Water Take from the Oreti River

Condition 1 — Amendment to clarify that 'commence' refers to the legal meaning under section 116 of the RMA.

Land Use Consent for River Bed Disturbance

Condition 1 — Amendment to clarify that 'commence' refers to the legal meaning under section 116 of the RMA .

Temporary Wastewater to Land

Condition 7 — Minor change to text to clarify that the consent does not lapse until its expiry.

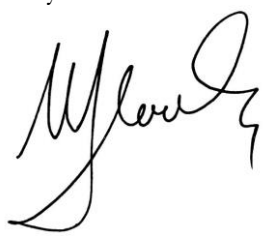
We are satisfied that these conditions are necessary and appropriate to avoid, remedy, or mitigate potential adverse effects identified in the evidence that was presented to us. We are also satisfied that the monitoring and reporting conditions will enable the ongoing effects of the activities to be assessed over time.

11 Determination

Pursuant to the powers delegated to us by the Southland Regional Council under section 34A of the RMA, we record that having read the application documents, the reporting officers' Section 42A reports, the submissions, and the evidence presented before, at, and following the formal part of the hearing, and having considered the various requirements of the RMA, we are satisfied that:

1. the Applicant has undertaken a thorough assessment of the potential adverse effects that might arise from the activities for which resource consents are being sought;
2. the potential adverse effects of the activities are either no more than minor or can be adequately avoided, remedied or mitigated by the imposition of conditions under Section 108 of the RMA;
3. the effects of the activities, when managed in accordance with those conditions, will not be inconsistent with the relevant statutory instruments and plans;
4. the activities will be consistent with the principles of the RMA; and
5. the activities will meet the purpose of the RMA.

The resource consents sought by the Alliance Group Limited for the activities as listed in Section 2 of this decision report are therefore **granted** subject to the imposition of the conditions set out in Appendix 2 for the reasons listed above and as further discussed in the body of this decision report.



Cr Neville Cook
Hearing Panel Chair
Date: 30 November 2016

Appendix 1 Appearances

Hearings Commissioners
Cr Neville Cook (Environment Southland)
Ms Yvette Couch-Lewis (Independent Commissioner)
Dr Rob Lieffering (Independent Commissioner)

Applicant
Mr Stephen Christensen – Legal Counsel
Mr P Callander – Environmental Scientist, Pattle Delamore Partners Limited
Mr A Khan – Chartered Professional Engineer, Pattle Delamore Partners Limited
Mr D Hailes – Company Secretary, Alliance Group Limited
Mrs F Wise – Group Environmental Manager, Alliance Group Limited
Dr M James – Aquatic Ecologist, Aquatic Environmental Services Limited
Mr M Copeland – Consulting Economist, Brown Copeland and Company Limited
Dr M Fitzpatrick – Environmental Chemist and Toxicologist, Freshwater Solutions Limited
Mr R Montgomerie – Freshwater Scientist, Freshwater Solutions Limited
Mr J Kyle – Planner, Mitchell Partnerships Limited
Mr R Cudmore – Air Quality Scientist, Golder Associates (NZ) Limited

Southland Regional Council
Ms Sarah Smith – Consents Officer
Dr Greg Ryder – Environmental Scientist, Ryder Consulting Limited
Mr John Iseli – Air Quality Scientist, Specialist Environmental Services Limited
Mr Rob Potts – Senior Environmental Engineer, Lowe Environmental Impact Limited

In Attendance
Ms Joanna Gilroy – Hearings Administrator
Mr Daniel Smith – Consents Team Leader

Submitters
Mr Ian Marshall – Group Manager Services and Assets, Southland District Council[63]
Mr Jacob Smyth – Resource Management Officer, Fish and Game New Zealand (Southland Region)
Ms Stevie-Rae Blair and Ms Ailsa Cain[64] – for Te Ao Marama Incorporated
Mr Robert Blackie – Union Secretary, New Zealand Meat Workers Union (Alliance Lorneville Sub-Branch)

[63] Cr Gavin McPherson was also in attendance but did not speak
[64] Ms Blair and Ms Cain spoke on behalf of Mr Dean Whaanga.

Appendix 2 Conditions

Details of Discharge Permit – Treated Wastewater to Water

Purpose for which permit is granted:		To discharge treated meat processing wastewater and sewage from the township of Wallacetown, to water
Location	- site locality	Lorneville
	- map reference	NZTM2000 1237821E 4856201N
	- catchment	Oreti
Legal description of land at the site:		Riverbed, adjacent to Sec 58 Block XIV Invercargill Hundred
Expiry date:		30 November 2041

Schedule of Conditions

General Conditions

1. Subject to complying with the conditions of this consent, the activities authorised by this consent shall be undertaken so as to be consistent with the application for this consent and the documents entitled:

   (a) Assessment of Environmental Effects dated December 2015
   (b) Technical Reports:
      (i) Appendix D – Assessment of the Receiving Environment for Alliance's Lorneville Wastewater Discharges
      (ii) Appendix I – Summary Report on Alternatives and Proposed Upgrading of the Wastewater Treatment Plant
      (iii) Appendix K – Assessment of Effects of the Wastewater Discharge
      (iv) Appendix L – Makarewa River Water Quality Monitoring Plan
      (v) Appendix T – Draft Environmental Monitoring Plan

2. This resource consent authorises the discharge of up to 22,730 m^3/day of treated wastewater from the Consent Holder's Lorneville Wastewater Treatment Plant to the Makarewa River at the location specified above. The Consent Holder shall maintain at all times suitable electromagnetic flow meters, with an error accuracy range of +/-5% to record the daily volumes of the discharge. The Consent Holder shall ensure the full operation of these meters at all times during the exercise of this consent.

   All malfunctions of the meters during the exercise of this consent shall be reported to the Consent Authority within five working days and appropriate repairs shall be performed within ten working days of the identification of the malfunction. Once the malfunction has been remedied, a Water Measuring Device Verification Form completed with photographic evidence must be submitted to the Consent Authority within five working days of the completion of repairs.

All meters shall be verified for accuracy every five years from the date of commencement of this consent. Each verification shall be undertaken by a Consent Authority approved operator and a Water Measuring Device Verification Form shall be completed and supplied to the Consent Authority with receipts of service. These shall be supplied within five working days of the verification, and at any time upon request.

The Consent Holder shall record adequate data to demonstrate compliance with the daily discharge limit specified in this condition. Discharge flow data shall be provided to the Consent Authority monthly (as required by Condition 23) or at any time upon request.

General Requirements – Certification of Management and Monitoring Plans

3.

(a) In carrying out its functions in relation to the certification process associated with any management or monitoring plan required by the conditions, the Consent Authority shall be satisfied that the plan meets the purpose stated within the relevant condition. The Consent Authority shall complete its certification within twenty working days of receipt of the management or monitoring plan. In the event of any dispute, disagreement or inaction arising as to any certification of any plan required by the conditions, or as to the implementation of, or monitoring required by the conditions, matters shall be referred in the first instance to the Consents Manager to determine a process for resolution of the dispute, disagreement or inaction.

(b) If a resolution cannot be agreed within ten working days of any dispute, disagreement or inaction arising, the matter may be referred to an independent appropriately qualified expert, acceptable to both parties, setting out the details of the matter to be referred for determination and the reasons the parties do not agree.

(c) The qualified expert shall be appointed within five working days of the Consent Holder or the Consent Authority giving notice of their intention to seek expert determination. The expert shall issue a decision on the matter within fifteen working days.

(d) The decision of the qualified expert is binding on the Consent Holder and shall be implemented.

(e) The dispute resolution process above shall be applied before any formal enforcement action is taken by the Consent Authority.

Environmental Monitoring Plan

4. No later than three months from the consent commencing the Consent Holder shall prepare and submit to the Consent Authority an Environmental Monitoring Plan (EMP) for certification. The EMP shall be prepared in general accordance with the draft plan provided with the documents and information provided as part of the Assessment of Environmental Effects dated November 2015. The purpose of the EMP shall be to describe the methods for monitoring the physical characteristics and water quality parameters of the discharge, and the physical, water quality and biological characteristics and parameters of the Makarewa River receiving waters as prescribed by this consent.

It shall include but not be limited to:

(a) the inclusion of a description and maps identifying the monitoring sites specified in Condition 5;

(b) a description of the methods and appropriate timing for undertaking the following monitoring requirements:

(i) discharge stream monitoring;
(ii) water quality monitoring;
(iii) benthic macroinvertebrate and associated habitat monitoring;
(iv) fish health survey;
(v) sediment sampling.

The EMP shall be reviewed by the Consent Holder at five yearly intervals. The purpose of this review shall be to confirm that it accurately reflects current on-site activities and operations and to identify if changes to management procedures contained within the EMP are required. The results of the review shall be reported to the Consent Authority within one month of the review being undertaken. If the review results in amendments to the EMP, the amended sections shall be provided to the Consent Authority for certification at this time.

This permit shall be exercised in accordance with the EMP at all times. Where there is inconsistency between the EMP and the conditions of this consent, the conditions of this consent shall prevail.

5. The EMP, prepared in accordance with Condition 4, shall include a description of the monitoring sites including the location/s where monitoring of the discharge prior to entry into the Boiler Ditch will occur, and monitoring sites within the Makarewa River upstream and downstream of the discharge point to be utilised for control and compliance monitoring. These monitoring sites shall be as follows:

(a) at a point where the discharge enters the "Boiler Ditch" as described and shown in the EMP;

(b) the Makarewa River "upstream control monitoring site" is located beyond the point in the river which is subject to tidal influences, approximately 2,000 metres above the treated wastewater outfall into the river as shown in the EMP;

(c) the downstream "compliance" site is located not more than 200 metres below the discharge outfall as shown in the EMP.

Monitoring

6. The monitoring of the discharge and the receiving Makarewa River water quality shall be undertaken at the locations and frequencies specified in the EMP and in accordance with the detail set out within these conditions, including Schedules A and B attached as Appendix A. All monitoring shall be undertaken using methods and standards agreed to the Consent Authority (as outlined in the EMP required to be prepared in accordance with Condition 4) and all water samples shall be collected using laboratory supplied containers.

7. No later than five years from the consent commencing and again for three consecutive years immediately prior to the Wastewater Treatment Plant Upgrade required by conditions 14 and 16 the Consent Holder shall undertake benthic macroinvertebrate

monitoring in accordance with the protocols set out in the EMP. This monitoring shall occur during the period 1 December to 30 April following a period of at least twenty consecutive days below annual median river flow, and if possible, after a period of sustained low flows. The monitoring shall be undertaken at two sites upstream of the discharge and two sites downstream of the discharge as set out within the EMP. The method for undertaking this monitoring shall be set out within the EMP. This monitoring shall be used to establish a baseline indication of benthic macroinvertebrate community health in order to enable subsequent comparative analyses to be made post the Wastewater Treatment Plant Upgrade required by conditions 14 and 16. The results of each survey shall be reported to the Consent Authority within three months of the completion of each survey.

8. (a) No later than five years from the consent commencing and again immediately prior to the Wastewater Treatment Plant Upgrade required by conditions 14 and 16, the Consent Holder shall undertake a fish health survey of resident fish species within the reach of the Makarewa River potentially affected by the discharge. A description of the purpose and method for undertaking this monitoring shall be set out within the EMP. The purpose and methods of this monitoring shall be established in consultation with Te Ao Marama. The results of each survey shall be reported to the Consent Authority within three months of the completion of the survey.

(b) No later than five years from the consent commencing, and every five years thereafter, the Consent Holder shall sample sediments within the Makarewa River at both the upstream and downstream locations identified within Condition 5 in order to determine concentrations of total nitrogen, total phosphorus, and total organic carbon. Results shall be compared to those historically obtained during the term of the previous consent (AUTH-92195). The sampling results (and the comparison with previous results) shall be reported to the Consent Authority within three months of each sampling event.

Treated Wastewater Limits – Pre Wastewater Treatment Plant Upgrade

9. (a) The Consent Holder shall ensure that the treated wastewater complies with the following limits at the monitoring site at the point of discharge to the Boiler Ditch as identified in the EMP and referred to in Condition 5.

Parameter	Limit
Carbonaceous BOD_5	30 g/m^3
Total suspended solids	110 g/m^3
Total nitrogen	180 g/m^3
Total phosphorus	20 g/m^3
E. coli	45,000 cfu/100mls

(b) Where one or more of the limits set out in Condition 9(a) is exceeded, the Consent Holder shall resample and / or retest that parameter as soon as practicable. In circumstances where one or more of the limits set out in Condition 9(a) are exceeded on two consecutive sampling occasions and these results are confirmed exceedances, the Consent Holder shall report to the Consent Authority in accordance with Condition 24.

Advice Note: The limits contained in Condition 9(a) are designed to ensure the quality of the wastewater discharge does not deteriorate from the levels existing at the time this consent was granted. The limits have been derived from the 95th%ile of the 5 year dataset derived from 1 October 2010 to 30 June 2015, a period that encompassed a range of climatic and processing variances.

10. From the third anniversary of the commencement of this consent, the Consent Holder shall ensure that the annual load of total nitrogen in the discharge does not exceed 255 tonnes/year. In circumstances where this total annual load is exceeded, the Consent Holder shall report to the Consent Authority in accordance with Condition 24.

Makarewa River Receiving Water Discharge Limits – Pre Wastewater Treatment Plant Upgrade

11. The Consent Holder shall ensure that the following receiving water standards are complied with at the downstream compliance site referred to in Condition 5:

    (a) daily maximum temperature of the receiving water shall not be increased by more than 3°C when the natural temperature is <16°C, and not more than 1°C when the natural temperature is >16°C when compared with the upstream control monitoring site referred to in Condition 5, and shall at no time exceed a maximum temperature of 23°C;

    (b) the pH of the receiving water shall be within the range of 6.5 – 9.0;

    (c) water clarity[65] shall not be reduced by more than 33% when compared with the upstream control monitoring site referred to in Condition 5;

    (d) there shall be no conspicuous oil or grease films, scums, foams or floatable or suspended materials produced as a result of the discharge;

    (e) the dissolved oxygen concentrations of the receiving water shall be consistently maintained at not less than 6 g/m^3 and shall not on any occasion be less than 5 g/m^3. For the purposes of this condition, the term "consistently maintained" shall mean at the required level for 96% of the samples taken in any year;

    (f) the soluble carbonaceous BOD_5 concentration of the receiving water shall not exceed 2 g/m^3, in more than 10% of annual samples, except where this is being exceeded at the upstream control monitoring site;

    (g) the concentration of total oxidised nitrogen within the receiving water shall not exceed an annual median (1 October to 30 September) of 2.4 g/m^3 and an annual 95%ile of 3.5 g/m^3;

    (h) the concentration of total ammoniacal nitrogen within the receiving water shall not exceed the following values at the defined pH:

[65] Water clarity shall be assessed using the Clarity Tube method or such other method agreed to in writing with the Consent Authority.

Total Ammoniacal Nitrogen Concentration (g/m³)			
pH	**30 day Rolling Average and Annual Median (3.75 g/m³ @pH 8.0)**	**4 day Rolling Average Maximum (4.75 g/m³ @pH 8.0) ***	**Annual 95th % ile (4.5 g/m³ @pH 8.0)**
6.5	10.3	13.0	12.3
6.6	10.1	12.8	12.1
6.7	9.9	12.6	11.9
6.8	9.7	12.3	11.6
6.9	9.4	11.9	11.3
7.0	9.1	11.5	10.9
7.1	8.7	11.1	10.5
7.2	8.3	10.5	10.0
7.3	7.8	9.9	9.4
7.4	7.3	9.2	8.7
7.5	6.7	8.5	8.1
7.6	6.1	7.8	7.3
7.7	5.5	7.0	6.6
7.8	4.9	6.2	5.9
7.9	4.3	5.5	5.2
8.0	3.7	4.7	4.5
8.1	3.2	4.1	3.9
8.2	2.8	3.5	3.3
8.3	2.3	3.0	2.8
8.4	2.0	2.5	2.4
8.5	1.7	2.1	2.0
8.6	1.4	1.8	1.7
8.7	1.2	1.5	1.4
8.8	1.0	1.3	1.2
8.9	0.9	1.1	1.0
9.0	0.7	0.9	0.9

**The rolling 4 day average concentration of total ammoniacal nitrogen over any 30 day period shall not exceed a maximum of 4.75 g/m³ (adjusted to pH 8) within the receiving water more than once over a three year period*

12. The standards and limits set out in Conditions 9(a) and 11 shall apply only until such time as the Consent Holder has fully implemented the wastewater treatment upgrades as required by conditions 14 and 16, after which time the standards and limits in set out in Conditions 17 and 18 shall apply.

