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5 April 2016

our ref: 6881

Environment Southland
Private Bag 90116
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Attention: Joanna Gilroy

Dear Joanna

RE: ALLIANCE GROUP LIMITED – LORNEVILLE FURTHER INFORMATION REQUEST

Thank you for your emails received on 22 and 23 March 2013 requesting that further information is required for the processing of the Alliance Group Limited. We have reviewed the requests and provide the following response:

Ryder Consulting Report on Abstraction of surface water

We have reviewed the feedback provided by Ryder Consulting (Ryder) on the report prepared by Freshwater Solutions Limited with regard to Alliance's proposed water abstraction (submitted on 17 February 2016). We have identified the following key issues raised as part of Ryder's review and respond in turn below:

1. **Clarify why the survey was carried out at higher flows than ideal?**

   The survey was undertaken on 8 December. The river flow on the day of the survey was approximately 26 m^3/s. The annual median flow for the Oreti River at Wallace town is approximately 28 m^3/s. The flow record for the months leading up to the survey show that there had not been a FRE3 (3x annual median flow) in the 7 - 8 week period prior to the survey. Freshwater Solutions Limited have advised that they regard the timing of the survey as having been undertaken under typical spring/early summer conditions and that all results are therefore robust.

2. **Locations of survey sites?**

   It was intended to try and sample sites closer to the abstraction point however there was no comparable or suitable riffles within the section of river immediately downstream of the abstraction so instead the first riffle downstream of the abstraction was sampled to ensure that all sampling was undertaken in the same habitat and to avoid habitat confounding the assessment of the potential effects of the abstraction.

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3. **Why no bypass for fish is proposed?**

With the low probability of fish entrainment due to the location of the take relative to the river and the fine mesh screen sized being proposed Freshwater Solutions Limited do not consider that a fish by pass is necessary.

4. **What were the tide conditions during the sampling, why was the sampling not undertaken during low tide when maximum effect is expected?**

The tide conditions were not relevant to the assessment as the sampling was undertaken in the section of river where there is no or minimal effect from the tide.

5. **Clarify whether the take was operating at the time of the sampling?**

The water take was operating during the survey, at an average rate of 145 l/sec. However it is not considered that whether the take was operational or not on that day is relevant to the overall assessment results. This is on the basis that the water quality and biological measures are reflective of the cumulative effect of the abstraction in the weeks and months leading up to the survey and not what was occurring on the day.

Further Comments from Lowe Environment Impact (LEI) 23 March 2016

We have also reviewed the further comments/points of clarification that were received from LEI on 23 March 2016. We have provided a response to these matters in the table below.

No.	Issue	Clarification Required	Further Information Response
AEE #26	Proposed a reduction in the boiler discharge limit (after five years) to 250 mg/m3. Section 8 of the AEE does not provide sufficient detail as to how this reduction will be made. Given this reduction is within the scope of the current application, the details of the upgrade required to meet the lower proposed	Supply further details on upgrade to meet proposed reduced limit.	Alliance is committed to achieving a reduction in the boiler discharge limit to 250mg/m^3 by Year 5 of the air discharge consent being granted. This commitment is secured by the proposed conditions of consent (refer condition 12 of the proposed air discharge conditions). As outlined in the Coal Fired Boiler Discharge Assessment Report (Appendix M) this limit could be achieved by the use of

	concentration limit should be specified.		improved boiler automation, oxygen control and a possible upgrade of coal fired boiler #1 multi-clone. Alliance will investigate the best practicable option (BPO) for achieving the limits as proposed, and will seek to ensure compliance with the limit as proposed via the conditions.
AEE #27	The discharge to water limits are lower than both the ANZECC (2000) 80% trigger value and the USEPA (2013) chronic criteria, and only slightly higher than the Freshwater NPS attribute state, which was set to provide 80% species protection. Due to the unsuitable nature of the habitat within the Makarewa River, most sensitive species are not commonly found, if at all, below the mixing zone, and thus the site-specific value is considered an appropriate limit for this river. A higher level of treatment is feasible.	why	The assessments relating to water quality have determined that the existing wastewater discharge is not having a significant adverse effect on the quality of the water downstream of the Plant, when compared to upstream results. There is a slight reduction in water clarity downstream of the discharge, however there is no evidence from fish, algae and benthic invertebrate surveys that the discharge is having any adverse effect on downstream water quality and habitat. The results indicate that the water quality and habitat is consistent with a typical low land river in Southland. Although the monitoring and

			assessment of the receiving river has not identified any measurable adverse toxicity effects that are directly attributable to the discharge, it has been recommended by Alliance's advisors that the current wastewater discharge quality needs to be improved to be able to meet a site specific in-river ammonia target and enable the achievement of the bottom line value in the National Policy Statement for Freshwater within the wider catchment. The higher protection limit referred to by LEI is for sensitive species which do not currently exist in this environment, and as such a higher threshold or limit is not considered to be necessary in this instance.
AEE #28	There seems to be some confusion as to whether wastewater irrigation will continue once the BNR plant is operating and WAS is being generated and spread on farmland.	why	As outlined on page 13 of the AEE and in the proposed conditions, once the upgraded wastewater system is operational, Alliance will no longer dispose of wastewater to land via irrigation, and will instead dispose dewatered biosolids to

			land. The discharge of biosolids to land would only commence once the irrigation consent has been surrendered. The total period for the discharges to land would not exceed a period of 35 years.
AEE #30	A number of BPOs are mentioned in the AEE but there is no certainty that any will be adopted as adaptive management is proposed, e.g. sulphide reduction in fellmongery, bio-gas capture from anaerobic pond, agitation of raw sludge, the use of lime at the monofill, the covering of the monofill, good management practices to reduce odour during sludge spreading	Upgrade plan as part of this process, with triggers as to when upgrades are required, as well as Sludge Management Plan and other Management Plans	The proposed conditions are intended to provide certainty that Alliance will take the appropriate steps to investigate and implement a comprehensive upgrade to its wastewater system. Alliance would like to allow flexibility in terms of the technology that is investigated and finally selected in achieving the upgrade and would prefer that this investigation is only completed once the security of the consent is in hand. The conditions however require that the upgrade deliver certain standards in terms of discharge and water quality and this provides the certainty that Alliance is committed to achieving an upgrade to improve its wastewater quality. A flow chart outlining the likely steps required to investigate

			and implement an upgrade is however attached as Annexure 1 to this response. As indicated above, this is for indicative purposes only and the specific details and technology involved in the upgrade are yet to be determined at this stage. With regard to the management of odours it is noted that adaptive management regimes are not designed to provide certainty that a specific odour option will be adopted, as operation information and experience are needed to clarify what control measures will eventuate as the BPO. A key trigger in an odour adaptive management plan would be community feedback or complaints regarding any odour effects. The timeline and process for managing fellmongery odours is outlined in the report attached as Appendix R, and further details regarding maintaining the BPO for odours is outlined in Appendix G of the application documentation.

