ryderconsulting
environment + planning + project management

195 Rattray Street
PO Box 1023
Dunedin, 9054

T 03 477 2119
F 03 477 3119
C 027 437 7617
g.ryder@ryderconsulting.co.nz

To: Joanna Gilroy/Hillary Lennox, **Environment Southland**

From: Greg Ryder, **Ryder Consulting**

Date: 22 January 2016

Subject: **Review of application documents relating to reconsenting of the Alliance Group's Lorneville Plant discharges**

Attached are our comments in relation to the application reports titled:

"***Assessment of Ecology, Water Quality and Recreation in the Makarewa River, Oreti River and New River Estuary***".

"***Assessment of the Receiving Environment for Alliance Lorneville's Treated Wastewater Discharge***" formally titled: "*Assessment of Ecology, Water Quality and Recreation in the Makarewa River, Oreti River and New River Estuary*".

"**Assessment of Effects - Monitoring of the Alliance Lorneville Wastewater Discharge and the Makarewa River**".

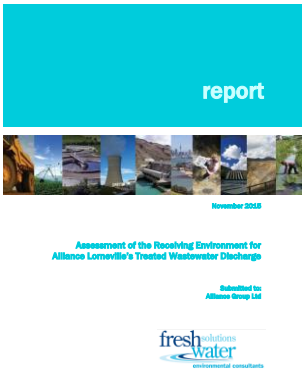
and

"***Alliance Lorneville – Summary Report on Alternatives and Proposed Upgrading of Wastewater Treatment Plant***".

These comments should accompany our review of the report on Alliance's abstraction from the Oreti River, forwarded to you yesterday. By and large, most substantive matters we commented on have been addressed to varying degress in the updated reports. We understand information on recreational use is being collected.

Yours faithfully,

Dr Greg Ryder*Environmental Scientist/Director*



Assessment of the Receiving Environment for Alliance Lorneville's Treated Wastewater Discharge

Submitted to: Alliance Group Ltd

Freshwater Solutions

Updated: November 2015

The main findings of the review are:

- The report is large and covers a wide range of matters relating to the character of the wastewater discharge and the receiving water environment.
- In general, we consider that the report would benefit by increasing the size and clarity of the figures particularly where complex and large datasets are presented. This has been largely rectified in the main body of the report, however some figures in the appendices are still not clear.
- A number of issues relating to data interpretation require further clarification and/or expansion in order to benefit the reader.

Section 1: Introduction (page 1)

This report states that it builds on previous assessments of wastewater and receiving water quality, quantity and aquatic ecology. The document is large, relatively complex and detailed in many places, and covers a wide range of matters. It includes five appendices containing more detailed information and specific, stand-alone studies. It is appropriate that these are appended rather than embedded as sections within the report. As it stands, the report suffers from trying to summarise too much varied information into one document, and in some instances it would have been preferable to expand on specific matters. A number of detailed figures, particularly graphs, have been reduced in size presumably to keep the physical size of the report to a minimum. However, this has resulted in the figures being difficult to read and examine in any detail. It is preferable to produce these figures at scales

that reflect the level of detail they are trying to relay. This has been largely rectified in the main body of the report. Similarly, some aerial figures suffer from poor resolution and/or colour differentiation. These problems remain, particularly in Appendix 5. A number of specific examples are noted in the review below.

Section 2: Assessment methods (page 3)

This section is brief and the reader is referred to Appendix 1 for a full description of methodology. A review of Appendix 1 is presented further on in this review.

Section 3: Receiving environment (page 6)

Under Hydrology (page 6), please specifiy what interval (filter) was used between flood events in calculating the number of FRE3 events. This has been addressed.

The Figure 1 map of the lower Makarewa River should include labels of the rivers and major tributaries discussed in this report. This has been addressed. The Figure 2 aerial (page 8) would benefit by just focusing on the section of Makarewa River between its confluence with the Oreti River and the most upstream monitoring site. As it is, this section of the river is highly condensed and has limited value as a visual guide. This has been addressed and is greatly imporved.

Under 'Ecology' (pages 10-11), ecology data collected by SRC on the Makarewa River between 2005 and 2010 is summarized. Has more recent years (post 2010) been assessed? If so, has it been presented? We feel this would be useful given the recent dry summers in Southland. Data has now been assessed up to 2014.

Under 'Recreation' the last sentence on page 11 "*The National angler survey data does separate out use in the upper and lower Makarewa River…*". Please clarify whether the sentence should read 'does separate' or 'does not separate'. This has been addressed.

In general, we consider that the section on recreation lacks any targeted information specific to the Lorneville Plant discharge. The information presented is often generic to the wider

lower Makarewa and Oreti catchments and somewhat out-dated or absent. The effects of the discharge on actual and potential recreational users of the area are not addressed in any detail. These comments also apply to the recreation section for the lower Oreti River (page 15) and New River Estuary (page 18). This section now notes that "*Further information about the recreational use and values of the Makarewa River is currently been collected.*".

Section 4: Discharge quality and characteristics

On page 21 the author states "*there is no apparent trend in seasonal median daily discharge volumes*". It is unclear whether any trend analysis has been performed on the data or whether the comment is based on any formal methodology, or just opinion. This statement has been removed. Figure 3 (daily discharge volumes) is too small. It would also be useful to plot daily discharge volumes and mean daily river flow on the same graph. This has been addressed.