Habitat Enhancement Plan

13. No later than one year from the commencement of this consent, the Consent Holder shall prepare and submit to the Consent Authority a Habitat Enhancement Plan which identifies habitat enhancement priorities to be carried out within Consent Holder's site. This Plan shall be prepared in consultation with Te Ao Marama. The Habitat Enhancement Plan shall incorporate, but not be limited to the following:

    (a) the methods to ensure ongoing liaison between the Consent Holder and Te Ao Marama in the development and maintenance of the Habitat Enhancement Plan;

(b) the protocols to be followed to identify areas for habitat enhancement and the development of a prioritised work programme over the first fifteen years of the consent term;

(c) details about the work programme and habitat enhancement priorities and how these will be implemented over a series of defined stages and managed over time. Likely habitat enhancement priorities will include planting and ecological restoration work at the ox-bow area, riparian planting at appropriate places on the margin of the Makarewa River and at other surface water bodies on the Consent Holder's site;

(d) specific monitoring that is required to ensure that the habitat enhancement work is successful;

(e) reporting and review protocols;

(f) a copy of the Habitat Enhancement Plan shall be submitted to the Consent Authority. The Consent Holder shall implement the enhancement and restoration works according to the work programme set out in (c) above.

Wastewater Treatment Plant Upgrade

14. No later than five years from the consent commencing, the Consent Holder shall prepare and submit to the Consent Authority a Wastewater Treatment Plant Upgrade Plan. This Plan shall identify the technology and Wastewater Treatment Plant upgrades necessary to improve the quality of the wastewater discharged to the Makarewa River in order to meet the standards and limits set out in Conditions 17 and 18, including for water clarity and the management of *E. coli*.

    (a) The Wastewater Treatment Plant Upgrade Plan shall include, but not be limited to, the following matters:

        (i) A description of the proposed technology and wastewater plant upgrades to be installed including its operational requirements and management;

        (ii) An investigation into the benefits of a diffuser outfall on downstream water quality and ecology.

        (iii) A description of the methodology of how the wastewater plant upgrades will be installed and a staged work plan describing the timing associated with the progressive implementation of these works;

        (iv) The monitoring and reporting obligations associated with the Wastewater Treatment Plant upgrades.

15. Once the Wastewater Treatment Plant Upgrade Plan has been prepared and submitted to the Consent Authority, the Consent Holder shall commence reporting to the Consent Authority annually (prior to the anniversary of the submission to the Consent Authority of the Upgrade Plan) to identify its progress towards implementation and commissioning of the Wastewater Treatment Plant Upgrade (in accordance with the work plan required by Condition 14(a)(iii)). This reporting shall describe any interim measures undertaken to improve the quality of the discharge, or physical plant works or operational changes associated with the upgrade.

16. The Consent Holder shall ensure that the Wastewater Treatment Plant Upgrade, including measures to manage water quality, water clarity, and *E. coli* is fully commissioned and operational no later than fifteen years from the commencement of this consent.

Makarewa River Receiving Water Discharge Limits – Post Wastewater Treatment Plant Upgrade

17. No later than fifteen years from this consent commencing, the Consent Holder shall ensure that the following receiving water standards are complied with at the downstream compliance site referred to in Condition 5:

    (a) Daily maximum temperature of the receiving water shall not be increased by more than 3°C when the natural temperature is <16°C, and not more than 1°C when the natural temperatures is >16°C when compared with the upstream control monitoring site referred to in Condition 5 and shall at no time exceed a maximum temperature of 23°C.

    (b) The pH of the receiving water shall be within the range of 6.5 – 9.0.

    (c) Water clarity shall not be reduced by more than 20% when compared with the upstream control monitoring site referred to in Condition 5.

    (d) The dissolved oxygen concentrations of the receiving water shall be consistently maintained at not less than 6 g/m^3 and shall not on any occasion be less than 5 g/m^3. For the purposes of this condition, the term "consistently maintained" shall mean at the required level for 96% of the samples taken in any year.

    (e) The soluble carbonaceous BOD_5 concentration of the receiving water shall not exceed 2 g/m^3, in more than 10% of annual samples except where this is being exceeded at the upstream control monitoring site.

    (f) There shall be no conspicuous oil or grease films, scums, foams or floatable or suspended materials produced as a result of the discharge.

    (g) The concentration of total ammoniacal nitrogen within the receiving water shall not exceed the following values at the defined pH:

Total Ammoniacal Nitrogen Concentration (g/m^3)			
pH	**30 day Rolling Average and Annual Median (1.9 g/m^3 @pH 8.0)**	**4 day Rolling Average Maximum * (4.75 g/m^3 @pH 8.0)**	**Annual 95th % ile (2.4 g/m^3 @pH 8.0)**
6.5	5.2	13.0	6.6
6.6	5.1	12.8	6.5
6.7	5.0	12.6	6.3
6.8	4.9	12.3	6.2
6.9	4.8	11.9	6.0
7.0	4.6	11.5	5.8
7.1	4.4	11.1	5.6
7.2	4.2	10.5	5.3
7.3	4.0	9.9	5.0
7.4	3.7	9.2	4.7
7.5	3.4	8.5	4.3
7.6	3.1	7.8	3.9
7.7	2.8	7.0	3.5
7.8	2.5	6.2	3.1
7.9	2.2	5.5	2.8
8.0	1.9	4.7	2.4
8.1	1.6	4.1	2.1
8.2	1.4	3.5	1.8

Total Ammoniacal Nitrogen Concentration (g/m³)			
pH	**30 day Rolling Average and Annual Median (1.9 g/m³ @pH 8.0)**	**4 day Rolling Average Maximum * (4.75 g/m³ @pH 8.0)**	**Annual 95th % ile (2.4 g/m³ @pH 8.0)**
8.3	1.2	3.0	1.5
8.4	1.0	2.5	1.3
8.5	0.8	2.1	1.1
8.6	0.7	1.8	0.9
8.7	0.6	1.5	0.8
8.8	0.5	1.3	0.7
8.9	0.4	1.1	0.6
9.0	0.4	0.9	0.5

**The rolling 4 day average concentration of total ammoniacal nitrogen over any 30 day period shall not exceed a maximum of 4.75 g/m³ (adjusted to pH 8) within the receiving water more than once over a three year period*

(h) The concentration of total oxidised nitrogen shall not exceed an annual median (1 October to 30 September) of 2.4 g/m³ and an annual 95%ile of 3.5 g/m³ within the receiving water.

Treated Wastewater Limits – Post Wastewater Treatment Plant Upgrade

18. (a) No later than fifteen years from this consent commencing, the Consent Holder shall ensure that the treated wastewater complies with the following limits at the monitoring site at the point of discharge to the Boiler Ditch as identified in the EMP and referred to in Condition 5.

Parameter	Limit
Total ammoniacal nitrogen	39 g/m³
Carbonaceous BOD_5	30 g/m³
Total suspended solids	50 g/m³
Total nitrogen	45 g/m³
Total phosphorus	11 g/m³
E. coli	Annual Median of 500 cfu/100mls, Maximum of 10,000 cfu/100mls, with 90% of samples not exceeding 5,000 cfu/100mls

(b) Where one or more of the limits set out in Condition 18(a) is exceeded, the Consent Holder shall resample and/or retest that parameter as soon as practicable. In circumstances where one or more of the limits set out in Condition 18(a) are exceeded on two consecutive sampling occasions and these results are confirmed exceedances, the Consent Holder shall report to the Consent Authority in accordance with Condition 24.

(c) Once the upgraded Wastewater Treatment Plant required by Conditions 14 and 16 has been commissioned and has been fully operational for twelve months, the Consent Holder shall ensure that the annual load of total nitrogen in the discharge

does not exceed 150 tonnes/year. In circumstances where this total annual load is exceeded, the Consent Holder shall report to the Consent Authority in accordance with Condition 24.

(d) The discharge of total ammoniacal nitrogen shall not exceed 200 kg/day at times when the flow in the Makarewa River is less than 2 m^3/s as measured at the Environment Southland Counsell Road flow recording site.

19. Once the upgraded Wastewater Treatment Plant required by Conditions 14 and 16 has been commissioned and has been fully operational for twelve months, the Consent Holder shall engage an appropriately qualified and independent water quality expert to review the post upgrade discharge limits for total nitrogen, total ammoniacal nitrogen, and total phosphorus set out in Condition 18. The purpose of this review shall be to determine whether these limits are appropriate for the purposes of maintaining and enhancing water quality in the Makarewa River and the review shall include:

(a) an evaluation of the monitoring results with regard to these limits;

(b) a review of relevant guidelines or standards for these parameters applicable at the date of the review, and other catchment wide improvements relating to water quality.

A copy of this review shall be provided to the Consent Authority. The Consent Holder's obligations to undertake this review and the associated reporting process shall be completed within six months after being initiated. If this review recommends that amendments to these limits are necessary, then the Consent Authority may initiate a formal review of the post upgrade limits for these parameters.

20. Once the upgraded Wastewater Treatment Plant required by Conditions 14 and 16 has been commissioned and has been fully operational for twelve months the Consent Holder shall undertake benthic macroinvertebrate monitoring in accordance with the protocols set within the EMP. This monitoring shall occur on an annual basis for a period of not less than three consecutive years during the period 1 December to 30 April following a period of at least twenty consecutive days below annual median river flow, and if possible after a period of sustained low flows. The monitoring shall be undertaken at two sites upstream of the discharge and two sites downstream of the discharge as set out within the EMP. This monitoring shall be used to establish any changes that have occurred between the baseline assessment undertaken in accordance with Condition 7 and the state of benthic macroinvertebrate community health post the Wastewater Treatment Plant Upgrade. The results of this monitoring shall be reported to the Consent Authority upon completion of this three year period of monitoring.

21. No later than two years from the commissioning and operation of the Wastewater Treatment Plant upgrade the Consent Holder shall repeat the fish health monitoring survey undertaken in accordance with Condition 8(a). The purpose of the survey shall be to determine what, if any, improvement in fish health has occurred post upgrade of the Wastewater Treatment Plant. The results of this monitoring shall be compared to the results of the monitoring carried out prior to the Wastewater Treatment Plant Upgrade and shall be reported to the Consent Authority upon completion of this survey.

Reporting

22. The following additional reporting requirements shall apply both before and after the wastewater upgrade required by Conditions 14 and 16.

23. The results of the flow recording, discharge quality and receiving water quality monitoring carried out in accordance with the conditions of this consent shall be supplied to the Consent Authority on a monthly basis.

24. Where any condition of this consent requires notification of exceedance under this condition, the Consent Authority shall be notified within 24 hours of the confirmation of any exceedance of a limit prescribed by the conditions of this consent. This notification shall include advice of any corrective actions taken by the Consent Holder. An incident report shall be provided to the Consent Authority within twenty working days of the notification of the exceedance. This report shall include:

    (a) identification of the likely cause of the limit exceedance;

    (b) the resulting effects on the receiving environment likely to arise because of the limit exceedance;

    (c) the management responses undertaken or which may be necessary to prevent any further limit exceedances occurring;

    (d) remedial action undertaken or which may be necessary.

25. The Consent Holder shall prepare and submit an Annual Monitoring Report to the Consent Authority. The report shall cover the 1 October to 30 September period and shall be provided to the Consent Authority by 30 November each year. It shall include:

    (a) A summary of the discharge flow recording, discharge quality monitoring results, receiving water quality monitoring results and assessment of compliance with the limits prescribed by this consent;

    (b) A calculation of the annual discharged loads of ammonia nitrogen, total oxidised nitrogen, total nitrogen, and total phosphorus and a comparative analysis of these loads against preceding seasons; and

    (c) Prior to the Wastewater Treatment Plant Upgrade, an assessment of the annual median and 95%ile of the total ammoniacal nitrogen concentrations in the receiving water against an annual median of 1.9 g/m^3 and an annual 95%ile of 2.4 g/m^3 (both at pH 8.0).

26. For the purpose of this consent, the analyses and preservation of all aqueous samples shall be carried out in accordance with the latest edition of APHA "Standard Methods for the Analysis of Water and Wastewater" or by methods approved by the Consent Authority.

27. The monitoring and analyses specified in these conditions are to be carried out by a laboratory with IANZ certification, or as agreed to in writing by the Consent Authority.

Technical Working Party Consultation

28. The Consent Holder shall facilitate the continuation of the Lorneville Wastewater Technical Working Party and shall distribute the Annual Monitoring Teport required to be prepared by Condition 25 to the members of the working party.

29. The Lorneville Wastewater Technical Working Party shall comprise representatives from the Consent Holder, the Southland Fish and Game Council, the Department of

Conservation, Te Ao Marama Incorporated, a Wallacetown community representative, Public Health South, Invercargill City Council, Southland District Council, and the Consent Authority. The Consent Holder shall be responsible for convening meetings, the provision of a venue for meetings and providing any necessary administrative support to the working party.

30. Should any of the external parties referred to in Condition 29 choose not to continue to be part of the Lorneville Wastewater Technical Working Party then the Consent Holder shall not be deemed to be in breach of these conditions.

31. The purpose of the Lorneville Wastewater Technical Working Party shall be to receive reports, review results, initiate meetings as required, and identify any required reviews of consent conditions. The Consent Holder shall consult with the Lorneville Wastewater Technical Working Party as part the review required by Condition 19.

Review Conditions

33 The Consent Authority may, within three months of receiving any report required by Conditions 19 and/or 25 of this consent, serve notice on the Consent Holder under section 128 of the Resource Management Act 1991 of its intention to review the conditions of this consent. The purpose of such a review is for any of the following reasons:

(a) to assess the significance of any exceedance of the discharge limits and receiving water standards set out in Conditions 9, 11, 17 or 18, and/or to determine whether the limits or standards should be altered with particular regard had to the reporting undertaken in accordance with Condition 19, or whether the exceedance has resulted in significant adverse effects; or

(b) determining whether the conditions of this consent are adequate to deal with any adverse effects on the environment; or

(c) amending the monitoring programme to be undertaken; or

(d) adding or deleting any compliance parameters or limits; or

(e) requiring the Consent Holder to adopt the best practicable option to remove or reduce any adverse effects.

Appendix A – Monitoring Schedules

Schedule A1. Treated Wastewater Discharge Monitoring Schedule for the Period 1 October to 31 May each year when discharging

Parameter	Daily (When discharging)	Weekly (when discharging)
Volume	X	
Electrical conductivity	X	
pH	X	
Temperature	X	
Dissolved oxygen concentration	X	
Total ammoniacal nitrogen	X	
Total nitrogen		X
Total oxidised nitrogen		X
Total phosphorus		X
Dissolved reactive phosphorus		X
Total suspended solids		X
Volatile suspended solids		X
Carbonaceous BOD_5		X
E. coli		X

Schedule A2. Treated Wastewater Discharge Monitoring Schedule for the Period 1 June to 30 September each year when discharging

Parameter	Daily (When discharging)	Weekly (when discharging)	Monthly (when discharging)
Volume	X		
Electrical conductivity		X	
pH		X	
Temperature		X	
Dissolved oxygen concentration		X	
Total ammoniacal nitrogen		X	
Total nitrogen		X	
Total oxidised nitrogen		X	
Total phosphorus		X	
Dissolved reactive phosphorus		X	
Total suspended solids		X	
Volatile suspended solids		X	
Carbonaceous BOD_5		X	
E. coli		X	

Schedule B1. Receiving Water Monitoring Schedule for the Period 1 October to 31 May each year: Upstream Control site and Downstream Compliance site

Parameter	Daily	Weekly	Weekly	Monthly
	When discharging		No discharge	
Electrical conductivity	X		X	
pH	X		X	
Temperature	X		X	
Dissolved oxygen concentration	X		X	
Foams and scums	X		X	
Total ammoniacal nitrogen	X		X	
Total oxidised nitrogen		X	X	
Total nitrogen		X	X	
Total phosphorus		X	X	
Dissolved reactive phosphorus		X		X
Total suspended solids		X		X
Carbonaceous BOD_5		X		X
Soluble carbonaceous BOD_5		X		X
E. coli		X		X
Turbidity		X		X
Clarity tube		X		X

Schedule B2. Receiving Water Monitoring Schedule for the Period 1 June to 30 September each year: Upstream Control site and Downstream Compliance site

Parameter	Weekly	Monthly
	Discharge / No discharge	
Electrical conductivity	X	
pH	X	
Temperature	X	
Dissolved oxygen concentration	X	
Foams and scums	X	
Total ammoniacal nitrogen	X	
Total oxidised nitrogen	X	
Total nitrogen	X	
Total phosphorus	X	
Dissolved reactive phosphorus		X
Total suspended solids		X
Carbonaceous BOD_5		X
Soluble carbonaceous BOD_5		X
E. coli		X
Turbidity		X
Clarity tube		X

Details of Discharge Permit – Wastewater to land (irrigation)

Purpose for which permit is granted:		To discharge treated wastewater to land via irrigation
Location	- site locality	Crowe Road, Lorneville
	- map reference	NZTM2000 1239224E 4855604N
	- catchment	Oreti
Legal description of land at the site:		Lots 32 and 33 Block II DP 64 and Lot 3 DP 10900 and Part Sections 35 and 36 Block XIV Invercargill Hundred
Expiry date:		30 November 2041, or earlier when implementation of the wastewater treament plant upgrade and the application of WAS/SYS solids to land occurs, upon which this consent will be surrendered.