AEE #31	No ammonia limit in discharge water monitoring	Why	There is no discharge limit proposed for ammonia on the basis that there is an effects based in-river limit for ammonia proposed both pre and post upgrade of the wastewater treatment system. It is noted however that there are limits proposed with respect to Total Nitrogen and Alliance is committed to achieving a substantial reduction in Total Nitrogen post upgrade of the wastewater system as indicated in the AEE and via the proposed conditions.
App E #33	The 2013 ambient monitoring was undertaken in a wet winter which may have underestimated background PM10 contributions from Wallacetown or Invercargill airsheds.	Provide further information as to expected background source contributions during a more typical winter scenario (drier, less rain).	Golder Associates (NZ) Limited (Golder) is to undertake further analysis of the modelling data to further to confirm the extent of CFB-related ambient PM_{10} impacts in Invercargill on cold winter nights when the background PM_{10} in the urban area is likely to be high. This is expected to be provided by 22nd April 2016.

App F # 34	There are a very small number of survey respondents in some survey groups, which may lead to responses which may be unrepresentative of overall surrounding population	Provide further information to clarify/estimate the overall population resident in the area around the site, and evidence to demonstrate that the responses are reflective of the overall population.	The odour survey in Appendix F necessarily focuses upon subsets of the surrounding population that receive different levels and character of odour impacts from the site. The experiences of the different groups are therefore very different and need to be assessed separately. As such it is not considered appropriate or sensible to try and demonstrate that specific locations surrounding Alliance's Plant would have experiences of odour that are reflective of the wider population. Because experiences of odour are specific to certain locations and there is no single representative experience.
35	The complaints data reviewed (as part of the assessment) was for the period up to July 2014. It is not clear why complaint data for the entire 2014 period was not reviewed. Given the report was updated in October 2015, the full 2014 complaint data set is likely to have been available and should have been reviewed to	All complaint data from 2014 should be reviewed to provide a more complete assessment of trends.	Alliance has provided this information to Golder Associates and it will be analysed and commented on by 22nd April 2016.

	provide a complete assessment.		
App G # 36	The report references a Biofilter Management Plan, but there is no copy of this plan included in the consent application.	Supply the BMP	Management of the biofilter already forms part of the Air Discharge Management Plan refer to section 5.5 of Appendix U.
37	Anecdotal evidence is used to support the conclusion that the management change to process waste releases has reduced odour emissions from the fellmongery. This is not supported by the baseline odour survey report (Appendix F) as there have been no odour surveys conducted subsequent to the management change. It is unclear if there have been any reductions in complaints received after the change. more evidence to support the assertion that the fellmongery management change has resulted in reduction in odour effects.	More evidence to support the assertion that the fellmongery management change has resulted in a reduction in odour effects	Golder Associates confirms that the assessment of the process changes at the fellmongery having alleviated odour issues was originally based on onsite observations made by R Cudmore during 2013 to 2015, and that a noticeable reduction has been achieved is based on his professional judgement. Golder Associates does not consider further work is required in this regard.
38	It is not clearly stated which additional mitigation method is proposed for the fellmongery	what mitigation method is proposed and timeline for implementation.	We can confirm that two options including: • The diversion of segregated pickle liquor

	discharges to air. Two options are mentioned to be BPOs but it is not stated whether they are proposed to be installed. Appendix G says that the applicant is investigating them but there is no timeline provided, and there is no clear outcome as to which method is proposed		wastewater flows to the aerated loop; and • Oxidation of sulphide bearing liquors are recommended as future measures to further manage odour effects. The BPO for managing odours will be investigated as part of the overall wastewater system upgrade and the timing for implementation will be consistent with the upgrade for the wastewater treatment. The proposed conditions require that as part of the Wastewater Treatment Upgrade Plan which will be prepared by Year 5 of the consent odour management for potential odour emissions is a required component.
App J # 39	The sludge generated by the BNR plant will only be dewatered and not digested (as stated in one of the reports). Moreover, only the aerobic sludge will be used. Anaerobic sludge quantities are not taken into account	Clarify sludge and its mineralisation rate. Modelling to be based on realistic mineralisation rates. What happens to anaerobic sludge and pond sludge?	The mineralisation rates for the waste activated sludge is provided in Appendix J – Biosolids Land Disposal Assessment (see Section 2.4). When activated sludge is lagooned for an extended period of time, the nitrogen content reduces from

	within the sludge/SYS land disposal scheme		typically 6% to 3%. This means, about 50% of the nitrogen is mineralised from the waste activate sludge. For the biosolids disposal proposal, 55% nitrogen mineralisation has been proposed. The modelling is based on this cumulative mineralisation rate in steps of 40% (Year 1), 10% (Year 2) and 5% (Year 3). Al-Dhumri (2014) reported that the mean value of nitrogen mineralisation in the case of aerobically digested biosolids to be around 40%, consistent with what has been proposed for Alliance Lorneville land disposal of biosolids. For the anaerobic sludge, from the covered anaerobic lagoon, when sludge management will be required, the sludge would be pumped into the aerobic part of the treatment plant in a controlled manner during the non-processing season to allow further aerobic digestion and then disposed to the monofill and/or to land subject to the climate conditions at the time

			of disposal. In addition, if the anaerobically digested sludge needs to be pumped out during the season, then the sludge would be pumped to the existing anaerobic lagoon for further stabilisation. It is likely that controlled management of the anaerobically digested sludge would be required at 3 – 4 year intervals, generally during the non-processing season. *Ref. Al-Dhumri SA (2014). An investigation into the Mineralisation of Nitrogen and Immobilisation of Carbon and Nitrogen in Biosolids amended Soil. PhD Thesis, RMIT University.*
40	What is the loading, effects and management of phosphorus for WAS/SYS application (i.e. if soil retention is being relied upon what is the site life)?		The phosphorus loading from the WAS is likely to be around 48 kg P/ha/yr based on the biosolids characterisation. The ryegrass pastoral requirements for phosphorus are generally considered to be around 40 -50 kg P/ha/yr. The soils are considered to have a high P-retention and

			continued monitoring will inform the phosphorus retention. The stockyard solids will be applied to land outside of the 180 ha required for the WAS disposal. The Irrigation Monitoring Report for 2012-13 prepared by Soilwork Ltd states that "*compared with optimum values for pasture growth, soil pH remains marginally low and Olsen P concentrations remain low. Applications of lime and phosphorus fertiliser are recommended*". The land application of biosolids will assist with meeting the pastoral requirements for phosphorus.
App M # 41	Based on the modelling predictions, the significance of the contribution is an arguable point. Peak contributions of 4 - 5ug/m3 (24-hr average) in urban areas with high background concentrations would typically be regarded as	5% of GLCs at the Invercargill airshed are not expected to occur on cold winter days when background concentrations are high. Analyse measured PM10 concentrations in Invercargill on days when highest GLCs are predicted. Consider seasonality of CFB emissions.	Golder Associates has considered this request. They confirm that the modelling assessment of short term and long term ambient concentrations is robust and has fully accounted for seasonal variations in boiler emissions. As such they advise that no