Table 4 (page 21) presents a summary of daily discharge volumes. It would be useful to examine the rate of discharge including instantaneous discharge rate. What are instantaneous discharge rates under low river flow conditions? This is useful information when considering effects such as toxicity and water clarity.

Table 6 (page 24) presents daily contaminant loads in the discharge. Please confirm that the daily loads for some contaminants (e.g., BOD and SS) are based on weekly measurements only. This has been addressed.

Specifying laboratory detection limits would be useful for assessing contaminant concentrations in wastewater and receiving water, even if presented in the appendices. Some commentary on the laboratories used for testing and their quality assurance programme would provide helpful background information.

Under 'Other parameters' on page 32, in order to assess the results of the metal testing of the discharge, it would be useful to know the discharge volumes on the days of the survey and also the processing volumes leading up to testing. Questions like 'was the Plant

operating in a typical fashion in terms of waste stream generation' would be reasonable to ask to put the testing results into an appropriate context.

Section 5: River water and sediment quality and characteristics

Tables 13 and 14 (pages 35-36) summarise water quality monitoring parameters and guidelines. This table would benefit from some explanation or notes on what each guideline relates to. For example, are the nitrate limits related to toxicity (which they probably are) or plant growth? Are other nutrient concentration limits specified in relation to plant growth or algae growth (or both)? Are the clarity limits related to aesthetics or ecological protection? This has been addressed.

It would be useful to provide some comment on on how contaminant loads, as specified under existing resource concent conditions, influence or affect receving water ecology. What are current contaminant load limits based on? This information would benefit the reader from understanding the relevance of contaminant loads versus contaminant concentrations.

In relation to dissolved oxygen (page 39), comments about the Class D standard not being met on 6 occasions would benefit from additional information on how long the standard was not met and how much lower below the standard the DO concentration reached? Also, what were the river flow and wastewater discharge conditions when the standard was not met? This information has now been provided.

Colour (page 40)

Table 13 (page 35) indicates that water colour was monitored during summer (1 November to 30 April), and that the relevant consent limit is "no conspicuous change". However, in Table 15 (page 40) it is apparent that colour monitoring has only been undertaken in one year, with a total of 21 measurements being made by Alliance staff on separate days (once each day) between 10 March and 23 April 2014. It would be helpful if water colour measurements could be compared to other water quality measurements made at the same time, such as clarity, but this is not possible given the way the data is presented.

No information is provided on the method used to measure water colour at the three monitoring sites (it is not provided in Appendix 1 – Study methods). Water colour is a subjective measurement, which must be made in the field (i.e., it can not be determined from a water sample), so it is important to ensure that field personnel are well trained, the method used is consistent between sites and times (e.g., horizontal or vertical measurement, in sun etc.), and if possible the measurements are all made by one person.

No information is provided as to what the river flow or the tide conditions were at the time of colour measurement, or what contribution the discharge was making, so it is not possible to assess the potential magnitude of the discharge's effect on water colour. A quick review of Makarewa flow data for the 10 March to 23 April period on the Environment Southland website indicates that the river was above its median flow for several days over the measurement period, which would dilute any effect of the discharge on water colour. Presenting information on flow and discharge magnitude alongside the colour data would allow these effects to be evaluated.

Information on daily discharge and river flow now accompanies the water colour monitoring data.

No further discussion of water colour is provided in the report.

Nutrients (page 42)

Under 'Physico-chemical parameters' (page 43) the text refers to DIN concentrations and Table 8. Table 8 is labelled as TON, not DIN and is confusing. In general, better explantion on the use of DIN and TON (and if they are used interchangeably) would be helpful for the reader.

The downstream nitrogen concentrations in the river at the monitoring site are high when discharges occur. Figures 16 and 17 are vey small and should be expanded. It would also be useful to include river flow on these figures. This has now been addressed although flow has not been included.

What is the ecological relevance of ammoniacal-nitrogen loads to receiving waters (page 44, Figure 19)? This is addressed later on in the report. The text on page 44 notes an overall trend of reduced ammoniacal-nitrogen loads. While there are three years when the overall load decreases, there would appear to be no 'overall trend' of reduction given the annual numbers presented in Figure 19.

The first paragraph on page 46 discusses BOD concentration. This is possibly in the wrong section which is to do with nutrients. This inclusion has been explained, although not convincingly so.

Comments on page 46 in relation to a reduced TP load are misleading given it is based over just three years and the last two years of data indicate an increasing trend. This statement has been removed.

Makarewa River sediment quality (page 49)

It would be helpful to explain the ecological significance of sediment contaminants and present any relevant guidelines or limits. Additional explanatory text has now been included.

Section 6. Makarewa River ecology (page 52)

Table 19 summarise stream habitat. It would be helpful to describe how substrate compactness and scouring were measured. This has been explained (albeit very briefly).

Aquatic plants (page 58)

It is reported on page 60 and in Figure 36 (page 61) that *Ceratophyllum demersum* (hornwort) was identified during the February 2014 survey of the Makarewa River. Hornwort is a serious noxious water weed and has not previously been found in Southland, although it is present in the North Island and there have been occasional outbreaks that have been controlled by Biosecurity elsewhere in the South Island[1]. It is likely that this aquatic plant has been incorrectly identified in the February 2014, however if not Environment Southland and Biosecurity New Zealand should be notified immediately. It has been confirmed this was a mis-identification.