Schedule of Conditions

General Conditions

1. Subject to complying with the conditions of this consent, the activities authorised by this consent shall be undertaken so as to be consistent with the application for this consent and the documents titled:
   (a) Assessment of Environmental Effects dated November 2015
   (b) Technical Reports:
      (i) Appendix I – Wastewater to Land Annual Monitoring Report

Discharge Limits

2. This resource consent: authorises the discharge of up to 3,000 m^3/day of treated wastewater (including treated sewage from Wallacetown) from Alliance Group Limited's Lorneville Plant Wastewater Treatment System onto Zone 1 soils as shown on the map attached as Appendix A via spray irrigation using K-Line irrigation methods.

Irrigation Limits

3. The irrigation of treated wastewater to land shall not occur on soils identified as Zone 2 on the attached Map A.

4. The irrigation of treated wastewater onto land shall comply with the following:

   (a) No irrigation or spray-fall is to occur within:

      (i) 100 m of any residential dwelling (excluding those owned by the Consent Holder) except where the owner or occupier of the dwelling has given written approval to the Consent Holder to use a smaller buffer distance;

      (ii) 50 m of any surface watercourse;

      (iii) 20 m of any property boundary;

(b) Where there is inconsistency between the map in Appendix A and the conditions of this consent, the conditions of this consent shall prevail. Only wastewater with a positive dissolved oxygen concentration, and with a sodium adsorption ratio less than 17, shall be discharged onto land.

(c) No irrigation is to occur when the soils are at or above 80% water filled pores as recorded at the Wallacetown- Price Road soil moisture monitoring site as shown on the Environment Southland website.

5. Irrigation of treated wastewater shall comply with the following operational parameters:

(a) The average irrigation rate shall not exceed 5 mm per hour, and the depth of application shall not exceed 50 mm, to any area in any 24 hour period;

(i) The return period between applications of treated wastewater to an area of land shall not be less than 15 days;

(ii) The annual nitrogen loading rate for wastewater and fertilisers on the area available for irrigation shall not exceed 250 kg/hectare.

6. There shall be no surface run off, ponding of an area greater than 50 m^2 24 hours after being irrigated, or contamination of surface water, resulting from the application of wastewater to pasture.

Monitoring

7. The Consent Holder shall:

(a) record, in writing or electronically, all activities associated with the wastewater irrigation system including, but not limited to the following:

(i) irrigation blocks sprayed and the return period between successive irrigation events for each block;

(ii) hours of operation on each irrigation block;

(iii) volume discharged to each irrigation block;

(iv) volume discharged per day;

(v) weather conditions, including rainfall and an estimate of wind direction and strength; and

(vi) soil moisture.

(b) record the details of any complaints received about the irrigation of the wastewater, including:

(i) the name and address of the complainant;

(ii) the date and time of the complaint;

(iii) the location of the complaint;

(iv) the weather conditions at the time;

(v) any events in the management of the irrigation system which may have resulted in increased odour emissions; and

(vi) the actions, if any, taken in response to each complaint.

(c) Make the records kept as per Conditions 7(a) and (b) available for inspection by the Consent Authority's staff upon request. The cost of such inspections shall be borne by the Consent Holder.

(d) Advise the Consent Authority in writing, in the event of a malfunction of an item of plant or equipment which may result in emissions of offensive odour beyond the boundary of the plant, as soon as practicable after the malfunction occurs, followed by a report in writing to the Consent Authority on the cause of the malfunction and the action taken, or proposed to be taken, by the Consent Holder to avoid recurrence of the problem. This report shall be lodged with the Consent Authority no later than five working days from the time of the malfunction.

8. The Consent Holder shall monitor the discharge by taking representative samples of the wastewater discharge stream:

(a) Each week while irrigating and analysing those samples for:

(i) Total suspended solids concentration;

(ii) BOD_5 concentration;

(iii) Total ammoniacal nitrogen concentration;

(iv) Total nitrogen concentration;

(v) Nitrate + nitrite nitrogen concentration;

(vi) Total phosphorus concentration;

(vii) Dissolved reactive phosphorus concentration;

(viii) Dissolved oxygen; and

(ix) *E. coli* concentrations.

(b) Each month while irrigating and analysing those samples for:

(i) The cations calcium, sodium, and magnesium and the SAR (sodium adsorption ratio) shall be calculated.

9. The Consent Holder shall monitor groundwater in two bores on the site, one of which shall be a control site (upstream of the irrigation area located at about map reference NZMS E 1239563; N4856494), and the other shall be at the downstream end of the wastewater irrigation area located at about map reference NZMS E 1238690; N 4855725.

(a) By measuring and recording the depth to groundwater at the two monitoring bores immediately before purging the bores and extracting the samples under Condition 9(b);

(b) By taking representative samples of the groundwater at each site at monthly intervals while irrigating and three monthly for the remainder of the year, and analysing those samples for the following parameters:

(i) pH;

(ii) chloride concentration;

(iii) electrical conductivity;

(iv) Nitrate + nitrite nitrogen concentrations;

(v) Total ammoniacal nitrogen concentration;

(vi) Dissolved reactive phosphorus concentrations; and

(vii) *E.coli* concentrations.

10. In the event that the groundwater monitoring undertaken in accordance with Condition 9 show that any sample in the downstream bore records a nitrate-nitrogen concentration of greater than 6.9 g/m^3 when that was not exceeded in the upstream control bore, the Consent Holder shall be required to immediately obtain a second sample to determine whether the measured concentration represents a sustained exceedance. In the event that the groundwater monitoring undertaken in accordance with Condition 9 show that any two consecutive samples in the downstream bore record a nitrate-nitrogen concentration of greater than 6.9 g/m^3 when that was not exceeded in the upstream control bore, the Consent Holder shall be required to notify the Consent Authority and investigate the likely cause of the exceedance. If the investigation determines that the irrigation is likely to have caused or contributed to the exceedance, then the Consent Holder shall be required to implement appropriate remedial action as recommended by an appropriately qualified and independent person upon receipt and review of the monitoring and investigation results. The results of this investigation and any mitigation or remedial action undertaken or to be implemented shall be reported to the Consent Authority within thirty working days of the exceedance being reported.

11. The Consent Holder shall monitor the effects of the discharge on Bateman's Drain at the point that it exits the irrigation area, or at another point agreed in writing by the Consent Authority, by taking representative grab samples of water from the drain, at monthly intervals during the period 1 December to 31 May, and analysing those samples for:

    (a) Electrical conductivity;

    (b) Total nitrogen concentration; and

    (c) Dissolved reactive phosphorus concentration.

12. For the purpose of monitoring the effects of irrigation of treated wastewater, the Consent Holder shall:

    (a) Carry out soil sampling, at a minimum of four irrigated sites within Zone 1 (Edendale/Waikiwi/Woodlands/Mokotua soils) and one non-irrigated control site (i.e. a site on which no effluent is sprayed), in June each year. The samples are to be analysed for:

        (i) Infiltration rate; and

        (ii) Hydraulic conductivity (saturated).

    (b) Carry out sampling (from the 0-7.5 cm soil depth) of Zone 1 soils in October, January, April and July each year at a minimum of four sites, one of which shall be a non-irrigated control site. The remaining sites shall be irrigated. The samples shall be analysed for:

        (i) pH

        (ii) exchangeable calcium

        (iii) exchangeable magnesium

        (iv) exchangeable potassium

        (v) exchangeable sodium

        (vi) phosphorus

(c) Estimates of nitrate leaching using lysimeters are to be made monthly at four Zone 1 (Edendale/Waikiwi/Woodlands/Mokotua soils) sites, one of which shall be a non-irrigated control site to assess nitrate losses. Nitrate nitrogen concentrations shall be measured on leachate samples, and estimates shall be made using a daily water balance model for the periods between sampling dates. Nitrate leaching shall be calculated monthly using the nitrate nitrogen concentrations and drainage data and reported within the Consent Holder's annual reports.

(d) A soil water balance shall be prepared annually for each irrigated block and a non-irrigated block comprising Zone 1 soil.

13. By the 15 December during each year of operation, the Consent Holder shall prepare and submit to the Consent Authority a monitoring report relating to the activities authorised by this consent over the preceding 1 October to 30 September period. This report shall be prepared by a suitably qualified person/environmental scientist and shall include, but not be limited to:

(a) trends in analytical results;

(b) results of lysimeter studies;

(c) effects on the soil or groundwater system and any mitigation measures applied to reduce contaminants;

(d) recommendations for improvements in the system;

(e) summary information on return periods and applications of effluent on each block;

(f) estimates of annual nitrogen loading including from fertiliser to each irrigation zone; and

(g) water budget, detailing water inputs; rainfall, irrigation volume, and daily estimate of water losses (drainage, evapotranspiration) and daily estimate of soil water contents for each irrigation area and a non-irrigation area.

Note: Suitably qualified person/environmental scientist means someone who is experienced in wastewater land treatment, such as annual assessment of soil chemistry, soil hydraulics, nutrient leaching, soil drainage and irrigation.

14. The report required by Condition 13 shall identify if there is a need to implement additional methods or improvements to be undertaken to the land irrigation system. Within scope of the consent the Consent Holder shall be required to implement any recommendations in accordance with the requirements set out in the report and apply for any applicable additional resource consent if required. These measures shall be implemented by the Consent Holder prior to commencing the following irrigation season and included into the Management Plan.

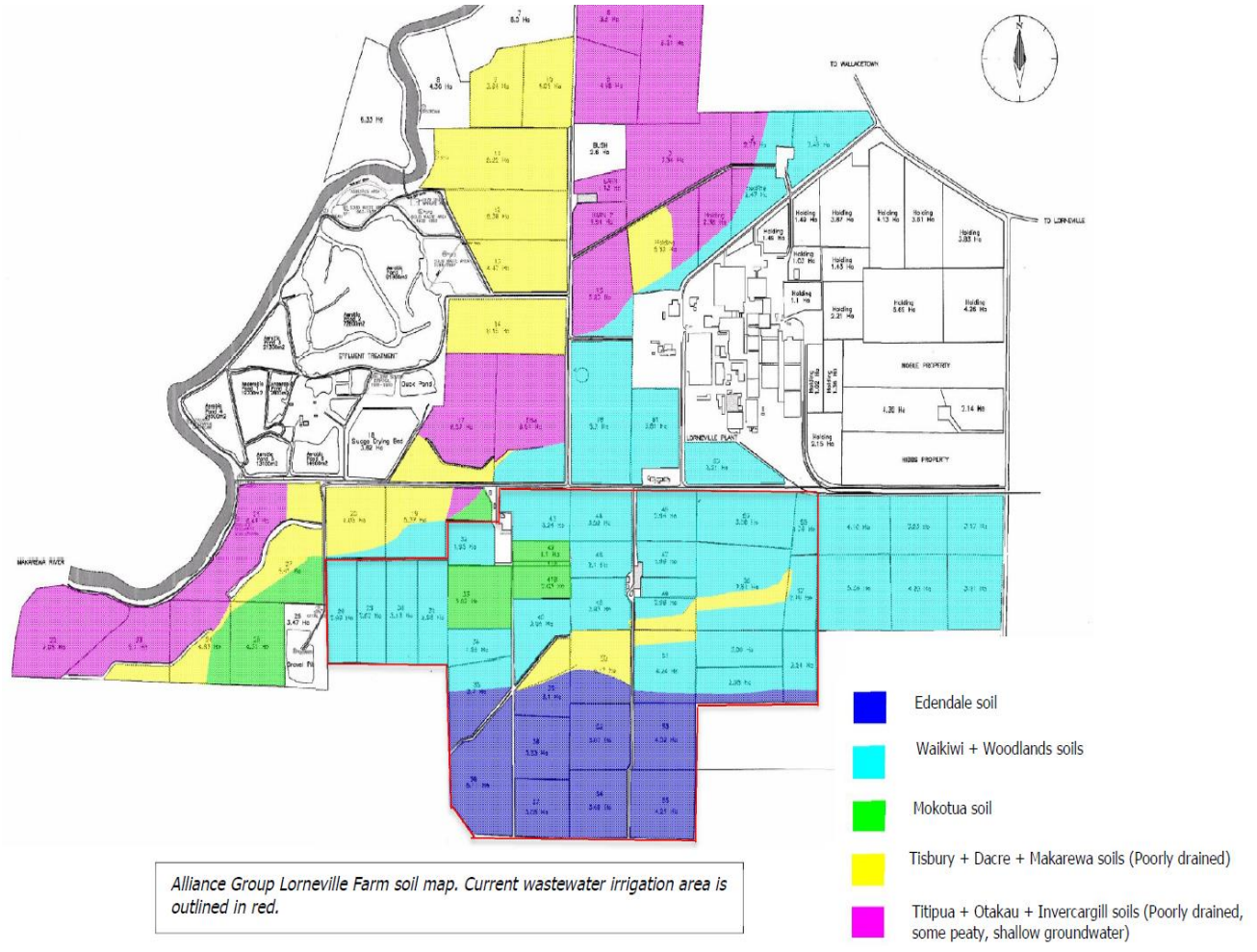
15. For the purpose of this consent, the analyses and preservation of all aqueous samples shall be carried out in accordance with the latest edition of APHA "Standard Methods for the Analysis of Water and Wastewater" or by similar methods approved in writing by the Consent Authority.

16. The monitoring and analyses specified in these conditions are to be carried out by a laboratory with IANZ certification, or as agreed to in writing by the Consent Authority.

Review

17. The Consent Authority may, within three months of receiving the report required by Condition 13 of this consent, serve notice on the Consent Holder under section 128 of the Resource Management Act 1991 of its intent to review the conditions of this consent. The purpose of such a review is to assess the significance of any of the groundwater and soil monitoring result which may be causing adverse effects on the receiving environment.

APPENDIX A – Irrigation Map



Alliance Group Lorneville Farm soil map. Current wastewater irrigation area is outlined in red.

Irrigation is to occur within the red outline area on Zone 1 soils. Zone 2 soils shall not be used for irrigation. Zone 1 soils are those represented in blues and greens. Zone 2 soils are those areas represented in yellow.

Details of Discharge Permit – Discharge of BNR Solids from the Wastewater Treatment Plant and Stockyards to Land

Purpose for which permit is granted:		To discharge dewatered BNR solids from the Wastewater Treatment Plant and Stockyards to land where contaminants might enter groundwater.
Location	- site locality	Crowe Road, Lorneville
	- map reference	NZTM2000 1239224E 4855604N
	- catchment	Oreti
Legal description of land at the site:		Lots 32 and 33 Block II DP 64 and Lot 3 DP 10900 and Part Sections 35 and 36 Block XIV Invercargill Hundred
Expiry date:		30 November 2041

Schedule of Conditions

General Conditions

1. For the purposes of section 116 of the Resource Management Act 1991, this resource consent shall not commence until resource consent AUTH-200034 (Wastewater to land) is surrendered or has expired.