	undertake a more robust analysis. Specifically, further examine the AEE's argument that the highest significant, and not "negligible" as stated in the AEE.		further work is required to confirm the report conclusions.
42	Use of 1.5 measured/modelled PM10 ratio may result in underprediction of peak GLCs. Similarly the use of 0.7 ratio for SO2 (rather than 0.9 for the 95th percentile) may result in under-prediction of peak SO2 GLCs.	consider the robustness of peak GLC predictions and amend as appropriate. Discuss typical boiler output profile (hourly averages) during a worst case 24 hour period. Recognise that limited ambient monitoring has occurred at one location only. Discuss uncertainties associated with peak hourly SO2 predictions, and revise as appropriate.	Golder considers the existing background air quality monitoring is sufficiently comprehensive to support a robust assessment of cumulative air quality impacts associated with the CFB discharges to air. They advise that no further monitoring is required and the level of information allows for a sufficiently accurate assessment of background air quality within the Lorneville area.
App P # 43	The hydraulic loading of 50 mm per application event (within 24 hrs) is high, resulting in forced drainage, even if the soils are less than field capacity.	can the return period be lessened with lower application depth? Nothing about PAW of the soils.	A memo has been prepared by SoilWork Limited to address this matter and is attached as Annexure 2 to this response.
App R # 44	The sludge application area shown on Drg 3 is significantly larger than the current wastewater irrigation	Provide soils information for the entire area that sludge is to be spread	The soils information is provided in the PDP Figure 1 Rev F – Alliance Lorneville Proposed Biosolids Disposal Area in Appendix J.

	area shown in the Soilworks Report.		
APP S # 45	Vector attraction to the monofill. No assessment	what effects are likely to be and mitigation	It is unlikely that vector attraction will be an issue for nutrient deficient dewatered biosolids in the monofill when a large naturally crusted anaerobic lagoon is in the vicinity of the monofill. In the event that there is any vector nuisance (fly strike, rodents, mosquitoes), a controlled pest control will be put in place. Bird scare gas cannons for bird control could be put in place to manage birds if this becomes a problem and is considered necessary.
App T # 46	Tables 5.3.2 and 5.5.4 in the EMP do not allow direct comparison between pre and post upgrade	Clarify	The reason as to why the limits relating to total ammonia nitrogen are expressed differently in the EMP and in the proposed conditions is because the pre-upgrade conditions have been maintained as per the current monitoring and limit regime applied on the existing consent and to ensure that the discharge or the receiving river quality is maintained (i.e compliance monitoring can be compared with existing data). Once the upgrade is in place however monitoring in

			accordance with the recommendations outlined in Appendix T has been adopted to ensure it is consistent with the most up to date and appropriate ecological monitoring and reporting requirements. Proposed condition 26 of the wastewater discharge to water also requires that on an annual basis throughout the life of the consent, Alliance is to prepare and submit an Annual Monitoring Report. This report shall include: • A summary of receiving water monitoring results and assessment of compliance with the limits prescribed by this consent; • An assessment of the annual median and 95%ile of the total ammonia nitrogen concentrations in the receiving water against an annual median of 1.9 g/m^3 and an annual 95%ile of 2.4g/m^3 (both at pH 8.0); • An assessment of the annual

			median and 95%ile of the total oxidised nitrogen concentrations in the receiving water against an annual median of 2.4 g/m^3 and an annual 95%ile of 3.5 g/m^3 • A calculation of the annual discharged loads of ammonia nitrogen, total oxidised nitrogen, total nitrogen and total phosphorous and a comparative analysis of these loads against preceding seasons. The purpose of this report is to assess the overall compliance with the limits set out in the consent (both pre and post upgrade), as well as to track improvements in the receiving water environment with respect to the proposed Amm-N and total oxidised nitrogen limits. This will ensure that the discharge from the Plant is not causing any deterioration to the current state of the receiving water environment, and will

			act as a record against which improvements in the discharge quality arising from the upgrades to the Plan can be determined.
47	The new BNR plant is supposed to alleviate the effects from the existing WWTP. Keeping the same discharge limits for most parameters is just allowing for more volume to be treated, not better quality.	Clarify	A significant reduction in Total Nitrogen (TN) and Total Phosphorous (TP) is proposed to be achieved post upgrade of the wastewater treatment. This will result in an improvement in the quality of the discharge in terms of its potential effects on the receiving river environment. No changes to BOD or TSS is proposed, as these are not identified as contributing or causing any adverse effects arising on the receiving water quality. No increase in wastewater volume is proposed as part of the upgrade.
48	Odour monitoring	Needs to be added to EMP	Odour is managed via the Air Discharge Management Plan.
App U #49	No details on meal room extraction system (baghouse; hood extraction). As the meal room baghouse and hood extraction systems form part of the management systems for site air discharges, their	Additional material should be included in the ADMP on meal room discharges management.	Further detail has been provided on this and is contained in the attached Air Discharge Management Plan as Annexure 3.

	management measures should be incorporated into the Air Discharge Management Plan. This would include measures relating to baghouse performance.		
50	There is currently no details provided in the Air Discharge Management Plan on the following performance monitoring as outlined in Section 6.3.7 of Appendix G (process odour mitigation report): Biofilter and raw material reception building fan motor current draw (amps); and Motor and cooling fan hours.	Additional OCS performance measures should be included in the ADMP.	Further detail has been provided on this and is contained in the attached Air Discharge Management Plan as Annexure 3.
51	Odour monitoring	Additional material should be included in the ADMP on the operational procedure for staggered release of fellmongery drum process wastes.	Further detail has been provided on this and is contained in the attached Air Discharge Management Plan as Annexure 3.
Conditions	Ammonia, other forms of nitrogen and DRP limits on wastewater are not included	Provide values for condition	The proposed conditions impose limits on Total Nitrogen and Total Phosphorous which is intended to provide the most useful and overarching indicator of the quality of the discharge. As noted in the proposed conditions, specifically Schedule A1 additional

			parameters including (Ammonia and DRP) will be monitored and the results of this can be provided to Council, however it is not considered appropriate or necessary to impose a limit for these parameters on the basis that there are limits proposed for in-river monitoring with regard to ammonia and nitrate levels to determine the potential effects of the discharge on toxicity in the receiving water.
	TN, TP and DRP are not included in river water monitoring	Provide triggers	Alliance has no control over the other inputs into the river system relating to TN, TP and DRP, however there is a limit on the discharge with regard to TN and TP to determine the quality of the discharge prior to it entering the river system. There are also currently no limits on TN or TP in the NPS for Freshwater Management so it is not considered necessary or appropriate to include limits on these parameters.