Benthic invertebrates (page 62)

Benthic macroinvertebrate communities were surveyed at three sites on three occasions; on two occasions when the discharge was occurring (March 2013 and March 2014), and on one occasion when it was not (November 2014). Difficulties in selecting ecology monitoring sites resulted in existing differences between the sites that were unrelated to the effect of the discharge and therefore made detecting any effects of the discharge between sites more difficult. Due to this, the comparison of an individual site between times (i.e., comparing times when the discharge is present or absent) is probably the most useful way to detect any effect of the discharge. It would have been helpful if this had been explained more clearly at the beginning of the benthic macroinvertebrate results section (page 62), with the focus being to discuss the results for each site through time, rather than discussing each of the three surveys in turn (i.e., March 2013 (discharge), November 2013 (no discharge), March

[1] http://www.stuff.co.nz/timaru-herald/news/8677526/Wicked-weed-gone-from-lake

2014 (discharge)). The focus on comparisons between upstream and downstream locations is given too much emphasis in the results, given that it was already expected that they would be different due to habitat differences unrelated to the discharge. An explanation has been provided at the start of this section.

Figure 48 (page 74) is useful for viewing how invertebrate community composition at sites downstream of the discharge differs between times when the discharge was occurring (March 2013 and March 2014), and when it was not occurring (November 2013). The interpretation of this figure is discussed on page 73 of the report where it is noted that "*The communities recorded from downstream Sites D1 and D2 in November 2013, when there was no discharge occurring, were similar to the downstream communities in March 2013 and 2014 when the discharge was occurring. This result indicates factors other than discharge water quality may be shaping the communities at downstream sites*." However the grouping of points in Figure 48 indicates that the invertebrate community at site D1 in November 2013 (no discharge) was somewhat different to that at site D1 in March 2013 and March 2014 (discharge); and that the community as site D2 in November 2013 was different to that at D2 in March 2013. Based on the results of the analysis this was not a statistically significant difference though. It would have been helpful if possible reasons for this pattern had been discussed in more detail.

Figure 49 indicates how environmental variables are related to community patterns. The analysis found that community differences at site D1 between November 2013 (no discharge) and March 2014 (discharge) were associated with higher Amm-N, DIN and DRP concentrations in March 2014 (page 74). It was concluded however, that " *… this does not necessarily indicate a causal relationship*" (page 75). If not related to the discharge an alternative explanation for the pattern should have been offered.

Considerably more interpretation of these analsyes have now been included in the report. A new section (Community Patterns at Each Site among Surveys) has been included with additional figures, and some re-casting of previous sections has been undertaken.

The caption for Figure 38 (page 65) appears to be incorrectly labelled as it refers to the 'mean taxa number', while the figure shows 'abundance'. As a general note there is also a lack of units shown for the y-axis in Figures 38 to 41.

Native fish (page 76)

Fish community surveys used appropriate methods for the type of habitat present and considered a variety of sources of information. Periods of migration for the fish species likely to be present in the vicinity of the discharge are discussed, and it is concluded that most fish migration occurs when there is no or a low volume discharge from the plant (page 79). It would be helpful if the information on the migration periods of the fish species was shown together in a table with the times when the discharge is occurring and an indication of its magnitude (e.g., low volume, medium volume etc.). This has been addressed with additional text and a new table.

Appendix 1 –Study methods

This section has no page numbers so it is difficult to reference comments.

Existing compliance water quality monitoring

Existing water quality monitoring is undertaken by Alliance at three monitoring sites. Water quality samples are collected at each site for analysis. This analysis is presumably undertaken at an external laboratory, however this laboratory is not identified. It is important that the name of the laboratory is given so the independence of the results can be assessed. This information is now provided.

Water quality sampling sites

The location of the three water quality sampling sites is as specified in the consent, however it is noted in Appendix 1 that the site that is referred to as '200 m' throughout the report is not actually 200 m downstream of the discharge but is 350 m downstream. This could be misleading when assessing the results so it is recommended that the site referred to as '200 m' throughout the report is changed to '350 m' for accuracy. This is now adjusted.

Ecology sampling sites

Four ecology sampling sites were selected for monitoring as follows (page 4):

1. U1: located 300 m downstream of Wallacetown Bridge, annual Environment Southland monitoring site.
2. U2: located approximately 2 km upstream of the discharge, upstream of the influence of the discharge and where the effect of tide and habitat conditions and water level variation is minor.
3. D2: located 70 m upstream of the discharge, but within the mixing zone during the incoming tide.
4. D1: located 100-200 m downstream of the discharge, within the discharge mixing zone.

Although U1, U2, D2 and D1 is the correct upstream to downstream ordering of the sites the tables and results graphs display the sites in the order U1, U2, D1 and D2 (e.g. Table 19, page 52; Figure 32, page 59). It is typical to arrange sites in their upstream to downstream order so it is confusing that they are displayed out of order.

The footnote to Table 1 (page 4) indicates that a fifth site 'U2 up' was also monitored in March 2014 only. Periphyton cover, macrophyte cover, benthic macroinvertebrates and fish were surveyed at this site (Table 1). No explanation is provided as to why this extra site was included in March 2014 or its exact location, although it is shown on Figure 1 in Appendix 1 to be upstream of site 'U2'. No information on habitat characteristics (Table 19, page 52) or physico-chemical data (Table 20, page 55) is provided for this 'U2 up', so it is not clear how comparable this site is to 'U2' or other sites. Where site 'U2 up' is included in the graphs it is shown between site 'U2' and 'D1' (e.g. Figure 35, page 60), which is confusing as its actual location, downstream to upstream is between 'U1 and 'U2' (Appendix 1, Figure 1).