2. Subject to complying with the conditions of this consent, the activities authorised by this consent shall be undertaken so as to be consistent with the application for this consent and the documents titled:
   (a) Assessment of Environmental Effects dated November 2015
   (b) Technical Reports:
      (i) Appendix I – Summary Report on Alternatives and Proposed Upgrading of the Wastewater Treatment Plant
      (ii) Appendix J – Biosolids Land Disposal Assessment
      (iii) Appendix Q – Groundwater and Surface Water Monitoring Report
      (iv) Appendix S – Proposed Contingency Biosolids Monofill

3. This resource consent authorises the land application of dewatered solids on Alliance Group Limited farmland and dewatered BNR solids and dewatered stock yard waste to an onsite monofill at the locations shown on Map A attached to this consent.

   Note: For the purposes of this consent the term ***"dewatered solids****" refers to any material originating from the stock yards and the Biological Nutrient Removal Plant (BNR) which is of at least 12% solids content.*

General Requirements – Certification of Management and Monitoring Plans

4. In carrying out its functions in relation the certification process associated with any management or monitoring plan required by the conditions, the Consent Authority shall be satisfied that the plan meets the purpose stated within the relevant condition. The Consent Authority shall complete its certification within twenty working days of receipt of the management or monitoring plan. In the event of any dispute, disagreement or inaction arising as to any certification of any plan required by the conditions, or as to the implementation of, or monitoring required by the conditions, matters shall be referred in the first instance to the Consents Manager determine a process for resolution of the dispute, disagreement or inaction.

5. If a resolution cannot be agreed within ten working days of any dispute, disagreement or inaction arising, the matter may be referred to an independent appropriately qualified expert, acceptable to both parties, setting out the details of the matter to be referred for determination and the reasons the parties do not agree.

6. The qualified expert shall be appointed within five working days of the Consent Holder or the Consent Authority giving notice of their intention to seek expert determination. The expert shall issue a decision on the matter within fifteen working days.

7. The decision of the qualified expert is binding on the Consent Holder and shall be implemented.

8. The dispute resolution process above shall be applied before any formal enforcement action is taken by the Consent Authority.

Management Plan

9. Prior to the commencement of this consent the Consent Holder shall prepare and submit to the Consent Authority for certification a BNR Solids Management Plan. This Plan shall be generally consistent with the draft BNR Solids Management Plan presented at the hearing, attached to the evidence of Mr Khan. The purpose of this plan shall be to describe the operational management associated with the disposal of dewatered solids and the application of other nutrients to land. It shall also describe the operational management methods to be applied to the disposal of dewatered Solids to an onsite monofill, if such a facility is deemed by the Consent Holder to be necessary. The objective of this plan shall be to ensure that the actual and potential adverse effects arising from the disposal of dewatered solids and the application of other nutrients to land and to an onsite monofill are appropriately avoided, remedied or mitigated. The BNR Solids Management Plan shall include but not be limited to:

   (a) Description of the likely generation and volume of dewatered solids from the Wastewater Treatment Plant and the stock yards;

   (b) Details of the land application methodology, including details of phosphorus, metals and nitrogen loads to be applied to land as a result of land application of dewatered solids on a per hectare per annum basis including an assessment of nitrogen loading from any fertiliser sources;

(c) Managerial procedures and physical methods to be implemented to avoid, remedy or mitigate adverse effects on the receiving environment including the management of odour;

(d) Stock withholding periods and other management matters to fit in with the farming activities; and

(e) A description of any required onsite monofill including but not limited to:
  (i) Details of each monofill cell, its location and capacity;
  (ii) Methods for recording and reporting dewatered solids deposition rate and annual loads to the monofill;
  (iii) Methods for measuring and reporting dewatered solids characteristics;
  (iv) Methods for managing leachate; and
  (v) Methods for the management of any potential odour and vector attraction issues.

The BNR Solids Management Plan shall be reviewed by the Consent Holder at least annually. The purpose of this review shall be to confirm that it accurately reflects on-site activities and operations and to identify if changes to management procedures contained within the BNR Solids Management Plan are required. The results of the review shall be reported to the Consent Authority within twenty working days of the review being undertaken.

If the review results in amendments to the BNR Solids Management Plan, the amended sections shall be provided to the Consent Authority for certification at this time.

This resource consent shall be exercised in accordance with the BNR Solids Management Plan at all times. Where there is inconsistency between the BNR Solids Management Plan and the conditions of this consent, the conditions of this consent shall prevail.

10. The Consent Holder shall ensure that the disposal and management of dewatered solids is undertaken in accordance with the BNR Solids Management Plan.

Disposal of Dewatered Solids to Farm Land

11. BNR solids and the application of other nitrogen sources (excluding the influence of grazing stock) applied to the areas of farmland shown on the map attached as Appendix A, shall not exceed an annual loading rate of any greater than the plant available nitrogen (PAN) rate of 140 kg N/ha/yr or 250 kg total N/ha/yr.

12. No spreading of dewatered solids onto land shall occur within:
  (a) 100 m of any residential dwelling (excluding those owned by the Consent Holder);
  (b) 50 m of any surface watercourse;
  (c) 20 m of any property boundary.

13. The Consent Holder shall ensure that there is no direct discharge or runoff of dewatered solids to any open water courses.

14. The Consent Holder shall ensure that the dewatered solids are applied to land as evenly as possible and shall be undertaken using specialised spreading equipment.

15. The dewatered solids shall not be applied to land if:
    (a) There has been a weather forecast predicting 20 mm or more of rainfall within the subsequent 24 hours, and/or
    (b) There has been a rainfall event of 20 mm or more, within 24 hours of the planned application.

16. A stock withholding period of fourteen days for grazed pasture or stock food cropped areas shall apply following the application of any dewatered solids to land.

Monofill

17. The Consent Holder shall discharge dewatered solids to an onsite monofill only in accordance with the requirements set within the BNR Solids Management Plan prepared in accordance with Condition 9. The monofill shall be used as a contingency disposal site available to receive dewatered solids from the stockyards and dewatered solids from the Wastewater Treatment Plant when one or more of the following events (or similar) arise:
    (a) When the land is unsuitable to receive the dewatered solids as determined by Condition 15 and with an additional allowance for the drying of the land of 1-2 days as necessary;
    (b) The requirement of the Consent Holder to accept stock from its suppliers in the event there is an increase in the destocking rates by those supplier farmers, usually as a result of drought;
    (c) The use of the machinery required to discharge dewatered solids will result in land damage within the discharge area;
    (d) When the land is unsuitable to receive stockyard solids or there is non acceptance of the stockyard solids at an offsite composting facility; or
    (e) Breakdown of the machinery associated with the land spreading of the stockyards waste and BNR solids.

18. The Consent Holder shall ensure that the monofill only receives dewatered solids produced at the site from the stockyards and BNR solids from the Wastewater Treatment Plant.

19. The Consent Holder shall ensure that once each monofill cell has reached capacity, it is rehabilitated including with the use of a capping of a 0.3 m thick clay/soil layer, or such other capping as may be agreed with the Consent Authority in writing.

Monitoring

20. The Consent Holder shall keep records of the following:

    (a) The date of each application of dewatered solids;
    (b) The daily location of the biosolids disposal area, and the size of the land area in hectares;
    (c) The weight of dewatered solids applied;

(d) Results of composite sampling and analysis of the dry solids content of the dewatered solids undertaken on a fortnightly basis;

(e) Document contingency actions undertaken when dewatered solids could not be discharged to land, including the use, volume and rate of discharge to onsite monofill cells.

21. At all times when dewatered solids are being applied to land, a representative sample of the applied material shall be taken monthly and analysed for:

(a) Total solids;

(b) Total nitrogen;

(c) Total ammoniacal nitrogen;

(d) Total oxidised nitrogen;

(e) Total phosphorus;

(f) Total potassium;

(g) Total calcium;

(h) Total magnesium;

(i) Total sodium; and

(j) *Escherichia coli*

22. Once per year a dewatered solids sample collected as above shall be analysed for the following in addition to those parameters above:

(a) Total copper;

(b) Total lead;

(c) Total zinc;

(d) Total nickel; and

(e) Total sulphur.

23. For the purpose of monitoring the effects of dewatered solids applications the Consent Holder shall:

(a) Carry out assessments of the soils within the application areas, in June each year, at a minimum of four sites, one of which shall be a control site, i.e. a site on which application of dewatered solids does not occur. The remaining monitoring sites shall be in areas where dewatered solids application has occurred in the previous year. The assessments are to include infiltration rate, soil structure (0-20 cm soil depth), and soil aeration status (0-20 cm soil depth).

(b) Carry out sampling (from the 0-7.5 cm soil depth) of the soils in December and June each year at a minimum of three sites, one of which shall be a control site where dewatered solids application does not occur. The remaining monitoring sites shall be in areas where dewatered solids application has occurred in the previous year.

The samples shall be analysed for:

(i) pH;
(ii) exchangeable calcium;
(iii) exchangeable magnesium;
(iv) exchangeable potassium;
(v) exchangeable sodium;
(vi) Total phosphorus;
(vii) Total organic carbon;
(viii) Total nitrogen;
(ix) Anaerobically mineralisable nitrogen; and
(x) Nitrate nitrogen.

(c) Estimates of nitrate leaching using lysimeters are to be made monthly, at eight sites throughout the application area, to assess nitrate losses. Nitrate nitrogen concentrations shall be measured on leachate samples, and estimates shall be made using a daily water balance model for the periods between sampling dates. Nitrate leaching shall be calculated monthly using the nitrate nitrogen concentrations and drainage data and reported as part of the annual monitoring report prepared in accordance with Condition 29.

24. The Consent Holder shall monitor the effects of the discharge on Bateman's Drain at the point that it exits the dewatered solids application area, or at another point agreed in writing by the Consent Authority, by taking representative grab samples of water from the drain, at monthly intervals, and analysing those samples for:

(a) Electrical conductivity;

(b) Total nitrogen concentration; and

(c) Dissolved reactive phosphorus concentration.

25. The Consent Holder shall monitor groundwater in two bores on the site, one of which shall be a control site (upstream of the dewatered solids application area located at about map reference NZTM2000 E 1239563; N4856494), and the other shall be at the downstream end of the dewatered solids application area located at about map reference NZTM2000 E 1238690; N 4855725.

(a) By measuring and recording the depth to groundwater at the two on-site monitoring bores immediately before purging the bores and extracting the samples under Condition 25(b);

(b) By taking representative samples of the groundwater at each site at three monthly intervals, and analysing those samples for the following parameters:

(i) pH;
(ii) chloride concentration;
(iii) electrical conductivity;
(iv) nitrate + nitrite nitrogen concentrations;
(v) Total ammoniacal nitrogen concentration; and
(vi) *E. coli* concentrations.

26. In the event that the groundwater monitoring undertaken in accordance with Condition 25 show that any sample in the downstream bore records a nitrate-nitrogen concentration of greater than 6.9 g/m^3 when that was not exceeded in the upstream control bore, the Consent Holder shall be required to immediately obtain a second sample to determine whether the measured concentration represents a sustained exceedance. In the event that the groundwater monitoring undertaken in accordance with Condition 25 shows that any two consecutive samples in the downstream bore record a nitrate-nitrogen concentration of greater than 6.9 g/m^3 when that was not exceeded in the upstream control bore the Consent Holder shall be required to notify the Consent Authority and investigate the likely cause of the exceedance. If the investigation determines that the discharge is likely to have caused or contributed to the exceedance, then the Consent Holder shall be required to outline and implement appropriate remedial action. The results of this investigation and any mitigation or remedial action undertaken or to be implemented shall be reported to the Consent Authority within thirty working days of the exceedance being reported.

27 In order to determine the volume of dewatered solids within the monofill cells, the Consent Holder shall record the number of truck and disposal movements to each monofill cell. Periodic weight per volume validations of waste shall also be undertaken and this shall be reported to the Consent Authority as part of the annual monitoring report prepared in accordance with Condition 29.

28. Once each monofill cell has reached capacity, it shall be capped in accordance with Condition 19. Once the cell has been decommissioned for a period of three years a final capping survey shall be undertaken to ensure that land contouring is undertaken over the surface to avoid any seepage of rain into the monofill. The results of this survey shall be provided to the Consent Authority within twenty working days of the survey being completed and outcomes included as part of the monitoring report prepared in accordance with Condition 29.

Reporting

29. By the 15 December during each year of operation, the Consent Holder shall prepare and submit to the Consent Authority a monitoring report relating to the activities authorised by this consent over the preceding 1 October to 30 September period. This report shall be prepared by a suitably qualified person and shall include but not be limited to:

    (a) Detailed assessment of the nitrogen loading rates and an assessment of compliance with Condition 11 of this consent;

    (b) Summation and discussion of all data collected as required under the conditions of this consent as relating to both disposal of dewatered solids to land and to monofill;

    (c) Description of the effects on soil and groundwater resources arising from the application of dewatered solids, any breaches of the trigger identified in Condition 26 and the mitigation measures undertaken;

    (d) Report and discuss any complaints received regarding the application of dewatered solids;

    (e) Critically evaluate the performance of any managerial procedures and physical mechanisms in place to avoid, remedy or mitigate adverse effects on the environment, identify any improvements undertaken and make recommendations on any additional improvements needed;

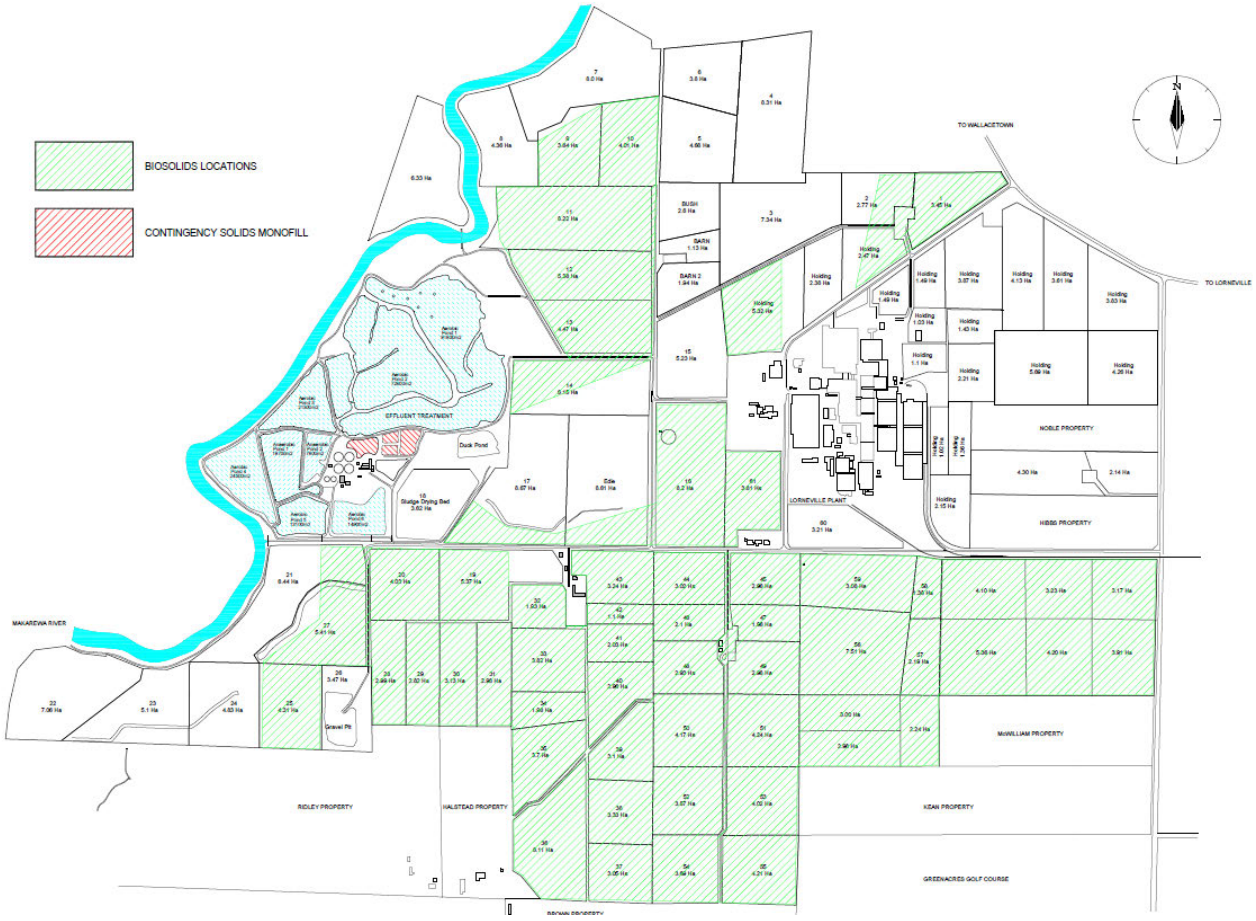
(f) After any monofill cell has been decommissioned for a period of three years, the monitoring report shall include a description of the contour and stability of the cover, an assessment of any ongoing effects and any recommendations for further remediation.