We trust that this information will enable the continuation of the processing and public notification of the various consents can occur as soon as possible. Should you wish to discuss or have any queries please do not hesitate to contact the undersigned directly.

Yours sincerely,
MITCHELL PARTNERSHIPS LIMITED

CLAIRE HUNTER

Email: claire.hunter@mitchellpartnerships.co.nz

cc: Frances Wise Alliance Group Ltd

Enc

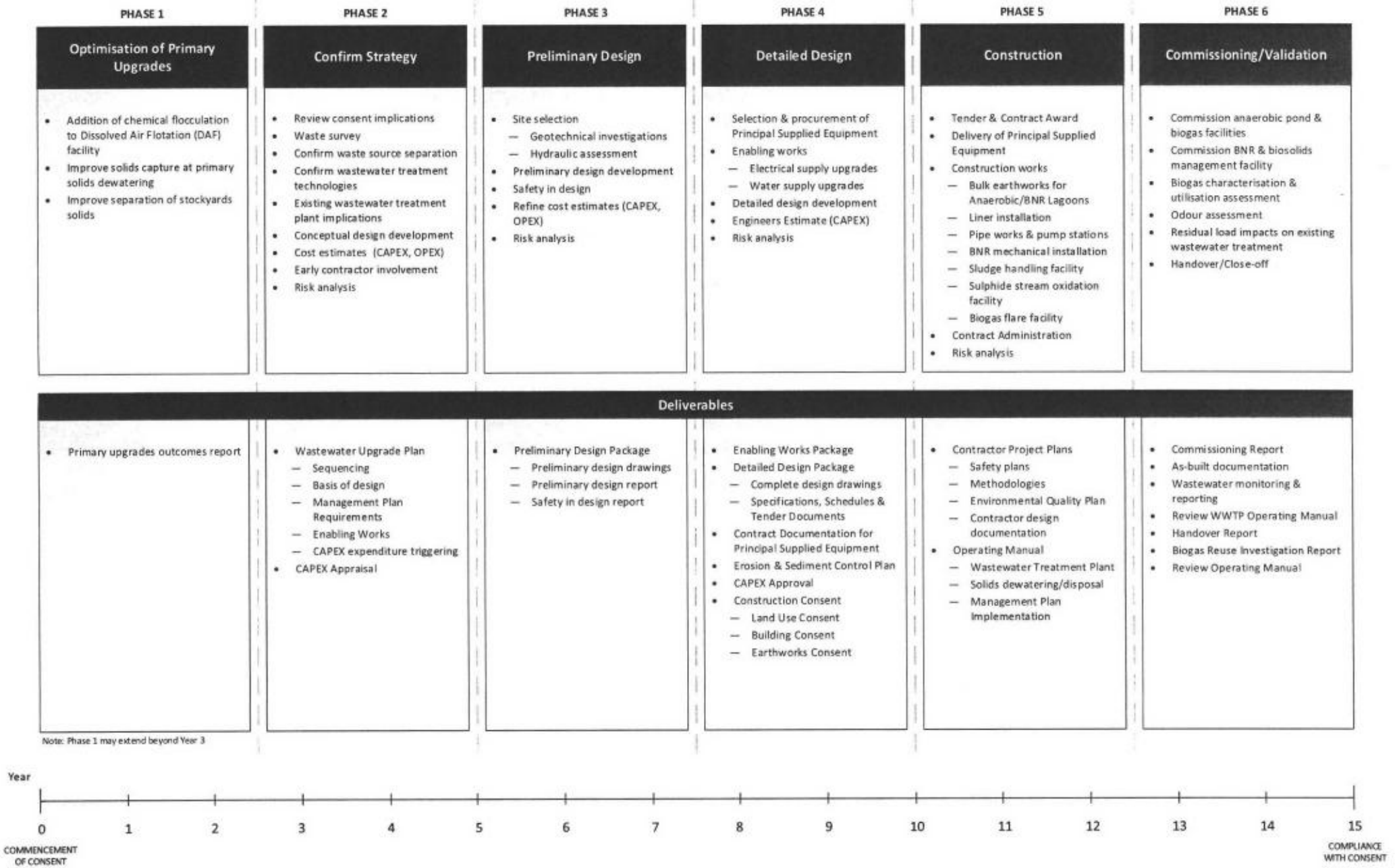
ANNEXURE ONE

Indicative Flow Chart of Wastewater Treatment Upgrade Components

PRELIMINARY

ALLIANCE LORNEVILLE CONSENTING PROGRAMME
WASTEWATER TREATMENT PLANT UPGRADE DESIGN & IMPLEMENTATION MASTER PLAN

Prepared by PDP (5 April 2016)
(A01856202G002)



ANNEXURE TWO

Memo From SoilWork Limited

SOILWORK LTD
Professional Soil Consultants PO Box 5908 Dunedin NZ Ph 03 467 9560

ALLIANCE GROUP LTD, LORNEVILLE PLANT:

WASTEWATER IRRIGATION: MEMORANDUM TO ADDRESS LOWE ENVIRONMENTAL IMPACT REVIEW

Prepared for

Alliance Group Ltd, Lorneville Plant
Invercargill
New Zealand

By P. B. Greenwood

October 2015

INTRODUCTION

This memorandum was prepared in order to address wastewater irrigation-related matters noted in the Lowe Environmental Impact (LEI) review of Alliance Group Ltd's wastewater treatment plan. It should be read in conjunction with that LEI review (20 August 2015).

HYDRAULIC LOADING

Although a hydraulic loading of 50 mm per irrigation event seems high compared with some other local wastewater irrigation systems, in this case it is not considered to be too high.

1. Soils within the irrigation area have recently been mapped as a part of this overall consent investigation and a summary soil map is shown in Appendix 1. The map shows that soils within the current 102.6 ha irrigation area comprise mostly Edendale silt loam, Waikiwi silt loam, Woodlands silt loam, and Mokotua silt loam. These are grouped into 'Zone 1' soils that occupy approximately 93.6 ha of the total 102.6 ha area. The irrigation area also contains a comparatively small area (9 ha) of poorly drained soils (mostly Dacre and Tisbury) that are grouped into 'Zone 2' soils. There are some minor, unmapped, areas of poorly drained Tisbury soils contained within the Zone 1 area.