The difficulty experienced in selecting monitoring sites to assess the effect of the discharge is discussed on page 3 of the report. As the discharge occurs near the upper end of the tidally influenced section of the river (although not within the saline influence), the discharge was anticipated to potentially have effects on benthic communities upstream of

the discharge point during the incoming tide. Consequently a downstream monitoring site was located upstream of the discharge, i.e., site 'D2'. This is an appropriate approach to take in this situation.

Tidal variations in water level in the river could also be anticipated to result in habitat differences between the sites unrelated to the effect of the discharge. In short, it was difficult to select upstream and downstream sites that had comparable habitat, and therefore difficult to minimize variation between the sites that was unrelated to any potential discharge effects. In this situation it would be preferable to have more sampling locations or more surveys through time, although cost restrictions would likely have prevented this. In the absence of extra sites or surveys the location of site U2 should have been further downstream, located closer to site D2 (rather than 1.9 km apart), and within the more tidally influenced reach of the river although still upstream of the mixing zone of the discharge. This would minimise the differences between U2 and D2 in terms of habitat and make any differences due to the discharge alone easier to isolate and detect.

Periphyton

Visual assessment

Periphyton cover was assessed in riffles. The New Zealand periphyton guidelines note that most commonly periphyton cover should be assessed in runs or pools (Biggs 2000). Higher water velocities in riffles can result in increased sloughing compared to runs and pools so periphyton cover is typically reduced in riffle relative to runs and pools, although it does depend on the periphyton community growth form. Text has been amended to clarify the sites were runs ('gentle riffles').

Ash-free dry weight and chlorophyll-a

Periphyton biomass monitoring was not undertaken at downstream sites D1 and D2 on any of the four monitoring occasions in 2013/2014. The explanation given in the report was that "*There was insufficient periphyton at downstream sites in March 2013, November 2013, February 2014 and March 2014 to allow chlorophyll-a analysis to be carried out*." Chlorophyll-*a* analysis is however not limited by the amount of periphyton in the sample

(although ash free dry mass can be), and in any case if there was insufficient periphyton in the area of substrate initially sampled a larger area of substrate could have been sampled. Some explanation in the text is now provided.

Benthic macroinvertebrates
Within survey statistical analysis

The analysis method used is appropriate, but it is not clear why separate analyses were undertaken i.e., 'within survey' and 'pooled survey'. It is also not clear how the results of these two separate analyses are reported in the body of the text. Some explanation in the text is now provided.

Pooled survey statistical analysis

The analysis method is not explained well. For example, it is not clear if interaction effects were included in the model. Reporting of the results of the statistical tests is also not done in a way that allows the power of the analysis to detect differences to be assessed (i.e., the degrees of freedom for the analysis aren't reported in the body of the report). Error bars are shown on some graphs (Figures 38 to 44) however, how they are calculated is not explained (this is now addressed). It would be helpful if the graphs in the body of the report had number coding above the bars so it could be easily seen between what sites the statistically significant differences were, alternatively a table could be included summarizing and interpreting the significant results. A new Appendix 4 has now been included detailing the statistical results.

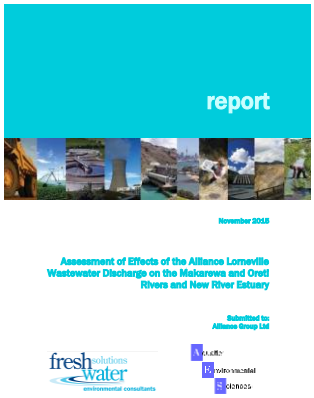
nMDS analysis

The multivariate analysis is appropriate and provides a useful summary of the differences in macroinvertebrate community composition between sites/times and also includes an analysis relating observed community differences to environmental factors.

Appendix 4 (now Appendix 5) – Mixing Zone Assessment Report

The quality of the figures showing the aerial photographs of the river overlaid with the depth-average water velocities is too poor to see the colour coding indicating the variation

in water velocities across the river. It would be helpful if the figures were identified with numbered captions so it is clear which were being referred too in the text. Figures now have captions.



Assessment of Effects of the Alliance Lorneville Wastewater Discharge on the Makarewa and Oreti Rivers and New River Estuary

Submitted to: Alliance Group Ltd

Aquatic Environmental Sciences and Freshwater Solutions

Updated: November 2015

The stated purpose of this report is to present an assessment of the ecological and recreation effects of the Lorneville Plant wastewater discharge to the Makarewa River based on a number of other reports and information sources used in preparation for lodging resource consent applications. It is stated at the outset that the report is structured to:

- provide an assessment of the actual and potential effects of the discharge from the Lorneville Plant;
- identify what standards and guidelines are required as targets and then assesses each of the effects of the current discharge quality against those standards and targets;
- identify what mitigation is required to meet those targets or guidelines.

Appendix 1 of the report presents a review of ammonia concentrations, relevant water quality guidelines and recommended ammonia limits for the Makarewa River.