30. The report prepared in accordance with Condition 29 shall identify if there is a need to implement additional measures or improvements to be undertaken with the system that is used to spread the dewatered solids to land. Within scope of this consent the Consent Holder shall be required to implement any recommendations in accordance with the requirements set out in the report. These measures shall be implemented by the Consent Holder within three months of receiving the report.

Review

31. The Consent Authority may, within three months of receiving the report required by Condition 29 of this consent, serve notice on the Consent Holder under section 128 of the Resource Management Act 1991 of its intent to review the conditions of this consent. The purpose of such a review is to deal with any adverse effect on the environment which may arise from the exercise of this consent; and/or requiring the adoption of the best practicable option to remove or reduce any adverse effect on the environment.

Appendix A – BNR Solids Application & Monofill Map



Disposal of dewatered solids to areas shaded green. Contingency monofill sites shaded red.

Details of Discharge Permit – Contaminants to Air

Purpose for which permit is granted:		To discharge contaminants to air for the purpose of operating a meat processing and export plant and associated activities and all other on-site activities including the disposal of waste.
Location	- site locality	Lorneville
	- map reference	NZTM2000 1237821E 4856201N
Expiry date:		30 November 2041

Schedule of Conditions

General Conditions

1. Subject to complying with the conditions of this consent, the activities authorised by this consent shall be undertaken so as to be consistent with the application for this consent and the documents entitled:
   (a) Assessment of Environmental Effects dated November 2015
   (b) Technical Reports:
      (i) Appendix E - Background Ambient Air Quality Report – Golder Associates
      (ii) Appendix F – Baseline Odour Survey – Golder Associates
      (iii) Appendix G – Process Odour Mitigation – Golder Associates
      (iv) Appendix M – Coal Fired Boiler Assessment – Golder Associates
      (v) Appendix R – Wastewater Treatment Odour Mitigation – Golder Associates
      (vi) Appendix U – Draft Air Quality Discharge Management Plan

2. Any incident causing abnormal and/or excessive emissions to the atmosphere, including odour, shall be abated as soon as is reasonably practicable. On becoming aware of such an incident, the Consent Holder shall immediately advise the Consent Authority and follow up with a written report on the cause, and the actions taken to prevent a recurrence.

3. Trade wastes may be burnt in the existing concrete lined area designated for this purpose. The wastes to be burned shall be limited to wood or paper waste and shall specifically exclude copper-chromium-arsenic (CCA) treated timber and painted timber. There shall be no other open air burning of trade waste on the premises.

General Requirements – Certification of Management and Monitoring Plans

4. In carrying out its functions in relation the certification process associated with any management or monitoring plan required by the conditions, the Consent Authority shall be satisfied that the plan meets the purpose stated within the relevant condition. The Consent Authority shall complete its certification within twenty working days of receipt of the management or monitoring plan. In the event of any dispute, disagreement or inaction arising as to any certification of any plan required by the conditions, or as to the

implementation of, or monitoring required by the conditions, matters shall be referred in the first instance to the Consents Manager determine a process for resolution of the dispute, disagreement or inaction.

5. If a resolution cannot be agreed within ten working days of any dispute, disagreement or inaction arising, the matter may be referred to an independent appropriately qualified expert, acceptable to both parties, setting out the details of the matter to be referred for determination and the reasons the parties do not agree.

6. The qualified expert shall be appointed within five working days of the Consent Holder or the Consent Authority giving notice of their intention to seek expert determination. The expert shall issue a decision on the matter within fifteen working days.

7. The decision of the qualified expert is binding on the Consent Holder and shall be implemented.

8. The dispute resolution process above shall be applied before any formal enforcement action is taken by the Consent Authority.

Management Plan

9. No later than three months after the commencement of this consent, the Consent Holder shall prepare and submit to the Consent Authority an Air Discharge Management Plan. The purpose of the Air Discharge Management Plan shall be to ensure that any adverse effects from the air discharges authorised by this consent are avoided, remedied or mitigated and that the discharges are appropriately monitored for compliance purposes. The Air Discharge Management Plan shall contain, but not be limited to:

   (a) A description of the air discharges arising from onsite activities and processes including:
      (i) Boiler operations and emissions requirements;
      (ii) Rendering plant operating requirements;
      (iii) Odour management;
      (iv) Methods to manage the effects of the air discharges including particulate emissions and odours.
   (b) Monitoring and reporting requirements.

   The Air Discharge Management Plan shall be reviewed at least annually. The purpose of this review shall be to confirm that it accurately reflects on-site activities and operations and to identify if changes to management procedures contained within the Air Discharge Management Plan are required. The results of the review shall be reported to the Consent Authority within twenty working days of the review being undertaken. If the review results in amendments to the Air Discharge Management Plan, the amended sections shall be provided to the Consent Authority for certification at this time.

   This permit shall be exercised in accordance with the Air Discharge Management Plan at all times. Where there is inconsistency between the Air Discharge Management Plan and the conditions of this consent, the conditions of this consent shall prevail.

Boiler Operating and Emission Requirements

10. The height of the stacks above surrounding ground level shall not be less than:
    (a) 30.9 m for the Babcock and Wilcox boiler;
    (b) 34.1 m for the Foster-Wheeler boiler.

11. (a) The sulphur content of fuel used for the boilers shall not exceed 0.5 wt% (as-received), based on the results of the following testing:
        (i) A grab sample of the supplied coal for the boilers shall be collected at least once per week and sent to an IANZ accredited laboratory for analysis for combustible sulphur as percent by weight of coal both on an as-received and dry basis.
        (ii) If the coal source changes then a representative analysis of the sulphur content shall be carried out to confirm compliance with the 0.5 wt% limit before the new coal source is accepted.
        (iii) The preparation of a monthly monitoring report which shall summarise grab sample test results including a comparison with the limit specified in this condition. A copy of this report shall be submitted to the Consent Authority each month upon completion.

12. The discharge from the boiler stacks shall be directed vertically into the air and shall not be impeded by any obstruction that could impede the vertical efflux velocity.

13. The opacity of smoke discharged from any boiler shall not exceed Ringelmann Shade 1 as described in New Zealand Standard 5201:1973 except:
    (a) for 60 minutes when lighting a boiler after a shutdown period of up to eight hours; or
    (b) for four hours when lighting a boiler after a shutdown period of longer than eight hours; and
    (c) at any other time, to allow for cleaning the fires and manual soot blowing of the boilers, for periods not exceeding two minutes at a time and not exceeding five minutes in any period of 60 minutes.

14. The Consent Holder shall install industry standard opacity meters within the boiler discharge stacks, using either light extinction or light scattering based technologies. The system shall be installed within eight months of the commencement of this consent and enable percentage opacity of the two boilers exhaust to be recorded and displayed to boiler operator staff.

15. The storage of coal and ash shall be managed so that there is no visible emission of coal and ash dust beyond the boundary of the site.

16. The coal fired boiler(s) used on the site shall be serviced at least once every year and the servicing shall be supervised by a person competent in servicing of such boilers. This servicing shall include:
    (a) Internal cleaning and replacement or repair of damaged equipment and services as necessary;

(b) Adjustment of the air to fuel ratio to optimise energy efficiency and to minimise the emission of products of incomplete combustion; and

(c) Calibration and adjustment of boiler monitoring equipment consistent with the monitoring obligations of this consent.

Servicing reports shall be prepared following each servicing event. Confirmation that this servicing has been undertaken, and a copy of the servicing report shall be supplied to the Consent Authority by 30 November each year.

17. (a) The exhaust air from the two coal fired boilers shall have a flow weighted PM_{10} concentration of 300 mg/Nm^3 at standard atmospheric pressure and temperature (STP) corrected to 12 vol.% CO_2 and dry, which equates to a maximum PM_{10} mass rate of 21.4 kg/hr.

(b) By no later than three years from the first exercise of this consent, and thereafter the flow weighted PM_{10} concentration from the two coal fired boilers shall not exceed 250 mg/Nm^3 at STP corrected to 12 vol.% CO_2 and dry, which equates to a maximum PM_{10} mass rate of 17.8 kg/hr.

For the avoidance of doubt, in the event that any review, required to be undertaken in accordance with Conditions 22 - 25, results in a requirement for the Consent Holder to achieve a more restrictive discharge standard for PM_{10} or any other determinand (e.g. $PM_{2.5}$), then that discharge standard shall supersede and replace clause (b) of this condition.

Monitoring

17A. The concentration of PM_{10} in the combustion gas in each of the boiler stacks shall be measured at least once every 12 months for the duration of this consent. Measurement shall occur when the tested boiler is being operated at a rate of at least 75% of its maximum continuous rating. The method of sampling and analysis for PM_{10} shall be USEPA Methods 201A and 2021a or an equivalent method approved in writing by the Consent Authority. The testing time shall be at least two hours continuous, within which at least three samples shall be collected. Testing and analysis of samples shall be carried out by an organisation and laboratory accredited by International Accreditation New Zealand (IANZ) for the tests and analyses involved. The results of the emission test, including comparison to the concentration and mass emission limits in Condition 17, shall be provided to the Consent Authority within 40 working days of the test being completed.

For the avoidance of doubt, any stack testing that may be required to be undertaken in accordance with Condition 19 (where ambient air quality limits are exceeded) may be used as fulfilment of the annual stack testing required by this condition.

18. The Consent Holder shall undertake continuous monitoring and logging of ambient 1-hour and 24-hourly average respirable particulate (PM_{10} and $PM_{2.5}$) concentrations in conjunction with wind speed and direction. The monitoring location shall be as close as practical to New Zealand Transverse Mercator coordinates (NZTM) 1240.240, 4856.670 (Eastings and Northings in kilometres (km)) being a site nearby the dwelling at 237 Steel Road. The monitoring campaign shall commence either before or by 1 December after the commencement of this consent and operate all year round.

Specific features of the methodology shall include:

(a) The ambient PM_{10} and $PM_{2.5}$ monitoring shall be by Beta Attenuation Monitor (BAM) in accordance with AS/NZ 3580.9.11:2008 '*Determination of suspended particulate matter - PM_{10} beta attenuation monitors*' or equivalent semi-continuous method. The sampling height shall be 3 metres above ground level.

(b) Concurrent monitoring of wind speed and direction at the monitoring site and logging of 10 minute and hourly averaged data at the same site as the ambient monitoring. Wind speed and direction shall be monitored using industry standard meteorological monitoring instrumentation that is attached to a mast at a height of 6 metres above ground level. Specifically the wind direction and speed monitoring equipment shall meet the following specifications:

Wind Speed Instrumentation:
Range: 0 to ≥ 30m/s
Accuracy: ≤ ±5% @ 3 m/s
Resolution: ≤ 0.1 m/s
Response Time: ≤ 1 second
Wind Speed Threshold: ≤ 0.5 m/s

Wind Direction Instrumentation:
Range: 0-359º
Accuracy: ≤ ±5% @ 3 m/s
Resolution: 1º
Response Time: ≤ 1 second
Wind Speed Threshold: ≤ 0.5 m/s

(c) Ambient PM_{10} and $PM_{2.5}$ concentrations in micrograms per cubic metre shall be recorded in electronic form as 1-hour and 24-hour averages (midnight to midnight). Wind speed in metres per second, and wind direction in degrees clockwise of true north, shall be recorded in electronic form as 1-hour and 10 minute averages.

(d) The Consent Holder shall report the hourly PM_{10} and $PM_{2.5}$ concentration measurements that occur when the monitoring site is downwind of the boiler stacks. This includes 1-hour average wind directions that are between 245 and 270 degrees from true north (or whichever directions are within 13 degrees of the direction bearing between the monitor sample point and the boiler stacks). The Consent Holder shall also report all 24-hour PM_{10} concentration measurements.

(e) From the downwind ambient 1-hour PM_{10} results, the Consent Holder shall report the maximum, 95^{th} and 50^{th} percentile values (ie. X, Y, Z indicated in Table 1, respectively). The maximum and 95^{th} percentiles (X and Y) shall meet their respective PM_{10} concentration percentile limits listed in Table 1. These are appropriate limits that relate to the applicable coal-fired boiler stack PM_{10} discharge limits of 300 mg/Nm^3 and 250 mg/Nm^3 (at 12 vol.% CO2 and dry STP condition). The applicable stack discharge limit for PM_{10} is defined in Condition 17.

Table 1: Ambient Pm_{10} Percentile Limits for Off-Site Monitoring

Hourly Downwind PM_{10} Percentile	Monitored hourly PM_{10} ($\mu g/m^3$), downwind conditions	Ambient PM_{10} ($\mu g/m^3$) limits for stack concentration of 300 mg/m^3 (applicable for up to the first three years of the consent)	Ambient PM_{10} ($\mu g/m^3$) limits for stack concentration of 250 mg/m^3 (applicable for the period post the first three years of the consent)
100%	x	122	117
95%	y	37	35
50%	z	18	17

19.

(a) Should the monitoring and reporting of hourly downwind ambient PM_{10} percentiles undertaken in accordance with Condition 18 identify that either of the appropriate 95th and/or the 100th percentile PM_{10} limits listed in Table 1 of Condition 18(e), are exceeded by 2 $\mu g/m^3$, or more, then testing of PM_{10} discharges from the boiler stacks using US EPA Methods 201A and 202 (or equivalent methods agreed with the Consent Authority) shall be undertaken no later than two months post the exceedance.

(b) Should the monitoring and reporting of 24-hour ambient PM_{10} concentrations undertaken in accordance with condition 18 identify any exceedance of a trigger value of 42 $\mu g/m^3$, then testing of PM_{10} discharges from the boiler stacks using US EPA Methods 201A and 202 (or equivalent methods agreed with the Consent Authority) shall be undertaken no later than two months post the exceedance. This requirement for stack testing shall not apply in circumstances where the ambient monitoring and wind direction data indicate that the 24-hour trigger exceedance was likely to be caused by abnormally high background PM_{10} concentrations caused by emission sources not controlled by the Consent Holder. In these circumstances the supporting data shall be submitted to the Consent Authority and agreement obtained in writing from the Consent Authority that the additional stack testing is not required.

20. The results of the stack testing undertaken in accordance with Condition 19, and completed ambient monitoring for the concurrent period undertaken in accordance with Condition 18 shall be reported to the Consent Authority within 30 working days of its completion. If the monitoring determines that the operation of the boilers is likely to have caused or contributed to an exceedance of the ambient limits set out in Condition 18(e) this report shall also identify the likely cause and remedial actions that are necessary to be undertaken in order to prevent such exceedances occurring again, and the appropriate timeframe for implementation. The Consent Authority may, at the Consent Holder's expense, engage a suitably qualified person to review the report and shall subsequently confirm in writing the necessary remedial actions and the timeframe for those actions. The Consent Holder shall implement the required action specified in writing by the Consent Authority in accordance with the specified timeframes.

Reporting and Review

21. By 30 November each year, the Consent Holder shall provide a monitoring report to the Consent Authority that summarises the monitoring results for the 12 month period ending on 30 September of the previous year, which shall include the following:

    (a) Electronic data set containing the time series of monitored hourly PM_{10} and $PM_{2.5}$, wind speed and wind direction;

    (b) Table containing the monitored results versus PM_{10} percentiles;

    (c) Time series plot of monitored 24-hour average PM_{10} and comparison with a trigger value of 42 ug/m^3 and the National Environmental Standard criterion for 24-hour PM_{10}; and

    (d) Results of any stack discharge testing carried out.