   Overall, therefore, approximately 91% of the irrigation area comprises Zone 1 soils. Water holding capacities of the soils in this zone are categorised by Landcare Research as either high (Woodlands soil) or very high (Edendale, Waikiwi, Mokotua soils), and vary between 107 mm and 117 mm. For the Zone 2 Dacre and Tisbury soils, water holding capacities have been categorised by Landcare Research as very high, and are 164-178 mm.

   For all of these soils, therefore, the application depth of 50 mm is less than 50% of water holding capacities.

2. Wastewater irrigation at this site only occurs over a period of approximately 50 days each season (average 51 days for the most recent five seasons), and this occurs during the summer and early autumn period (mostly mid to late January until early April) when seasonal soil moisture conditions are driest.

   Although results of daily sol water modelling for the most recent season (2014-2015) showed that the average amount of extra drainage under wastewater irrigation (120 mm) was equivalent to approximately 84% of the average amount of wastewater applied (143 mm), the additional drainage occurred during significant rainfall events in March-May after the cessation of irrigation

for the season. At the time of those events, soil in the irrigation zone was wetter than for non-irrigated areas, and drainage was increased as a result. In the previous season (2013-2014) the amount of additional drainage in the wastewater areas was equivalent to 57% of the amount of wastewater applied that season. Thus, by the time that the additional drainage occurs, in response to mid-late autumn rain, pasture plants would have taken up a significant proportion of the nitrogen applied in wastewater.

Over the average irrigation period of 51 days, the amount of nitrogen taken up by pasture plants at this site is expected to be at least approximately 160-200 kg N/ha, and this amount is greater than the average amount of nitrogen applied each season in wastewater (average 106 kg N/ha in the most recent eight irrigation seasons. Additionally, it is likely that some of the nitrogen applied in wastewater via sprinklers is lost to the atmosphere by volatilisation because nearly all of the nitrogen is in the form of ammonium-N.

3. Over the previous eight irrigation seasons, an average of 82 mm of wastewater has been applied annually, and this has resulted in an annual increase in drainage of 57 mm. After adjusting for different areas of Zone 1 and Zone 2 soils, this wastewater irrigation is estimated (from lysimeter and drainage data) to have increased the average annual amount of nitrate-N leached by 6.6 kg N/ha. The average amount leached from the overall irrigation area over those eight seasons is estimated to be just 10.8 kg N/ha/yr, thus groundwater nitrate-N concentrations have not subsequently increased. Values at the irrigation and downstream monitoring bores are not higher than at the upstream bore.

4. Throughout the period of soil monitoring to date, soil within the wastewater irrigation area has remained in satisfactory to good structural condition and there has been no evidence of any anaerobic conditions. Hydraulic conductivities within the A horizon of the soil have remained sufficient for full internal transmission of excess water. In this region, such results do not occur if hydraulic loadings of wastewater are too high.

In summary, the wastewater irrigation scheme at this site applies only a small amount of wastewater annually, and applications only occur during the driest months of the year when pasture nitrogen uptake exceeds the amount of nitrogen contained in that wastewater. The average amount of nitrate-N leached each season is low and it has not affected nitrate-N concentrations in groundwater. The soil remains in good condition for further wastewater irrigations. While an assessment of more frequent irrigations using smaller application depths and shorter return times could be made, this is not considered to be warranted based on monitoring data collected to date.

With current diversions of wastewater to the river, and current wastewater quality, the following irrigation parameters are recommended as appropriate for this site:

- The depth of wastewater irrigation shall not exceed 50 mm in any 24 hour period;
- Wastewater is to be applied by K-Line irrigation, at a rate not exceeding 5mm/hr;
- The irrigation return period shall not be less than 15 days;
- The annual nitrogen loading rate for wastewater and fertilisers shall not exceed 250 kg N/ha/yr;
- Irrigation shall only occur when soil moisture content is lower than field capacity .

ZONE 1 AND ZONE 2 AREAS

Monitoring data has shown that, under wastewater irrigation, nitrate-N losses though the soil are higher in Zone 2 areas than in Zone 1. Averaged since 2003-2004, estimated annual losses from Zone 2 and Zone 1 were 14.0 kg N/ha and 8.1 kg N/ha respectively. Although this results in only a small increase in overall nitrate-N losses from the site because the area of Zone 2 soils within the irrigation area is small, it is nonetheless of benefit to avoid the major Zone 2 areas except during dry conditions when the soil can retain the full depth of wastewater applied. Currently, one (Paddock 49) of the three paddocks that contain nearly all of the Zone 2 soils is already excluded from wastewater applications.

It is recommended that Paddock 49 and the northern halves of Paddocks 39 and 50 are excluded from further wastewater irrigations. Together, these comprise most of the Zone 2 soils within the irrigation site. Other, much smaller, Zone 2 areas exist and these should be avoided wherever practicable.

LYSIMETERS

Based on soil physical, water and air movement, and nutrient leaching, experience with lysimeters of various kinds and sizes continuously since 1985 in Southland, Otago, and Canterbury, together with current monitoring of lysimeters installed in several wastewater irrigation sites, I consider that the number of small diameter lysimeters installed at this site is generally appropriate. For each of the six lysimeter monitoring sites (paddocks) here, there are three individual lysimeter installations, and leachate samples collected monthly from the three are bulked prior to analysis to provide six nitrate-N analyses. For small-sprinkler wastewater irrigation systems, I consider that one lysimeter per 5-8 ha (depending on soil type) is adequate. For the Lorneville wastewater irrigation site, there is one lysimeter installation per 6 ha of irrigable land.