Section 2: Potential ecological and recreational effects (page 2)

As noted in our reviews of other pre-application reports, Figure 1 (page 3) showing the location of discharge and sampling sites in relation to the river could do with being enlarged to better show locations of individual sampling sites relative to each other, the discharge point and tidal movements. These are critical matters in the accompanying assessments and so clearly being able to identify the location of key monitoring sites and other key features is

important. Figure 1 has been greatly improved. The scale has been enlarged and key sites and points of interest are easily located and distances between sites are able to be determined.

Direct potential effects of the discharge on the receiving environment identified in the report (page 4) are:

- ammoniacal-nitrogen toxicity;
- increased nutrient concentrations;
- increased bacteria concentrations;
- reduced dissolved oxygen concentration;
- altered colour and clarity;
- generation of foams and scums.

Indirect potential effects identified in the report are:

- development of nuisance algal growths;
- altered benthic invertebrate community;
- altered fish community;
- reduced cultural and recreational values.

The separation of effects into 'direct' and 'indirect' is perhaps an arbitrary one for some of the listed effects. For example, ammonia toxicity has a direct effect on aquatic biota and so altered fish and invertebrate communities due to ammonia toxicity can be regarded as a direct effect and not an indirect effect. Indeed, on page 6 of the report, it states: "*The discharge has the potential to have direct effects (e.g., through Amm-N toxicity) on fish diversity and abundance*". The text on page 4 has been amended such that all potential effects are now grouped together.

In general, the list appears to be comprehensive and cover the most obvious actual and potential effects arising from the wastewater discharge.

Each of the effects listed on page 4 is discussed separately in the report, in general terms.

Amm-N (page 4)

The report considers that ammoniacal nitrogen concentrations in the discharge have the potential to cause adverse effects in the discharge's mixing zone and lower Makarewa River through chronic and acute toxicity. Adversely affecting fish migration in the mixing zone and contributing to nitrogen loadings in the lower Makarewa, lower Oreti and New River Estuary are other effects of ammonia identified.

The contents of the first paragraph at the top of page 5 appears to be out of context (it refers to nitrogen and phosphorus causing nuisance algae growths, but is positioned under the ammonia section). It probably should be positioned under the next sub heading titled 'Nutrients'. This has been amended accordingly.

Dissolved oxygen (page 5)

The report notes that the discharge can occasionally contribute to low summertime DO concentrations below 5 g/m^3 in the lower Makarewa River that have the potential to have an adverse effect on aquatic biota.

Colour, clarity foams and scums (page 5)

Page 5. The report states that "*the Makarewa River downstream of the discharge the river is used by duck hunters and fishermen and their enjoyment of fishing and hunting could be reduced by the presence of a detectable change in colour and clarity and foams and scums*". It would have been appropriate in our view to have surveyed actual and potential recreational users of the lower Makarewa and Oreti rivers and associated estuary to gauge the effect of the discharge on their use and perception of the local environment.

Recreational use and value (page 6)

While the report acknowledges that the discharge has "*the potential to contribute to the cumulative negative effects of the wider catchment on the recreational values of these waterways by altering water quality and biological communities*", as previously stated above, we consider it would have been appropriate to conduct actual surveys of recreational users and groups in order to accurately assess the level of effect on these parties.

Section 3: Targets for Receiving Environments (page 9) (note the title of this section has been altered to **"Receiving Water Quality"**)

Section 3 of the report addresses proposed targets for water quality and biological communities in the receiving environment.

Table 3, which is titled "Proposed target state for the receiving environment", is confusing in some respects as it is unclear what the proposed 'target state' is for some parameters (the table uses the word 'limit' rather than target) and whether these are to apply after reasonable mixing and if so how the latter is defined. Further, it seems to us unwise to ignore regional water plan water quality standards, as has been done in several instances. The introduction to this section has been altered to explain more clearly its purpose. New tables 4 and 5 has been added.

Should not the clarity row for Table 3 also include the Southland water plan standard?

pH (page 9)

Please explain why a pH range of 6-9 is "suited to the lowland river receiving environment"? This paragraph has been amended to include the comment: "*The Southland Regional Water Plan (SRWP) has a limit of 6.5–9.0 and has been selected as the target for the receiving environment.*".

Dissolved oxygen (Page 9)

The statement: "*Considering the invertebrate and fish community present in the lower Makarewa River, which is composed of more water quality and habitat tolerant species, the NPS-FM (MFE 2014) bottom lines for DO are considered appropriate and have been selected for assessing the effects of the discharge.*" requires some further explanation. This text has been amended as has the recommended DO minimum levels in new Table 5. The statement appears to indicate that assessing against the Southland Regional Council water plan dissolved oxygen standard is considered unnecessary.

Colour and clarity (Page 10)

It would be useful in this section to provide some guide on the relationship between turbidity (expressed as NTUs) and clarity (expressed as visual sighting distance). The text has

been updated and the comment made that "*The discharge and river TSS and river clarity (by clarity tube) is currently monitored by Alliance. Turbidity has been monitored in the 2014 – 2015 processing season.*". The current wording may be confusing to readers unfamiliar with these concepts. The discussion on % reductions in clarity does not necessarily equate to proportional reductions in NTU readings.

There is no commentary on the Southland water plan standard for clarity for this section of the river.