22. No later than five years from the consent commencing and at five yearly intervals thereafter, the Consent Holder shall conduct a review of:

    (a) The results of the monitoring required by the conditions of this consent;

    (b) Relevant guidelines or standards for discharges to air applicable at the date of the review; and

    (c) Available technology for the control of emissions to air from the discharge sources at the site.

    (d) The current and relevant health related science to confirm the best practicable option (as defined in section 2 of the Resource Management Act 1991) for the control of emissions to air from the discharge sources at the site.

23. The reviews required by Condition 22 shall identify if there is a need to implement additional methods for controlling the effects of the emissions at the site to ensure adherence to best practicable option obligations. The review shall detail any additional emissions control technology that is necessary, a programme of procurement and implementation associated with any required additional emissions control technology and the predicted emissions reduction that is likely to accrue from the implementation of this technology.

24. A report detailing the reviews required by Condition 22 shall be provided to a suitably qualified, independent air quality expert for verification that the review has been undertaken in accordance with achieving the best practicable option for controlling emissions. The suitably qualified, independent air quality expert shall be a person agreed to by the Consent Authority in writing before their engagement by the Consent Holder. The results of the review, and the advice received from the independent air quality expert shall be reported to the Consent Authority for certification that the requirements of Condition 23 have been met. This report shall be submitted to the Consent Authority immediately upon completion of the review. The Consent Holder's obligations to undertake each review and the associated reporting process shall be completed not more than three months after each review is initiated.

25. The Consent Holder shall implement any recommended emissions control measures in accordance with the procurement and implementation programme set out within the certified report. Within three months of commissioning any required emissions control measures the Consent Holder shall provide a report to the Consent Authority that

confirms that the work has been completed and which details future monitoring requirements and expected emissions performance standards. The Consent Holder shall meet these monitoring requirements and emissions performance standards for the remainder of the term of this consent.

Rendering Plant Operating Requirements

26. Other than slink carcases or dead stock seasonally in the spring (fallen stock), only fresh or suitably stabilised material shall be processed in the rendering plant. This includes material from offsite sources. Slink carcases or fallen stock shall be processed as soon as practicable after arrival at Lorneville Plant.

    Note:

    For the purposes of Condition 26:

    1) "Fresh" means; for material derived from the slaughter and dressing of stock, no older than 24 hours from the time of slaughter; for chilled or frozen materials derived from the cutting, boning, or further processing operations, no older than 24 hours from the time of delivery to the rendering department.

    2) "Stabilised" means stabilised by a recognised method which may include acid stabilisation or the use of proprietary stabilisation agents applied at manufacturer's recommended dose. Stabilisation should occur as soon as is practicable but shall be no later than 8 hours from the time of slaughter or 8 hours from the removal of the animal carcase from a chilled facility.

27. Material shall not be left in an uncooked or partially cooked condition overnight in the rendering processing line.

28. No blood older than 48 hours shall be processed.

29. The Consent Holder shall ensure that an odour control system is installed and functional with respect to the rendering plant activities at all times. The odour control system shall be operated according to an assigned set of protocols which set out:

    (a) A description of the odour extraction, cooling and biofilter systems;

    (b) A description of the operating parameters, the target values, methods and frequency and location of odour control systems;

    (c) Performance monitoring procedures for the odour control systems including daily, weekly, monthly and annual observations and monitoring that is required; and

    (d) Methods for managing the biofilter which includes operational parameters and monitoring obligations.

30. The protocols for managing the biofilter prepared in accordance with Condition 29(d) shall ensure that the biofilter associated with the rendering plant is operated and maintained to an appropriate standard to minimise odour effects. The following parameters shall be monitored at the frequencies specified:

    (a) Daily visual observations of the state of the biofilter bed, particular for short circuiting and clogging of the bed;

    (b) Continuous monitoring of the inlet temperature;

(c) Weekly monitoring of pressure drop across the biofilter bed;

(d) Monthly monitoring of biofilter bed moisture content; and

(e) Monthly monitoring of biofilter bed pH.

31. The inlet gas temperature to the biofilter shall be maintained at less than 40°C at least 99% of the time.

32. Floors, conveyors, and other equipment shall be kept free of accumulations of raw material which may putrefy and generate odours.

33. The Consent Holder shall have in place a contingency plan of actions that shall be implemented in the event that the rendering plant is inoperative due to equipment failure. A copy of this contingency plan shall be provided to the Consent Authority within three months of the first exercise of this consent. If the contingency plan is changed or updated to reflect a change in operational practices a copy of the revised plan shall be submitted to the Consent Authority within one month of the change or update being made.

Odour Management

34. The Consent Holder shall ensure that its activities, including the rendering plant and wastewater treatment facility, are operated in such a way as to ensure that there are no odour discharges to air that are noxious, dangerous, offensive or objectionable to the extent that it causes an adverse effect at or beyond the boundary of the site in the opinion of an officer of the Consent Authority.

35. Following any non-compliance with Condition 34 being identified, the Consent Holder shall immediately advise the Consent Authority and follow up with an investigation of the likely source of the odour and shall as soon as practicable prepare a report identifying the source and the methods to be implemented to reduce or properly manage the odour. The report shall be submitted to the Consent Authority. The methods set out within the report shall be implemented by the Consent Holder.

36. The Consent Holder shall keep a log of all odour complaints, which shall include:

(a) The location where the odour was detected by the complainant;

(b) The date and time when the odour was detected;

(c) A description of the odour character, intensity and duration of exposure;

(d) The most likely cause of the odour detected;

(e) Note if there were any abnormal activities at or discharges from the Plant that may have resulted in the complaint; and

(f) Weather conditions at the time of the complaint.

This log shall be provided to the Consent Authority upon request.

37. No later than five years from the consent commencing and as required by Condition 14 of consent AUTH-20158595-01 (discharge of treated wastewater to water), the Consent Holder shall prepare and submit to the Consent Authority a Wastewater Treatment Plant Upgrade Plan. This Plan shall address measures to manage odour from the Wastewater

Treatment Plant Upgrade, including the proposed disposal of dewatered biosolids. The objective of this part of the plan shall be to ensure that any adverse effects on sensitive receptors arising from discharges from the existing Wastewater Treatment Plant and the upgraded Wastewater Treatment Plant are appropriately avoided, remedied or mitigated. This part of the plan shall:

(a) Identify appropriate methods that will be undertaken as part of the overall plant upgrade in order to reduce fugitive odour emissions from the existing wastewater treatment system. This shall include but not be limited to the segregation of pickle liquors and oxidation of sulphides within the waste lime wash liquors.

(b) Identify appropriate methods that will be undertaken as part of the overall plant upgrade in order to manage and minimise fugitive odour emissions from the upgraded treatment plant. This shall include but not be limited to:

  (i) A description of the potential sources of odour associated with the Wastewater Treatment Plant Upgrade;

  (ii) Methods to manage or minimise odours arising from the Wastewater Treatment Plant Upgrade including the storage and application of biosolids and design and management of the monofill sites;

  (iii) Ongoing monitoring of the Wastewater Treatment Plant Upgrade with respect to potential odour sources and reporting requirements.

38. The Consent Holder shall be required to implement the measures contained within the Wastewater Treatment Plant Upgrade Plan.

39. Once the upgraded wastewater system has been commissioned in accordance with consent AUTH-20158595-06, and has been fully operational for twelve months, the Consent Holder shall be required to undertake a review of the effectiveness of the relevant odour measures and methods contained within the Wastewater Treatment Plant Upgrade Plan and provide a report to the Consent Authority. Should the report identify that any changes are necessary these shall be implemented in agreement with Consent Authority within three months following receipt of the report.

40. The Consent Holder shall ensure that any new anaerobic lagoon(s) required as part of the Wastewater Treatment Plant Upgrade Plan are to be constructed with a synthetic cover that is designed to allow for the collection and storage of biogas. The Consent Holder shall ensure that biogases emitted from the anaerobic lagoon are thermally combusted at all times except under the following circumstances:

(a) in the event of a combustion equipment failure; or

(b) for combustion equipment maintenance purposes; or

(c) when adverse weather conditions prevent safe combustion equipment operation.

Where biogases are not thermally combusted then they shall be vented to a biofilter.

Review

41. The Consent Authority may, in accordance with section 128 of the Resource Management Act 1991, serve notice on the Consent Holder of its intention to review the conditions of this consent during the period 1 February to 30 September each year, or within two months of any enforcement action being taken by the Consent Authority in relation to the exercise of this consent, or on receiving monitoring results, for the purposes of:

    (a) determining whether the conditions of this permit are adequate to deal with any adverse effects on the environment; or

    (b) amending the monitoring programme to be undertaken; or

    (d) adding or adjusting compliance limits; or

    (e) requiring the Consent Holder to adopt the best practicable option to remove or reduce any adverse effects; or

    (f) requiring ambient monitoring of sulphur dioxide for a period of at least one year in the event that there is a change to any national environmental standard (NES) or ambient air quality guideline set by the New Zealand Government or the Southland Regional Council that sets a guideline or standard for sulphur dioxide of less than or equal to 50 $\mu g/m^3$ (24 hour average); or

    (g) requiring measures to reduce sulphur dioxide emissions from the coal fired boiler plant to a level that is predicted to comply with the standard or air quality guideline described in Condition 41(f).

Details of Water Permit – Water Take

Purpose for which permit is granted: To take surface water for a meat processing operation

Location	- site locality	Lorneville
	- map reference	NZTM2000 1236014E 4858400N
	- catchment	Oreti
Legal description of land at the site:		Sec 93 Blk XVI New River Hundred and Lot 1 DP 8017
Expiry date:		30 November 2041

Schedule of Conditions

1. For the purposes of section 116 of the Resource Management Act 1991, this consent shall not commence until consent AUTH-203358 is surrendered or has expired.

2. This consent authorises abstraction of up to 22,500 cubic metres of water per day at a maximum rate of 260 litres per second from the Oreti River, at or about the location specified within the map reference above.

3. (a) The Consent Holder shall maintain at all times a water meter to record the water take, within an error accuracy range of +/-5% over the meter's nominal flow range, a datalogger with at least 24 months data storage capacity and a telemetry unit to record the rate and volume of take, and the date and time this water was taken.

   (b) The water meter shall be located in a straight length of pipe, before any diversion of water occurs. The straight length of pipe shall be part of the pump outlet plumbing, easily accessible, have no fittings and obstructions in it. There shall be a straight length of pipe on either side of the water meter, on the upstream side there shall be a distance that is 10 times the diameter of the pipe and on the downstream side there shall be a distance of 5 times the diameter of the pipe.

   (c) The Consent Holder shall ensure the full operation of the water meter and datalogger at all times during the exercise of this consent. All malfunctions of the water meter and/or datalogger during the exercise of this consent shall be reported to the Consent Authority within five working days of observation and appropriate repairs shall be performed within five working days. Once the malfunction has been remedied, a Water Measuring Device Verification Form completed with photographic evidence must be submitted to the Consent Authority within five working days of the completion of repairs.

   (d) (i) If a mechanical insert water meter is installed it shall be verified for accuracy each and every year from the exercise of this consent.

   (ii) Any electromagnetic or ultrasonic flow meter shall be verified for accuracy every five years from the exercise of this consent.

   (iii) Each verification shall be undertaken by a Consent Authority approved operator and a Water Measuring Device Verification Form shall be completed

and supplied to the Consent Authority with receipts of service. These shall be supplied within five working days of the verification, and at any time upon request.

(e) The Consent Holder shall record adequate data to demonstrate compliance with Condition 2. Data from the datalogger shall be provided once daily to the Consent Authority by means of telemetry. The Consent Holder shall ensure data is compatible with the Consent Authority's time-series database.

4. The Consent Holder shall implement, as necessary, the measures detailed in its *Low Flow Contingency Plan for Abstraction from the Oreti River as measured at Environment Southlands Wallacetown flow recording site*. In accordance with that plan the following shall apply:

Oreti River Trigger Levels	**Conservation Measures**
4.2 m^3/sec	i. Notify all plant personnel of low flow conditions and the need to reduce water use. ii. Cease supplementary supply of potable water to Wallacetown iii. Commission an independent audit to identify specific water conservation measures iv. Establish a Water Conservation Task Force to implement water conservation measures including those identified by the water use audit v. Redirect stock and/or redirect further processing to other Alliance plants if practicable vi. Participate in the Consent Authority's drought response measures including daily reporting on achievements in water conservation
3.3 m^3/sec	i. Adopt the measures that apply at 4.2 m^3/sec listed above ii. Redirect partially processed products to other Alliance plants or independent processors where this will reduce water use. iii. Reduce water use in conveyance of products between departments

5. For the first two years of this consent, the Consent Holder shall maintain a fish screen on the abstraction intake which shall comprise of two fish screens, one a 50 mm x 13 mm galvanised bar screen at 40 mm centres, for screening of large debris, and the second a screen with 12 mm diameter holes at 18 mm centres.

6. Within two years of the commencement of this consent, the Consent Holder shall be required to upgrade the second fish screen referred to in Condition 5, as follows:

(a) The Consent Holder shall install, operate and maintain the fish screen in accordance with the NIWA publication "*Fish Screening: Good Practice Guidelines for Canterbury, October 2007*", NIWA Client Report CHC2007R092.

(b) The fish screen shall have a maximum cross-sectional approach velocity of no greater than 0.12 metres per second.

(c) The intake shall be operated to ensure that fish are not impinged against the fish screen and are able to swim away back to the Oreti River.

(d) In the event that the fish screen is damaged so as to be rendered less effective at excluding fish from the intake, the Consent Holder shall repair or replace the fish screen as soon as practicable, or shall shut down the fish diversion barrier such that water ceases to pass through it.

The Consent Holder shall within 12 months of the fish screen installation undertake monitoring to assess compliance with Condition 6(b). If it is found that fish are being impinged due to approach velocity, the necessary adjustments shall be made to ensure full compliance with Conditions 6(a), 6(b) and 6(c).

7. The Consent Authority may, pursuant to sections 128 of the Resource Management Act 1991, serve notice of its intention to review the conditions of this consent. Such notice may be served on the Consent Holder at any time between the period 1 March to 31 July each year for the purposes of:

(a) requiring the monitoring of the rate of, and/or the effect of the abstraction; or

(b) requiring efficiency of water use; or

(c) addressing the effects of the abstraction of the river and/or estuary.

Details of Land Use Consent

Purpose for which permit is granted:		To disturb the bed of a river during sediment removal and general maintenance of an intake channel
Location	- site locality	Kirkbride Street, Wallacetown
	- map reference	NZTM 1236014E 4858400N
	- catchment	Oreti
Legal description of land at the site:		Section 93 Block XVI New River Hundred and Lot 1 DP 8017
Expiry date:		30 November 2041

Schedule of Conditions

1. For the purposes of section 116 of the Resource Management Act 1991, this consent shall not commence until Land Use consent AUTH-201227 is surrendered or has expired.

2. This consent authorises the following activities associated with maintaining a water abstraction intake channel at the location specified above:

   (a) removal of riverbed sediments at the mouth of the intake channel;

   (b) taking water associated with sediment removal;

   (c) discharge of contaminants (sediment and associated water) into water;

   (d) discharge of contaminants (sediments and associated water) onto the nearby riverbank in circumstances which may result in those contaminants entering water; and

   (e) temporary discoloration of the river due to sediments released during the disturbance of the riverbed authorised by this resource consent.

3. Sediments may be removed from the bed of the Oreti River to a horizontal distance of 5 metres from the mouth of the intake channel.

4. The Consent Holder shall notify the Consent Authority at least five working days prior to commencing maintenance of the channel on each occasion.

5. The Consent Holder shall schedule planned maintenance work to occur on an annual basis, outside the period 1 October to 31 August. This does not apply to channel maintenance work that might be necessary to clear material and debris following flood events or other emergency work that might be required.

6. In undertaking the channel maintenance works the Consent Holder shall:

   (a) Keep the affected working area to a practicable minimum and ensure that all plant and machinery working in the river is in good working order and is cleaned so as to be free of weeds or other pest plants prior to entering the water.

   (b) Ensure that any reinstatement of works after floods are, as far as is practicable undertaken during the recession of the flood, while the river flow is still naturally turbid.