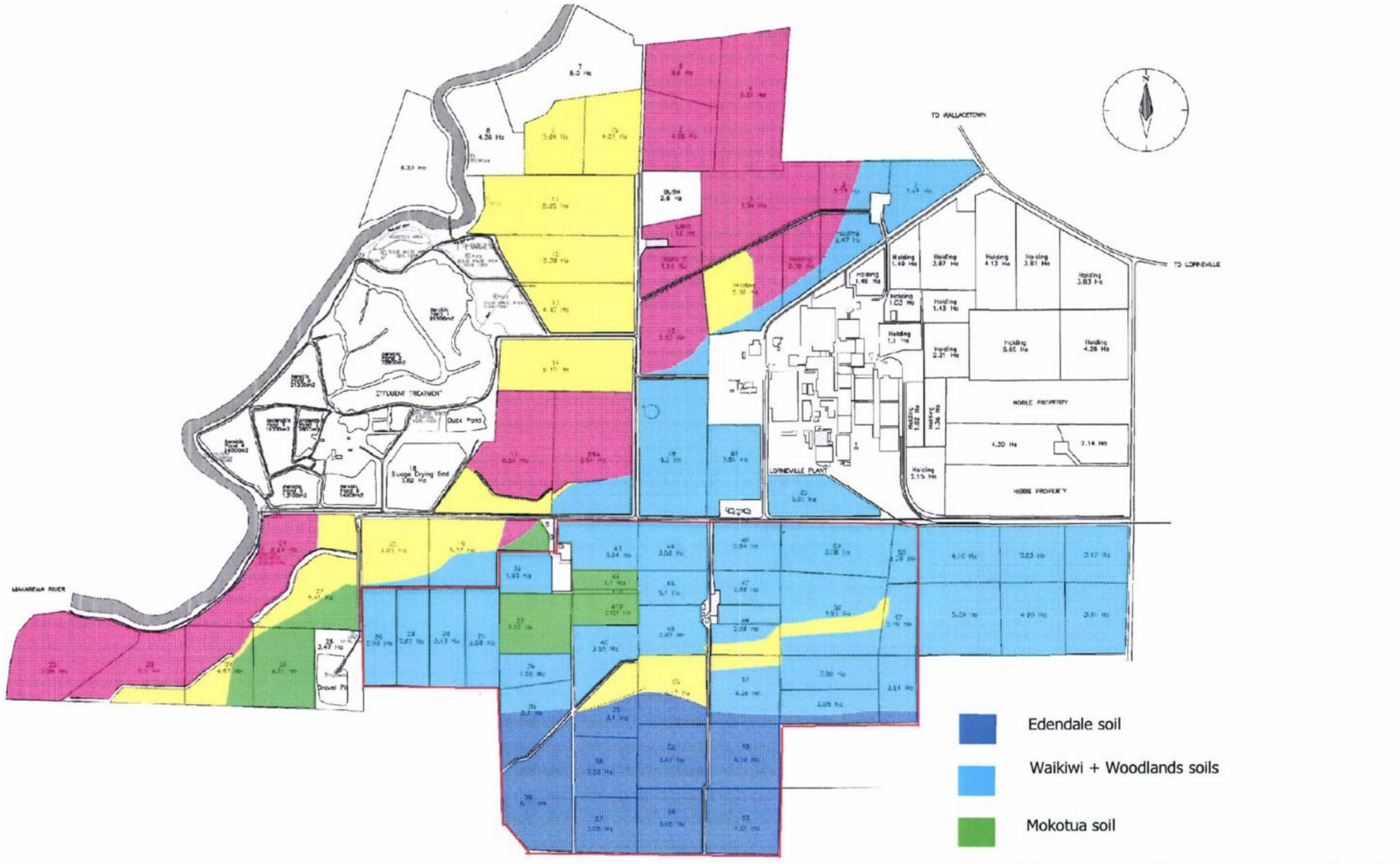
While the current number of lysimeters is considered to be adequate, the distribution of these between Zone 1 and Zone 2 soils is no longer appropriate if the main areas of Zone 2

land are excluded from irrigation as recommended. Additionally, it is not necessary to further assess the difference between these zones in nitrate-N losses through the soil under wastewater irrigation.

Nonetheless, it is recommended that the current Zone 2 installations remain, in order to further assess nitrate-N losses through the poorly drained soils in this area in the absence of direct wastewater irrigation. This will assist in determinations of nitrate-N losses from the wastewater and overall farm areas. For the Zone 1 irrigation area, it is recommended that an additional two lysimeter sites (three individual lysimeters per site) are established in well drained Waikiwi soils. Overall, this will provide eight lysimeter sites (twenty four lysimeters) instead of the six (eighteen lysimeters) that are currently used.

APPENDIX 1

Soil map of Lorneville farm including the current wastewater irrigation area.



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

ANNEXURE THREE

Revised Air Discharge Management Plan

(To Replace Appendix U)

Document Reference	LNV AIR 001
Revision	004
Written By	J ten Hoorn Boer
Date	2016
Page	1 of 14

Contents

1.0 Purpose

The document details the operating procedures, monitoring, and reporting requirements to be followed for the management of odour discharges arising from operations at Alliance's Lorneville site. This plan is a requirement of Consent No XXXX, Condition 5.

2.0 Scope

This procedure applies to the management of odour from all operations associated with the Lorneville site.

3.0 References

Resource Management Act	1991
National Environmental Standards for Air Quality	2011
Ambient Air Quality Guidelines(MfE / MoH)	2002
Regional Air Quality Plan for Southland	1999
Environment Southland Air Discharge Permit	Consent No XXXX
Environment Southland Land Discharge Permit	Consent No XXXX
Environment Southland Wastewater Discharge Permit	Consent No XXXX
MfE Good Practice Guide for Assessing and Managing Odour in NZ	2003
Assessment of Environmental Effects (MPL)	November 2015
Background Ambient Air Quality (Golder)	October 2015
Assessment Of Coal Fired Boiler Air Emissions (Golder)	October 2015
Baseline Odour Survey (Golder)	October 2015
Wastewater Treatment Odour Mitigation (Golder)	March 2015
Process Odour Mitigation (Golder)	October 2015
Odour-Control Biofilter for Treating Rendering Emissions, Agresearch	March 2012
Lorneville Land Irrigation Management Plan	LNV EFT 002
Lorneville Rendering Department Procedure	LNV REN 001
Effluent Treatment Plant Operating Procedure	LNV EFT 001
Services Department Procedure	LNV SER 001
Compliance Issues Register	PRO 117

4.0 Definitions

Term	Definition
Plant	Lorneville Plant including all processing and ancillary functions excluding the farm operation
PDS	Press Dewatering System – low temperature rendering plant
WWTP	Wastewater Treatment Plant
DAF	Dissolved Air Flotation plant

5.0 Actions and Responsibilities

Due to the scope of this management plan, actions and responsibilities shall be covered in individual sections.

5.1 Resource Consents

The Lorneville site operates under a number of Resource Consents issued by Environment Southland and Southland District Council.

The activities associated with the discharge of contaminants, including odour, to air are covered by the following resource consent:

Environment Southland Air Discharge Permit (Consent no. XXXX)
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.

Expiry date: XXXX

5.2 General Conditions

5.2.1 Operational changes

Any proposed changes to Plant operations are to be assessed against the Assessment of Environmental Effects (Nov 2015) and the supporting Technical Reports. Should any proposed change be inconsistent with these documents the need for a new or varied resource consent should be considered.

The need for a new or varied resource consent should also be considered if a proposed operational change is likely to significantly adversely alter the nature or quality of contaminants emitted or the effects of those emissions on the environment. (Condition 2)

It is the responsibility of the Plant Manager to seek the appropriate advice should changes be proposed.

5.2.2 Open burning

There can be no burning of trade waste in the open on the Plant. Paper or wood waste only (eg: wooden pallets) can be burnt in the concrete lined ash storage bunker adjacent to the Wastewater Treatment Plant. (Condition 4)

Burning of rubbish is the responsibility of the Services Supervisor and this condition is addressed in LNV SER 001.