The argument provided in this section along the lines of, 'because water clarity has not been assessed as an important characteristic of the lower Makarewa River, and is already low, so an additional significant reduction in downstream clarity is an acceptable guide for assessment', is not sound in our view. The assessment should be effects based. The text on this matter has been amended.

Foams and scums (page 10)

The statement: "*The recreational use of the Makarewa River within and immediately beyond the mixing zone is limited and for this reason the proposed limit for foams and scums is 'no conspicuous' foams and scums*" could be regarded as a circular one if the limited recreational use is due in part to issues such as the presence of foams and scums. However, a lack of recent information on recreation user perception of the area prevents a more critical assessment from being reached. Further clarification on the reasoning behind this assessment has been provided.

Amm-N (page 10)

This section states: "*Regional councils are required to adopt the NPS limits and for this reason the NPS (MFE 2014) Amm-N bottom line has been selected along with the Amm-N limits derived by Freshwater Solutions (2014b) for assessing the effects of the discharge.*". We think this statement should be clarified as it implies that adopting the NPS bottom line attribute state is appropriate. Our understanding is that a regional council can adopt a higher water quality attribute state if it considers it appropriate to do so.

Appendix 1 of the report (see below) addresses in detail ammonia limits for the Makarewa River.

DIN, DRP, TN and TP (page 11)

This section notes that Robertson and Stevens (2013) estimated that the TN load to the New River Estuary from the catchment would need to decrease by between 69–84% compared with present loadings to reach the 'moderate state'. However the report uses a Southland Regional water plan policy to improve degraded lowland rivers by reducing nitrate and phosphorus by ≥10% before January 2020, for assessing the effects of the discharge.

As a general comment, we consider the report authors need be careful that they are not seen to be 'cherry picking' water quality targets to suit the discharge character. That is one reason why we recommend that the discharge be assessed against all relevant regional water plan standards regardless of whether the authors consider them to be appropriate or not.

Macrophytes (page 13)

The comment under this section that: "*NIWA (2012) recommended provisional guidelines for macrophyte cover (Table 4) and these could be adopted for assessing the effects of the discharge but its application depends on whether they are a nuisance species…*" could be followed by a short commentary on whether any macrophyte species observed at the monitoring sites are deemed to be nuisance species. The text has been amended slightly.

Benthic Invertebrates (MCI, SQMCI, QMCI) (page 13)

It is not clear from the commentary in this section why an invertebrate index for soft-bottomed habitats has not been considered. These would appear more suitable for comparative purposes than MCI, SQMCI, and QMCI. Further explanation has been added as to why hard bottom score have been used.

Section 4: The Effects of the Current Discharge

As a general comment, we think that the assessment of the ecological effects of the discharge would have benefited greatly by the inclusion of targeted Whole Effluent Toxicity Testing (WETT) to assess the toxicity of the effluent on various freshwater species. We feel

this would help address some of the concerns surrounding the difficulty in distinguishing the effects of the discharge from those associated with changes in habitat caused by tidal influence and substrate character. It would also help address the actual effect of effluent toxicity, particularly ammonia toxicity, given the importance of this parameter in driving decisions regarding future wastewater treatment options. We note that the report now includes the results of WETT testing of the Lorneville Pond 6 effluent undertaken in 2002.

4.1 Water and Sediment Quality (Makarewa and Oreti Rivers) (page 15)

The sentence: "*At the median TSS load (580 kg/day) and median Makarewa River flows at the 200 m Site (7.65 m^3/s) the contribution from the discharge TSS to the Makarewa River amounts to <1 g/m^3, which is considered unlikely to result in a significant reduction in clarity or any effect on aquatic biota.*" is unhelpful. Using median values to assess instream effects is always likely to describe only part of the situation. It would be more appropriate in our view to have described typical worst case situations of a low river flow in combination with a high and/or typical TSS loads. Further, the relationship between suspended sediment concentration and water clarity has not been described for this environment. The comment about an apparent lack of long-term trend in clarity should be backed up with an appropriate trend analysis. Further text has been included to clarify the above assessment.

New River Estuary (pages 16 and 17)

It would have been useful to have viewed the full 2014 report by Coast and Catchment referred to in this section of the report.

4.4 Fish

The first paragraph states: "*The Southland Region Fish Integrated Biological Index (IBI) score for the site immediately upstream and downstream of the discharge was 58 placing the sites in the 'excellent' class.*". It would be helpful to describe exactly where these sites are located and what methods were employed to undertake the assessment (field surveys or desk analysis)[This information has now been provided]. I could not find a reference in the references cited that helped in this respect.

The following statement appears on page 22: "*However the river water clarity is low upstream of the discharge and the benthic invertebrate community in the lower river has few benthic macroinvertebrate taxa that can potentially enter the water column and thus food that trout would visual feed on in the drift is likely to be low. The overall effect of the discharge on visual feeding efficiency is therefore expected to be minor*.". The conclusion that that effects would be minor is questionable given that brown trout are largely visual feeders. How would a significant reduction (i.e., 33-50%) in water clarity of already low clarity river affect visual feeding by trout on small prey species such as whitebait? Further text has been included to clarify the above assessment.

4.5 Recreational values (page 23)

This section is rather speculative and supported by few facts or scientific assessment. It is more opinion based rather than an assessment based on the results of targeted studies of recreational use and values.