   (c) Ensure that all disturbed vegetation, soil or other material is deposited, stockpiled or contained to prevent the movement of the material so that it does not result in:

      (i) The diversion, damming or blockage of any river or stream;

      (ii) The passage of fish to the main stem of the Oreti River being impeded, or fish or eel stranding within the channel or on the riverbanks;

      (iii) The destruction of any significant habitat in a waterbody;

      (iv) Flooding or erosion.

   (d) Ensure that prior to the maintenance works occurring the channel is inspected for the presence of eels. If eels are present within the channel, then the Consent Holder shall ensure that prior to any work commencing they are removed (trap and transfer) and returned to the main stem of the Oreti River.

   (e) Ensure that there shall be no washing or refuelling of machinery in the bed of the watercourse.

   (f) Ensure that all construction equipment, machinery, plant, and debris is removed from the site on completion of the works.

7. There shall be no discharge to the Oreti River during the channel maintenance works that may cause or result in any of the following to occur after a zone of reasonable mixing, being 150 m downstream of the confluence of the channel embayment and the main stem of the Oreti River:

   (a) Conspicuous oil or grease films, scums or foams, or floatable or suspended materials;

   (b) Conspicuous change in the colour or visual clarity;

   (c) Emission of objectionable odour; or

   (d) Rendering of river water unsuitable for consumption by farm animals.

8. The Consent Holder shall take all reasonable precautions to minimise the spread of pest plants and aquatic weeds. In particular, the Consent Holder shall:

   (a) remove any vegetation caught on the machinery; and

   (b) to avoid the spread of the *Didymosphenia geminata* or any other pest plant, do not use machinery in the berm or bed of the river that has been used in any area where the pest plant(s) are known to be present in the previous twenty working days, unless it has been thoroughly cleansed.

9. The Consent Authority may, pursuant to sections 128 of the Resource Management Act 1991, serve notice of its intention to review the conditions of this consent. Such notice

may be served on the Consent Holder at any time between the period 1 March to 31 July each year for the purposes of the purposes of addressing any adverse effects on the environment which may arise from the exercise of this consent, and which it is appropriate to deal with at a later stage, or which become evident after the date of commencement of the consent.

Details of Discharge Permit – Wastewater to land (temporary storage)

Purpose for which permit is granted:		To discharge treated wastewater to land in circumstances that any result in contaminants entering water, from a contingency short term storage area
Location	- site locality	Crowe Road, Lorneville
	- map reference	NZTM2000 1238021E 4856102N
	- catchment	Oreti
Legal description of land at the site:		Part Section 45 Block XIV Invercargill Hundred
Expiry date:		30 November 2041

Schedule of Conditions

1. Subject to complying with the conditions of this consent, the activities authorised by this consent shall be undertaken so as to be consistent with the application for this consent and the documents titled:
   (a) Assessment of Environmental Effects dated November 2015

2. This resource consent authorises the discharge of treated wastewater onto land, which may result in contaminants entering water via seepage, for contingency short term storage of wastewater in an 8.3 hectare area of land at the location specified above.

3. The Consent Holder shall advise the Consent Authority, Invercargill City Council, and the landowners and or occupiers adjacent to part Section 45 Block XIV Invercargill Hundred (the lagoon site), prior to each period of discharge of treated wastewater into the lagoon.

4. The maximum continuous period of storage in any one storage event shall not exceed three months.

5. The wastewater discharged to land shall be of a quality sufficient to comply with Conditions 9 (pre-Wastewater Treatment Plant Upgrade) and 18 (post Wastewater Treatment Plant Upgrade) of Consent AUTH-20158595-01, the discharge of wastewater into the Makarewa River.

6. At least once each week while wastewater is stored within the temporary storage area the Consent Holder shall inspect the area around the site, and the northern end of Leonard Road, to assess odour effects. The following observations are to be noted during each inspection.
   (a) Date, time, wind direction and a description of wind strength;
   (b) Whether or not odour was detected and, if detected, the location;
   (c) The offensiveness and intensity of the odour; and
   (d) Whether or not the odour was, in the opinion of the Consent Holder, attributable to the wastewater in the storage area.

A copy of the latest inspection report shall be forwarded to the Consent Authority each week while monitoring occurs under this condition.

7. For the purpose of section 125 of the Act this consent shall not lapse until its expiry.

8. The Consent Authority, may service notice of its intention to review the conditions of this consent, in accordance with section 128 of the Resource Management Act 1991, within five working days of receiving the report prepared in accordance with Condition 6 for the purposes of dealing with any adverse effects on the environment which may arise from the exercise of this consent.

Appendix D: High-Level Microbial Risk Assessment.

Microbial Risk Assessment Tool: Output Report

Prepared by simon bloomberg (E3scientific) on 30/10/2026

The tool is available online at https://mra-tool-nz.streamlit.app/

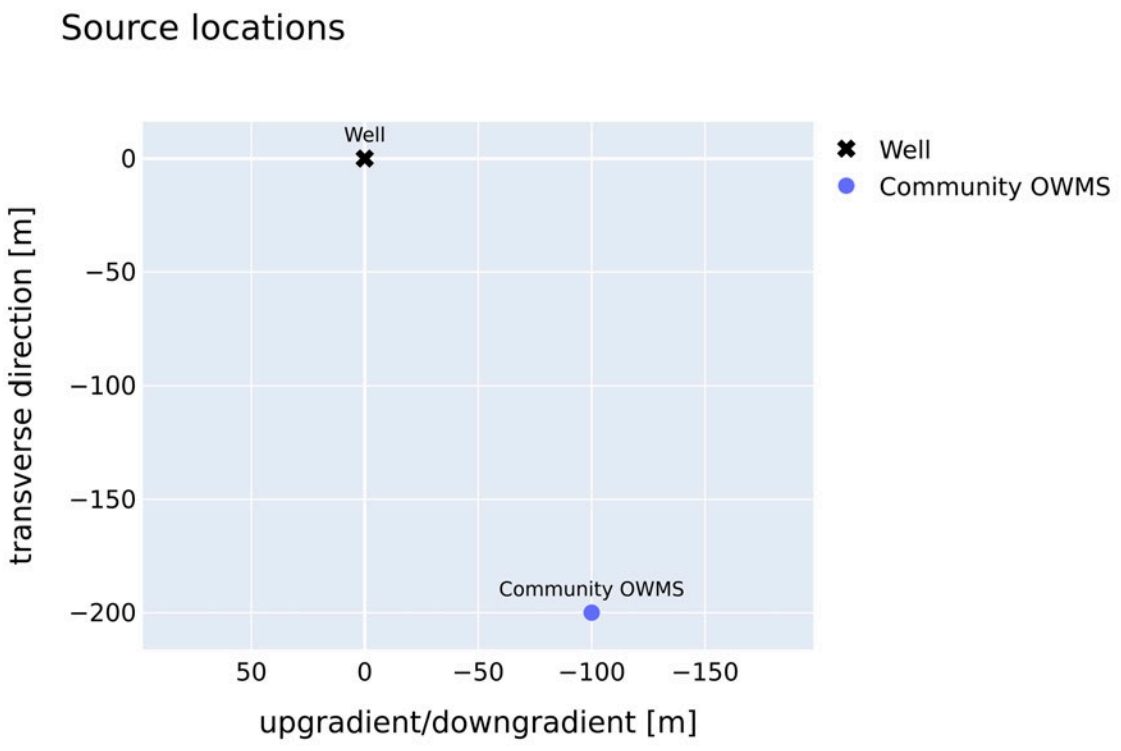
The Microbial Risk Assessment (MRA) tool allows users to make decisions about the management of activities near drinking water supply wells that have the potential to impact health risks to the drinking water. Users can view the complete uncertainty range relative to a maximum acceptable microbial concentration, rather than selecting a specific level of uncertainty.

Microbes selected for risk assessment: Norovirus, E. coli, Campylobacter.

Norovirus is selected as the most suitable viral pathogen for human related land-use scenarios. E. coli is included for all land-use scenarios as an indicator of faecal contamination and its use in regulatory standards. Campylobacter is considered the most appropriate organism for agriculture related land-use scenarios due to its widespread prevalence in animals and high rate of infection within the New Zealand population.

For Norovirus and Campylobacter, the maximum acceptable concentration is the concentration expected to result in the tolerable annual infection probability (1 in 10,000 per year). For the indicator microbe E. coli, a drinking water standard of < 1 per 100 mL has been set by the Ministry of Health, therefore 5 per L has been used as the maximum acceptable concentration.

Number of microbial contaminant sources: 1

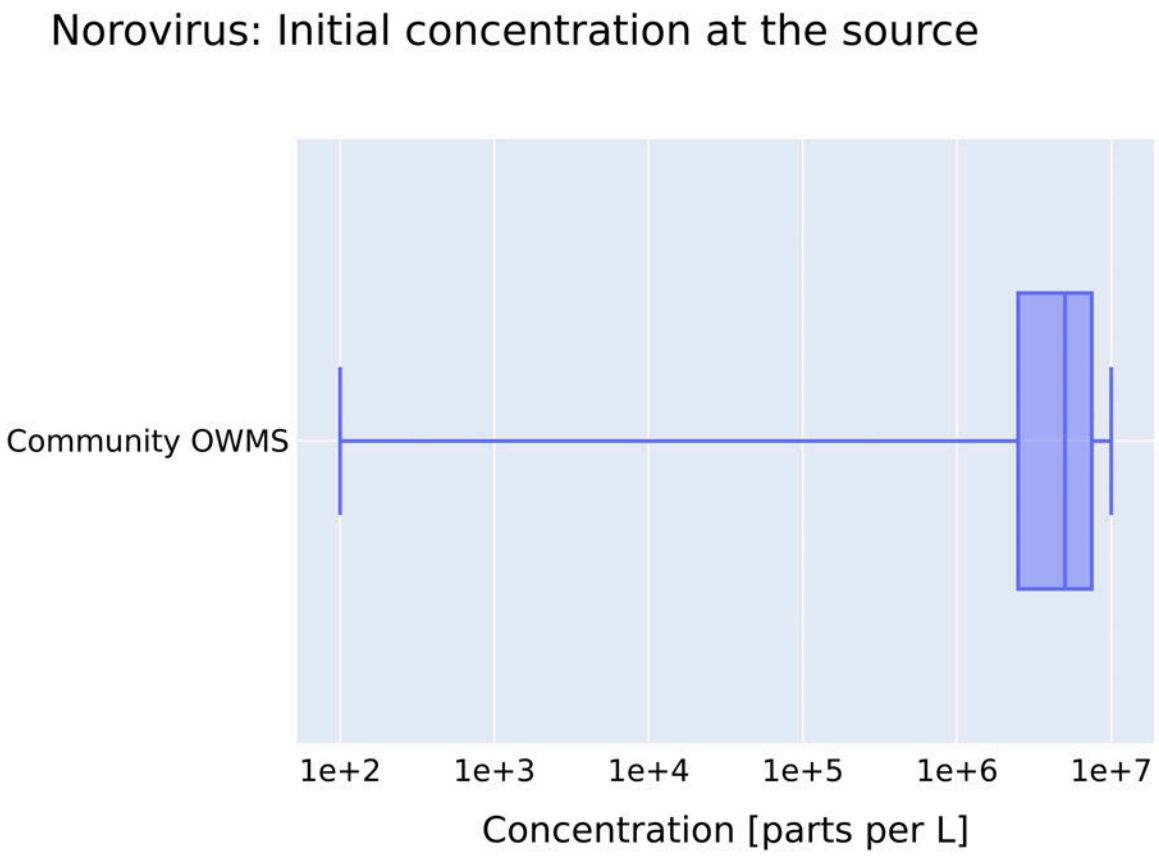


List of contaminant sources

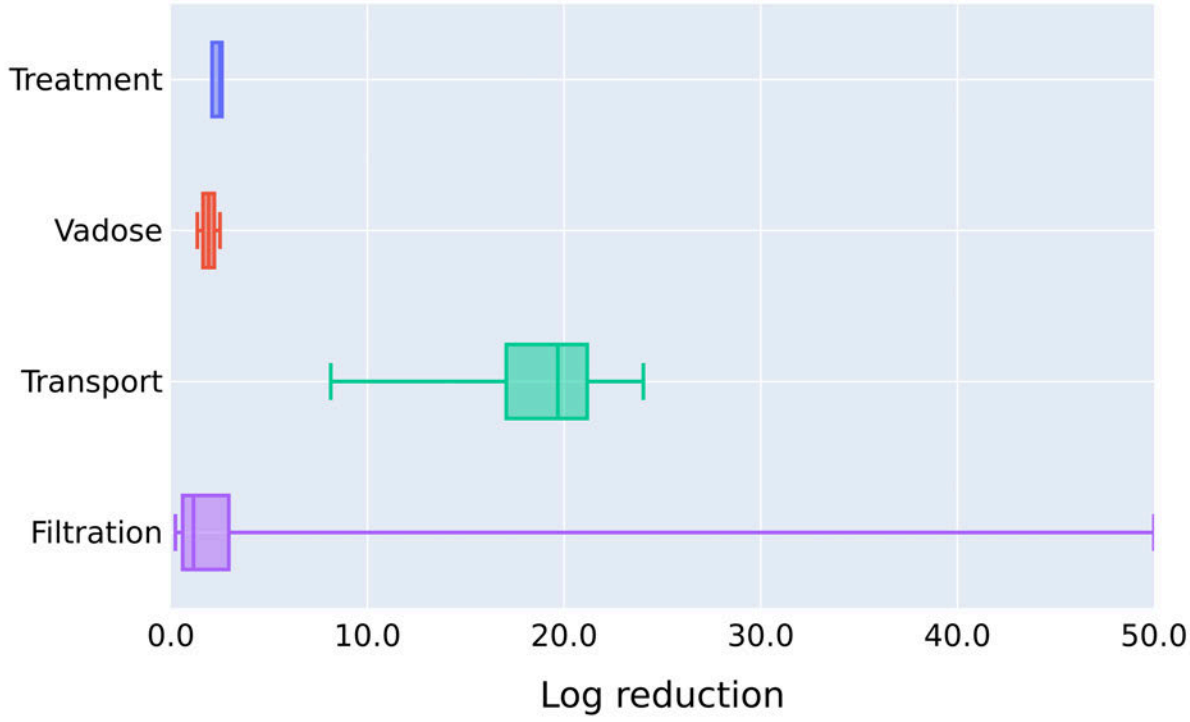
Source Community OWMS:

Pumping scenario: Single dwelling (SD)
Climate: G2
Land use: Community OWMS | Treatment: Advanced secondary
Soil material: None | Soil depth: 0m
Vadose zone material: AlGr | Vadose zone depth: 5m
Aquifer material: Alluvial gravel (AlGr)
Distance upgradient: -100.0m | Transverse distance: -200.0m
Distance from well: 223.6m

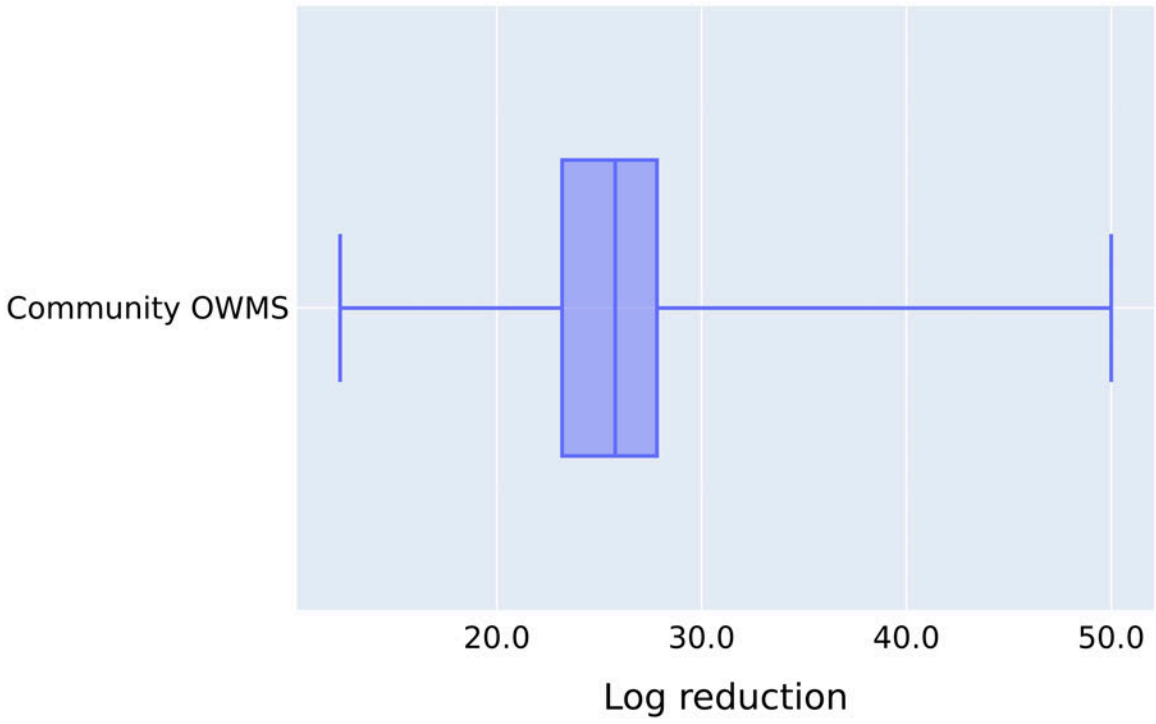
Norovirus


Norovirus: Initial concentration at the source
Community OWMS
1e+2
1e+3
1e+4
1e+5
1e+6
1e+7
Concentration [parts per L]