5.2.3 Operational malfunctions

In the event of the malfunction of an item of plant or equipment which may result in emissions of offensive odours beyond the boundary of the Plant, production personnel shall notify the Environmental Coordinator who in turn shall notify Environment Southland immediately of the potential for offensive odours to be detected beyond the Plant boundary. ES should be advised of any contingency measures put in place, the measures being taken to correct the malfunction and the expected timeframe for this to occur. (Condition 3)

Should an offensive odour beyond the boundary be reported then the Environmental Coordinator is to prepare a report to ES detailing the cause of the malfunction and the action taken, or any action proposed, to avoid a recurrence of the problem. This written report is to be lodged with the Council no later than 25 working days from the time of the odour complaint. It is the responsibility of the Environmental Coordinator, in conjunction with the appropriate plant personnel to ensure that any identified corrective and preventative actions are carried out. (Condition 28)

5.3 Boiler Plant Operations

The Plant operates two lignite coal fired boilers to provide its steam and hot water requirements. They are the 18 megawatt Babcock and Wilcox (No1) and the 12.7 megawatt Foster-Wheeler (No 2) boilers.

Their operation is seasonally impacted with maximum steam demand expected to be between December and May. Maximum coal rates are: No 1 = 7.23 t/hr; No 2: 4.57t/hr; and maximum steam production rates at 8 Bar are: No 1 = 26.65 t/hr; No 2: 18.80 t/hr.

Lignite coal (Industrial Blend) is currently supplied by Solid Energy from its East Southland Newvale mine. It has a calorific value of approximately 15 MJ/kg and a sulphur content of 0.4 – 0.5%. Other contract conditions include: Total moisture; 40-45%: Ash; 3.5 – 6%: Fines <3.35 mm; 20% maximum: Top size; 40mm.

Opportunities for servicing and certification generally occur when processing has ceased or significantly reduced to where one boiler can supply the Plant's requirements.

The Boiler Plant operation is documented in the Boiler House Operating Procedure (LNV BLH 001). Four hourly process control checks are recorded on the Service Log (Form 1206) and any variations from standard operating requirements are recorded on the Non-Conformance Report (Form 1212).

5.3.1 Stack height

The height above the surrounding ground level of the two boilers is not to be reduced below their current height: No1 Boiler (Babcock and Wilcox); 30.9m; No 2 Boiler (Foster-Wheeler); 34.1m. (Condition 6)

5.3.2 Coal sulphur

A grab sample of supplied or stored coal is to be collected every week and analysed for combustible sulphur percentage of weight of coal on both an as-received and dry basis by a laboratory certified by IANZ for this analysis (EG:SGS).

The coal sulphur content is not to exceed 0.5 wt% on an as received basis. The Environmental Coordinator is to check individual results for compliance, summarise the results annually and report to ES by the 30th November each year with a comparison against the limit. (Condition 7)

Prior to accepting a new coal source a representative sample is to be analysed for combustible sulphur percentage to confirm its compliance with the coal sulphur limit of 0.5%.

5.3.3 Opacity

A smoke opacity greater than Ringelmann 1 is permitted for short periods of time only under the following conditions:

- For 60 minutes when lighting a boiler after a shutdown period of up to eight hours; or
- For four hours when lighting a boiler after a shutdown period of longer than eight hours; and
- 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.

Start-up conditions particularly heat and pressure are managed carefully to ensure compliance with this condition. If there is doubt about the timeframes being met the smoke opacity can be checked via the on-site Ringelmann test set-up.

To monitor compliance with this condition during normal boiler operations the opacity of the boiler stack smoke is periodically compared with a Ringelmann chart. This is recorded and retained in the maintenance department office. (Condition 9)

5.3.4 Coal and Ash Dust

Coal and ash are to be managed to ensure that there are no discharges to air from them that are visible beyond the boundary of the site. (Condition 10)

Coal is pushed up as required into the coal storage bin and coal delivery trucks are advised to ensure deliveries are made within the confines of the bin. The area external to the storage bin is to be maintained clear of dust.

Ash is transported by trailer from the boilers to the concrete walled burner at the Wastewater Treatment Plant for storage until transported by coal delivery vehicles to the New Vale coal mine for disposal as backfill in the mine void (Solid Energy Consent No 202596, Expires 2019). In the event that stored ash becomes very dry and likely to release dust that travels to the boundary, the ash pile is to be wetted.

5.3.5 Boiler Maintenance

The at least annual servicing of both boilers is to be supervised by competent people or organisations. Servicing is to include at a minimum:

- Internal cleaning and replacement or repair of damaged equipment and services as necessary;
- Adjustment of the air to fuel ratio to optimise energy efficiency and to minimise the emission of products of incomplete combustion; and
- Calibration and adjustment of boiler monitoring equipment consistent with the intent of this consent. (Condition 11)

Service and maintenance requirements are documented in BLH 001. This documentation refers to:

- Routine checks and their recording systems (Forms 1207, 1208, 1212).
- Equipment calibrations and their recording systems.
- Quarterly inspections to be carried out by an approved contractor (Easteel).
- Annual survey – SGS.
- Repairs to be carried out by the manufacturer, their designated agent or another organisation approved by the inspecting authority and recorded on Form 1211.
- Maintenance – during the season and off season maintenance – to be recorded on Form 1213 (#1 Boiler) and Form 1214 (#2 Boiler).
- Modifications only to be carried out with the approval of the inspection authority, the manufacturer or their designated agent. Any internal documentation affected by a modification should be reviewed and reissued in necessary.
- Boiler Management Systems annual external verification.

Records of all servicing carried out are to be collated by the Environmental Coordinator and reported to Environment Southland by 30 November each year.

5.3.6 Boiler emissions

For the first five years of the resource consent, the flow weighted average PM_{10} concentration exhausted from the two boilers is not to exceed **300** mg/m^3 adjusted to zero degrees Celsius, 101.3 kilopascals, and 12 percent carbon dioxide on a dry gas basis. This equates to a flow weighted average of 21.4 kg/hr. (Condition 12a)

By no later than 5 years from the first exercise of the Consent no XXXX (XX 2021), the flow weighted average PM_{10} concentration exhausted from the two boilers is not to exceed **250** mg/m^3 adjusted to zero degrees Celsius, 101.3 kilopascals, and 12 percent carbon dioxide on a dry gas basis. This equates to a flow weighted average of 17.8 kg/hr (Condition 12b).

5.3.7 Compliance Assessment

The primary assessment of compliance with the particulate emission limits described above is by ambient monitoring. The Environmental Coordinator in conjunction with the Engineering Manager must ensure that the appropriate monitoring equipment and recording systems are organised and available for the monitoring programme of at least 4 months between 1 December and 1 April (Condition 13).