Section 5: The effects of the discharges and mitigation required (page 25)

A summary table showing the recommended mitigation relating to individual issues is recommended for inclusion at the end of this section, or else as an executive summary at the start of the report.

We have some concerns surrounding the discussion about appropriate ammonia standards on page 27, however we accept that these are matters that may need to be considered more thoroughly through the consenting process once application documents are lodged with the regional council. It would be useful to include a figure showing ammonia concentrations at upstream and downstream monitoring sites. DIN concentrations are shown in one figure in one report, but not ammonia. Such a figure would help put the change in downstream ammonia concentrations into perspective and, in terms of NPS attribute states, enable an examination in the potential change in ammonia state as a result of the discharge.

Table 6 on page 28 is in relation to ammonia and the title should reflect this (currently titled: 'Reductions required to meet NPS limits for 80% species protection') and units should be specified in the table.

New River Estuary (page 29)

The purpose of the first paragraph is unclear. The statements : "*While the recommended reductions would result in an improvement in water quality and reduce loadings, on its own it is unlikely that any change to the discharge quality will result in an observable improvement in estuary eutrophication. The reduction of 69–84% could only be achieved through a catchment-wide reduction of nitrogen loads.*" may be correct, however arguably every farm operation in the catchment is in the same position. If the intention of this section is to put the discharge of nitrogen (and other contaminants) from the Lorneville Plant into some sort of catchment context, then in our opinion, the report should endeavour to address more widely the regional council's approach and policies towards catchment management issues such as nutrient limits and effects on Southland estuaries. Arguably, such an analysis may be better suited to another section of the AEE rather than in this technical report on effects. The following text has been added to this section: "*The assessment of effects report prepared by Mitchell Partnerships Ltd addresses Alliance's proposed approach to the catchment wide management of nutrients proposed by the SRC.*".

5.8 Recreation (page 31)

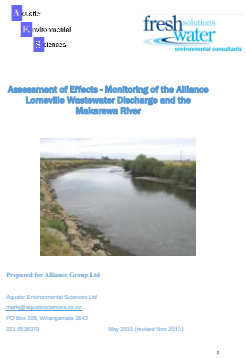
As previously noted, we find the comments about effects on recreation to be largely the opinions of the authors rather than being based on any actual feedback from existing or potential recreational users of the area.

APPENDIX 1: Ammonia Limits for the Makarewa River

Appendix 1 provides an overview of ammonia limits with the purpose of deriving limits that are 'suitable' to be applied to the Makarewa River downstream of the Alliance discharge, and that can be used for the purposes of evaluating potential treatment system upgrade options.

A case is made for rejecting use of the ANZECC (2000) ammonia trigger levels and NPS (2014) numeric attribute states. Instead, new ammonia limits have been derived for the Makarewa River using ANZECC (2000) methodology and including more recent, relevant ammonia toxicity data. The case for developing alternative ammonia limits is well presented, although detailed and relatively complex. It is acknowledged in the appendix that the practical application of these limits requires an understanding of diurnal pH and temperature patterns in the Makarewa River.

It is likely that the issue of ammonia will attract considerable attention through the reconsenting process.



Assessment of Effects – Monitoring of the Alliance Lornville Wastewater Discharge and the Makarewa River

Submitted to: Alliance Group Ltd

Aquatic Environmental Sciences and Freshwater Solutions

February 2015, revised November 2015

Note: Text in the body of this report has been largely unaltered. Some additions have been included at the end.

Background (page 1)

This introductory section clearly explains the background to the report and its purpose, which is to provide a monitoring plan to be used for the basis for the AEE and development of consent conditions.

Monitoring (page 2)

The recommended monitoring approach is that the monitoring be undertaken in accordance with an environmental monitoring plan, agreed in consultation with Environment Southland, and that the monitoring plan be made a condition of consents. This is an appropriate approach that we are familiar with and has been employed successfully for other discharge consent monitoring. Each section of the monitoring is helpfully set out with a clear statement of the purpose of monitoring, existing monitoring and the monitoring that is proposed, and the limits that the data will be assessed against.

Discharge monitoring (page 3)

Discharge samples are currently collected daily or weekly for a range of water quality parameters depending on the time of year (pages 2 and 3). It would be helpful if this information was summarised in a table, showing what parameters are monitored at what time of year and at what frequency (e.g., daily, weekly). Changes to the existing monitoring

programme are recommended (page 4), including adding weekly *E. coli* sampling, volatile TSS, additional TP and TN measurements. Changes to the period of monitoring are also proposed. At this stage we have not considered in any detail the merits of these recommended changes, but expect that they will be considered more thoroughly as a part of the consent application process.

Monitoring of receiving waters (page 3)

Changes are proposed to the receiving water monitoring sites (page 4), including replacing the upstream monitoring site with one that is largely beyond the influence of tidal influences, changing the name of the '200 m downstream site' to '350 m downstream' and discontinuing monitoring at the Boundary site as a compliance site.

In general the merits of altering monitoring sites will need to be examined through the reconsent process, however we question the merits of some of the recommendations and suggest some more justification or explanation is required. For example, there may be merit to have an upstream site that is tidally influenced as well, provided it is not influenced by the discharge (via tidal flow upstream). Also, rather than changing the name of the '200 m downstream site' to '350 m downstream', it may be more appropriate to relocate the site to where the consent requires it to be, that is 200 m downstream of the discharge.