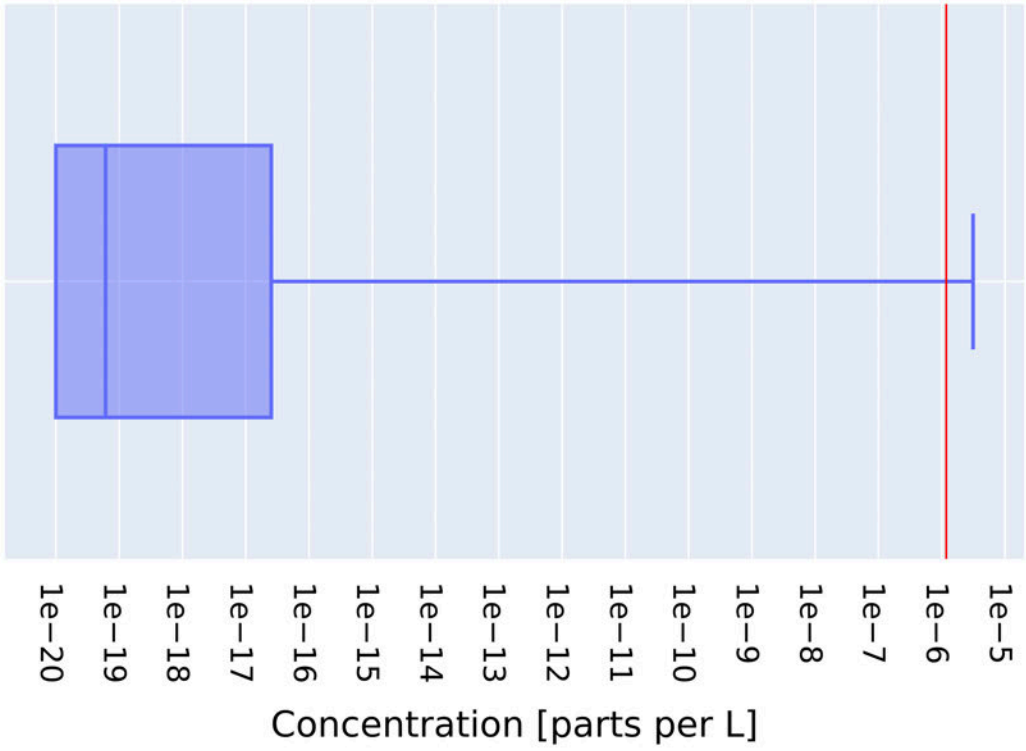
Norovirus: Community OWMS log reduction components



Norovirus: Log reduction from source to well

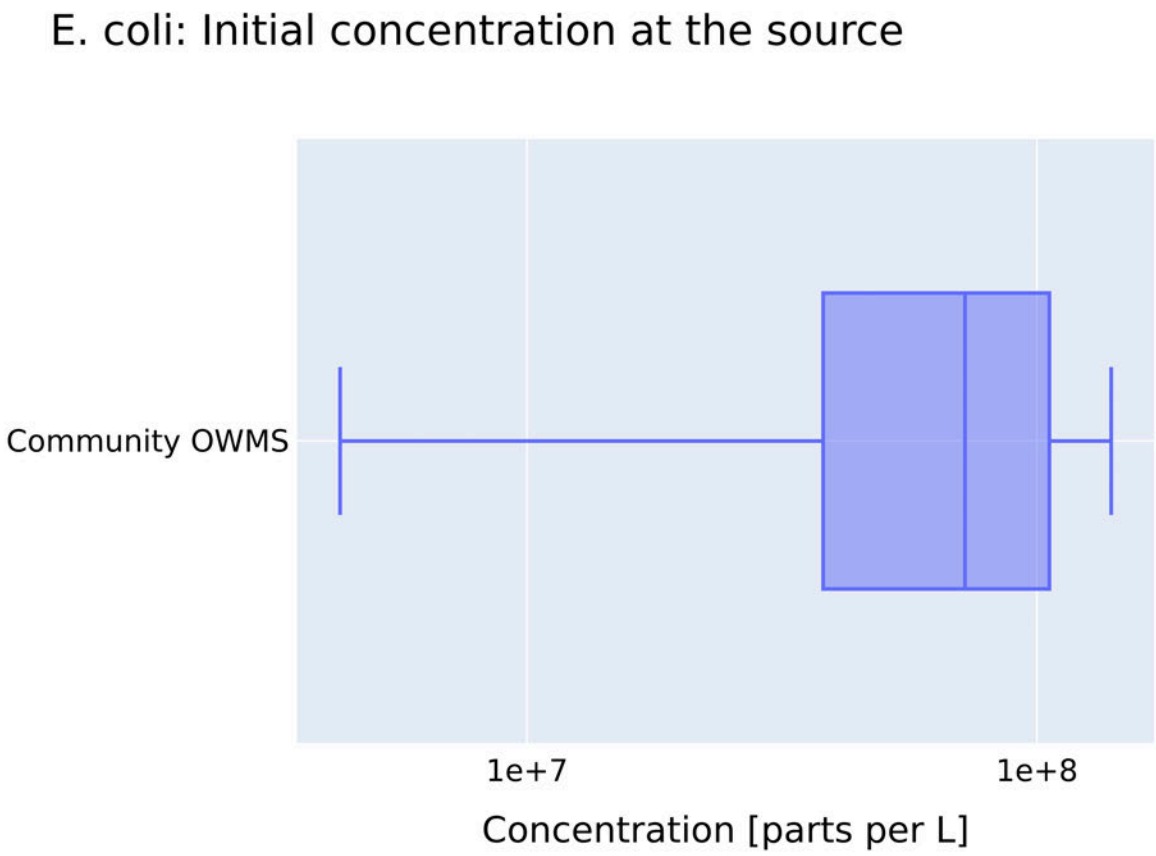


Norovirus: Total concentration at the well
P(above max acceptable conc of 1e-06) = 0.007%

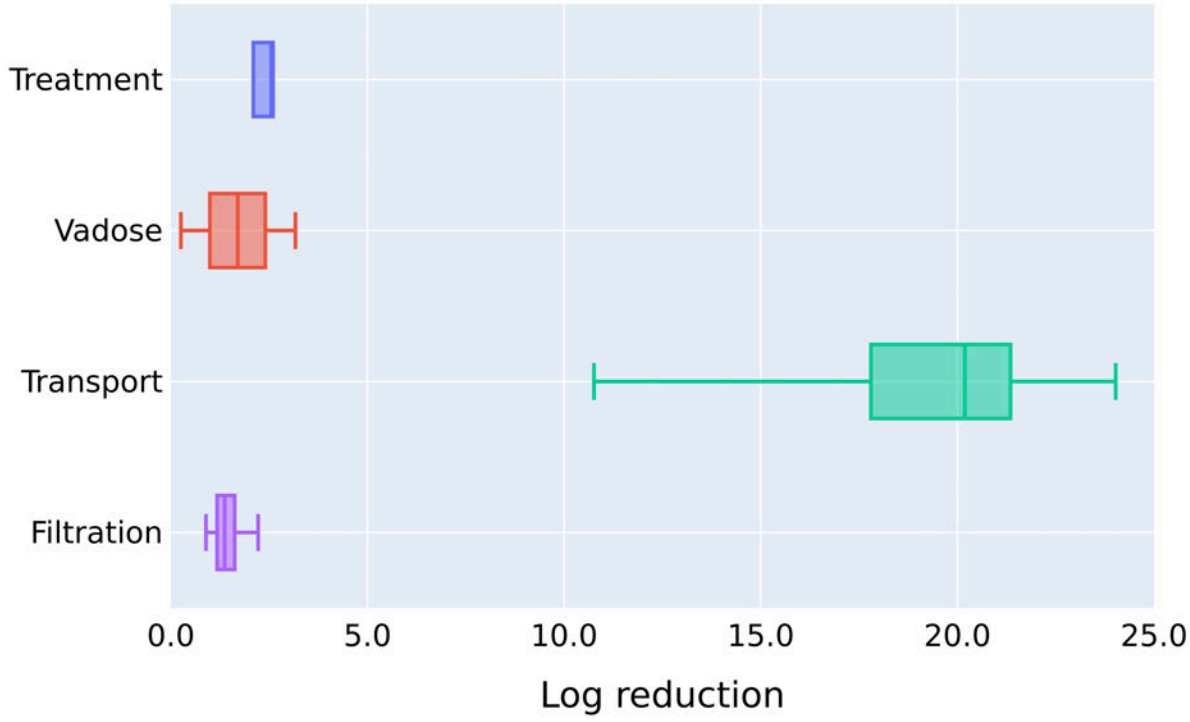


Percentile	Concentration [parts per L]
0%	< 1.0e-20
1%	< 1.0e-20
2%	< 1.0e-20
5%	< 1.0e-20
10%	< 1.0e-20
20%	< 1.0e-20
25%	< 1.0e-20
50%	6.1e-20
75%	2.5e-17
80%	1.7e-16
90%	3.6e-14
95%	2.4e-12
98%	8.7e-11
99%	7.4e-10
100%	3.1e-06

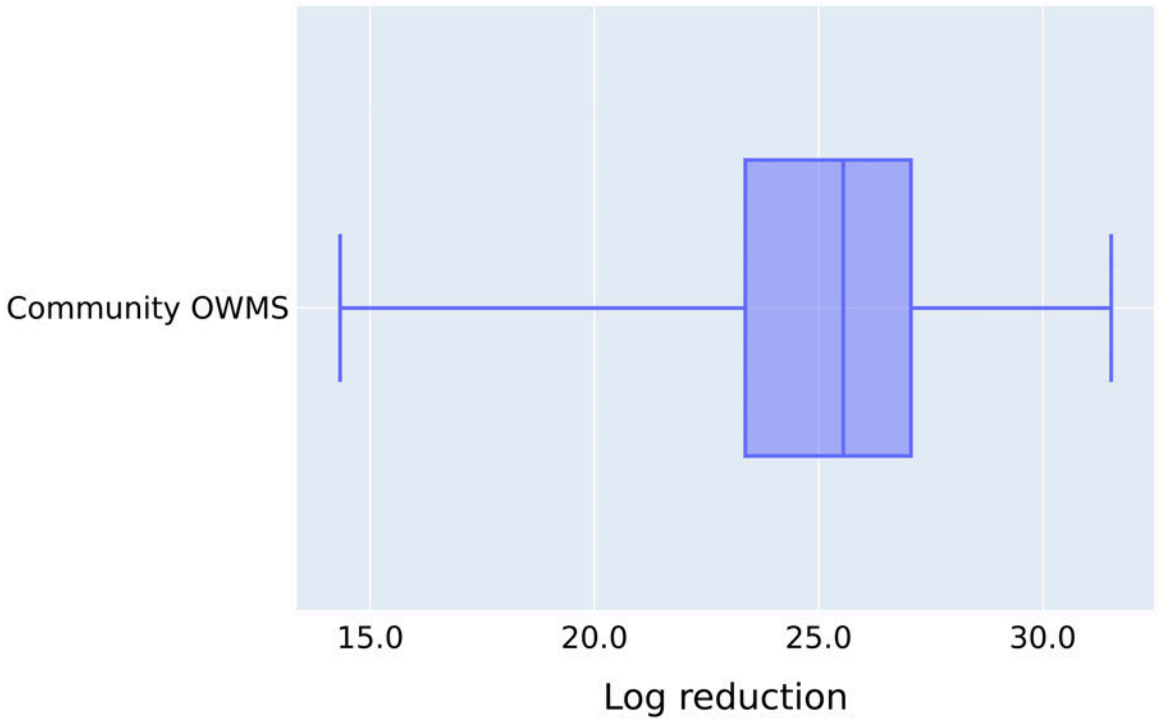
E. coli


E. coli: Initial concentration at the source
Community OWMS
1e+7
1e+8
Concentration [parts per L]

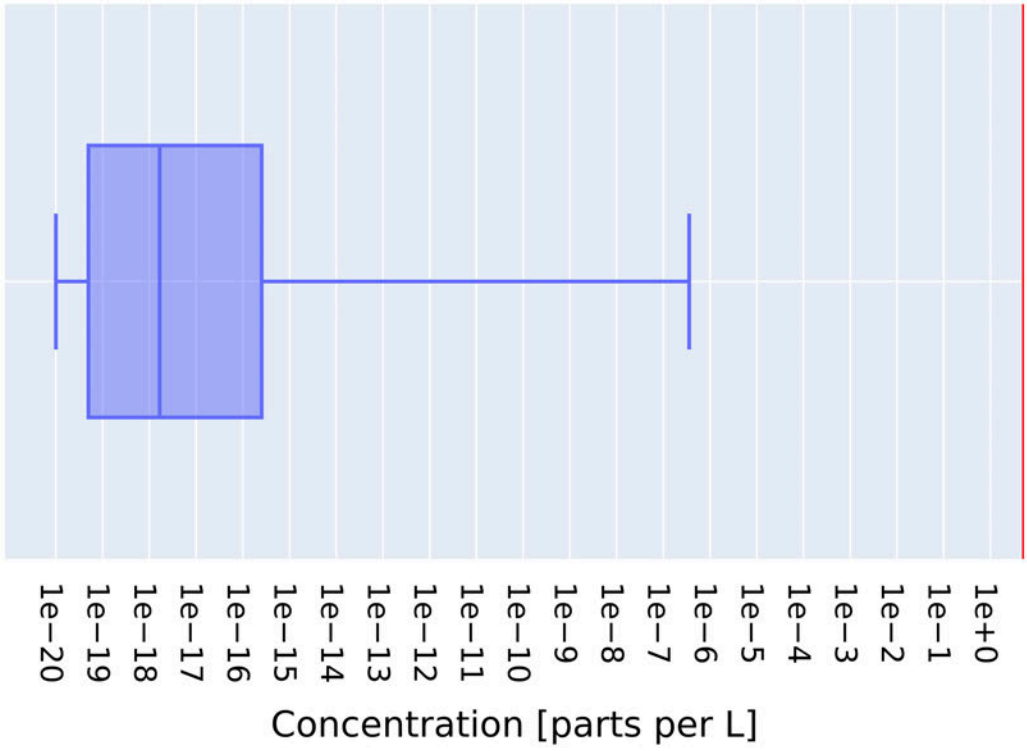
E. coli: Community OWMS log reduction components



E. coli: Log reduction from source to well



E. coli: Total concentration at the well
P(above max acceptable conc of 5e+00) = 0%



Percentile	Concentration [parts per L]
0%	< 1.0e-20
1%	< 1.0e-20
2%	< 1.0e-20
5%	< 1.0e-20
10%	< 1.0e-20
20%	2.4e-20
25%	5.0e-20
50%	1.7e-18
75%	2.5e-16
80%	9.4e-16
90%	3.0e-14
95%	8.4e-13
98%	5.4e-11
99%	5.3e-10
100%	3.6e-07

Summary

Norovirus: 1 source (Community OWMS)

P(above max acceptable concentration of 1e-06) = 0.007%

E. coli: 1 source (Community OWMS)

P(above max acceptable concentration of 5e+00) = 0%

Campylobacter: 0 sources