There may be merit in the removal of the boundary site, as its location downstream of the Tomoporakau Creek confluence means that it is influenced by other inputs. One appropriately located upstream monitoring site and one downstream site may be sufficient to provide enough information to assess the impact of the discharge, if monitoring is undertaken regularly. However, some further consideration of monitoring sites is necessary before firm conclusions can be drawn.

A number of recommendations are made in the report relating to changes in the monitoring programme relating to the discharge and the receiving environment. While we have a view on the pros and cons of some of these recommendations, we have not presented them here

given that the reports are pre-application documents only. We have, however, made comments on the following parameters:

Dissolved oxygen: We think that consideration should be given to continuous (logged, 15 minute) monitoring of dissolved oxygen at the site immediately downstream of the discharge.

Ammoniacal-N toxicity: The proposed limit is an annual median of <1.9 g/m^3. This does not meet the NPS-FM national bottom line requirement for less than 1.30 g/m^3. Additionally the NPS-FM has an annual maximum bottom line of 2.20 g/m^3, however no annual maximum is recommended for the Alliance consent. The reasoning stated for this is the most sensitive species are not commonly found, if at all, below the mixing zone. Has consideration been given to the presence of brown trout?

Sediments: Sediment sampling for TN, TP and TOC was required 200 m upstream and downstream of the discharge within 18 months of the existing consent and, as there is some indication that levels are elevated within the mixing zone, it has been recommended that this is repeated every five years (page 8). Have limits been specified for the three parameters?

Biological sampling and analysis (page 8)

Long term regular monitoring of the benthic macroinvertebrate and periphyton community is not recommended based on the type of habitat and tidal nature of the river in the vicinity of the discharge (page 8 and 9). Benthic macroinvertebrate and periphtyon monitoring is instead only recommended before and after any major upgrades to the waste water treatment system. However, given the observation that elevated nutrient levels in sediments could potentially increase macrophyte growth (page 8), and the type of habitat present, consideration should be given to some long term monitoring of macrophyte cover and community composition. Consideration should be given in the report to a limit for macrophyte cover (e.g., maximum 50% cover).'

A survey of the health of resident fish species is recommended within 5 years of the consent and also before or after a major upgrade (page 9). More detail is required on what this survey will involve in terms of the fish species to be included, the number of individuals required to be sampled, and how health is to be determined. This information has now been provided.

Habitat enhancement is recommended as mitigation, although minimal detail is provided, and it is suggested that a habitat enhancement plan be prepared (page 9). Such a proposal may have merit, but such a plan should have a clear aims, a timeframe for implementation and specify a means of evaluating its success.

Overall the plan would benefit from a table that clearly summarizes the monitoring that has been recommended, when it is to be undertaken, and the limits that relate to it.

Tables (as appendices) have now been included outling the proposed monitoring programme.

Alliance Lorneville – Summary Report on Alternatives and Proposed Upgrading of Wastewater Treatment Plant

Prepared for: Alliance Group Ltd. – Lorneville Plant

Pattle Delamore Partners Ltd.

October 2015 (version 2)

This report summarises the technical waste minimization and waste treatment solutions available to Alliance Lorneville to mitigate the effects of the wastewater discharge to the Makarewa River.

In general, the report lives up to its stated purpose and provides a good historical overview of wastewater sources and treatment at Lornville, and options for managing waste streams and wastewater treatment moving forward.

The report is very clear in stating that a key driver determining treatment upgrade options is the recommendations in the 2014 report of Freshwater Solutions and Aquatic Environmental Services regarding improvements in the contaminant levels in the wastewater discharge to the Makarewa River, namely:

i. a 75% reduction in ammoniacal nitrogen from 2012/13 season levels;
ii. reductions in phosphorus commensurate with catchment targets;
iii. long term improvement in microbial quality of the discharged treated wastewater as part of catchment-wide plans to reduce levels of microbial contaminants; and
iv. reducing risk of scums and foams at the point of discharge.

The report outlines how projected wastewater flows and contaminant loads were determined and used for assessing treatment options.

The report notes that the ammoniacal nitrogen in the final discharge would need to be below 55 g/m^3 during peak discharge to achieve a 75% reduction in nitrogen. This compares with an average concentration of ammoniacal nitrogen in the final discharge for the 2013 season of 137 g/m^3.

Options for the treatment of contaminants other than ammoniacal nitrogen are discussed.

Section 3.4 (Environmental Investigations undertaken) now includes reference to a PDP report on groundwater and surface water monitoring (PDP, 2015).

Section 3.7.5 (Land Treatment Systems for Nitrogen Management) has been expanded signficantly with additional text.

Section 4 (Page 28) of the report presents an proposed approach for upgrades and a preferred treatment option, driven largely on need to significantly reduce the existing ammonical nitrogen concentration in the discharge. The report's final recommendations in **Section 5** (Page 34) revolve mainly around the need to undertake further assessments around the implications of a treatment upgrade, rather than committing to a particular treatment method. These include the acceptance of the relevant site-specific limits derived for ammoniacal nitrogen through the resource consenting process.

Finally, the report includes a useful appendix summarising the various treatment technologies which could potentially be implemented at Alliance Lorneville.

In general, we have no major concerns with the content of this report, which is an overview useful of treatment options and the rationale behind their consideration or rejection for the Lorneville Plant. We note that a complete land disposal option was rejected on the basis of cost.