5.3.8 Performance Review

During the first years operating under Consent No XXXX the performance of the boilers should be reviewed and an assessment made of the measures, or technologies, necessary to meet the lowered 5 year limit (250 mg/m^3). If required, appropriate arrangements (EG by Capex request if necessary) should be made well in advance of the required compliance date.

The Plant Manager must ensure that any identified appropriate actions are undertaken at an appropriate time to ensure compliance with the lowered 5 year limit.

5.3.9 Ambient Monitoring

Ambient limits have been developed that relate directly to 1) 300 mg/m^3 and 2) 250 mg/m^3. Those limits are:

Hourly Downwind PM_{10} Percentile	Monitored hourly PM_{10} ($\mu g/m^3$), downwind conditions	Expected PM_{10} ($\mu g/m^3$) for stack concentration of 300 mg/m^3	Expected PM_{10} ($\mu g/m^3$) for stack concentration of 250 mg/m^3
100%	x	122	117
95%	y	37	35
50%	z	18	17

Ambient monitoring is to be undertaken annually at a monitoring location as close as practical to the location used to collect data for the consent application, adjacent to the Molloy property. The Environmental Coordinator in conjunction with the Engineering Manager is to arrange for the appropriate equipment to be available. It is expected that initially this will be organised through an external agency (EG: Watercare) but that in time the Plant may purchase its own equipment with an external contract in place to service and calibrate it.

The monitoring is to be continuous and log ambient 1-hour and 24-hourly average respirable particulate (PM_{10}) concentrations in conjunction with wind speed and direction. Ambient data is to be collected for a

period of at least 4 months between 1 December and 1 April (Condition 13). Key points of the monitoring programme are:

- The PM_{10} monitoring is to be by Beta Attenuation Monitors (BAM) in accordance with AS/NZ 3580.9.11:2008 'Determination of suspended particulate matter - PM_{10} or equivalent semi-continuous method. The sampling height is to be 3 metres above ground level.
- There is to be concurrent monitoring of wind speed and direction and logging of 10 minute and hourly averaged data at the same site as the PM_{10} monitoring. Wind speed and direction is to be monitored by 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: 0-359°
  Accuracy: ≤ ±5% @ 3 m/s
  Resolution: 1°
  Response Time: ≤ 1 second
  Wind Speed Threshold: ≤ 0.5 m/s

- Ambient PM_{10} concentrations in micrograms per cubic metre are to be recorded in electronic form as 1-hour and 24-hour averages (mid night to mid night). Wind speed in metres per second, and wind direction in degrees clockwise of true north, are to be recorded in electronic form as 1-hour and 10 minute averages. The data is to be logged on the Plant SCADA.
- The hourly PM_{10} concentration measurements that occur when the monitoring site is downwind of the boiler stacks - 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) are to be reported.
- The maximum, 95th and 50th percentile values from these data are to be reported (ie. X, Y, Z indicated in the limits table above). The maximum and 95th percentiles (X & Y) shall not exceed their respective PM_{10} concentration percentile limits listed in the table above.

Within 2 months of the completion of the ambient monitoring period the Environmental Coordinator is to report to Environment Southland (Condition 14). The report is to include:

- Start and end dates of monitoring;
- Electronic data set containing the time series of monitored hourly PM_{10}, wind speed and wind direction;
- Table containing the monitored versus PM_{10} percentiles;
- Time series plot of monitored 24-hour average PM_{10} and comparison with the NES criterion for 24-hour PM_{10};
- Confirmation of any stack discharge testing being planned, and the testing and reporting schedule in response to either the 95th and/or the 100th PM_{10} concentration percentile limits being exceeded as described in 5.3.10.

5.3.10 Stack testing

If either or both of the 100th or 95th percentile limits described above have been exceeded by more than 2µg/m^3, stack testing for PM_{10} particulates should be instigated as soon as possible and no later than 2 months after the identification of the non-compliance (Condition 15). Testing shall comply with test methods USEPA 201A (filterable PM_{10}) and 202 (condensable PM_{10}) or equivalent methods agreed with ES. In this event ambient monitoring should be continued until the stack testing occurs.

The Environmental Coordinator in conjunction with the Engineering Manager is to arrange for the stack emission testing to be carried out by a suitable agency (EG: CRL Ltd) as required. The Environmental Coordinator is to provide the results of the stack testing and the extended ambient monitoring to Environment Southland within 30 days of the completion of the testing. If the monitoring identifies that the operation of the boilers is the likely cause or is likely to have contributed to the exceedance of the ambient limits, the report is to identify the likely cause and the remedial action required to prevent such exceedances occurring again and the appropriate timeframe for implementation. The Engineering Manager is to ensure that the identified measures are implemented within the identified timeframe. (Condition 16)

5.3.11 Review

Within 10 years of the commencement of Consent No XXXX and after that at 5 yearly intervals for the duration of the consent a review is to be carried out that considers:

(a) The results of the monitoring required by the conditions of this consent;
(b) Relevant guidelines or standards for discharges to air; and
(c) Technology for the control of emissions to air from the site.

The purpose of this review is to identify if there is a need for further mitigation and if so, what is the most appropriate technology to further reduce any adverse effects as a result of air discharges from the combined boilers on the environment. The results of this review is to be provided to ES within one month of the report being completed and the consent holder shall be required to implement any practicable actions set out within the review in agreement with the consent authority.

5.4 Rendering Plant Operation

The Lorneville rendering operation is carried out on-site using a continuously fed Rendertech Press Dewatering System (PDS). The PDS is a low temperature rendering process. The operation currently consists of two operational process lines with one processing predominantly ovine raw material produced at Lorneville and the second line processing bovine raw material from Mataura. Calf raw material from Lorneville and skinned fallen stock are processed seasonally.

Raw material is received either from the slaughter and boning operations in the Lorneville plant or from off-site into receival bins. Wool-on product is processed through a hydrolyser, and then is combined with the other raw material. The raw material is pre-cooked, pressed to remove the remaining fat and water from the product, and dried. The dried product is milled to produce meat and bone meal, which is sold for animal feed. The press liquid is passed through a decanter to remove fine solids. From there it is then passed through a separator for refining to produce tallow. This is the standard operation.

The Rendering Plant operation is documented in the Rendering Department Procedure (LNV REN 001).

It is recognised and accepted that there can be a cooking smell associated with an animal product rendering plant. This is minimised during standard processing by extracting the emissions from all processing point sources. The gases are cooled through a heat exchanger before being treated through a bark biofilter. Exhaust gases from the dryer are used to heat the waste heat evaporator (WHE). The non-condensable dryer exhaust air stream that exits the WHE is treated, in combination with the other odorous airstreams, through the biofilter. In addition to this, emissions from the hydrolyser along with blood drying emissions are ducted to the boiler plant where they are added to supply combustion air and incinerated.

5.4.1 Raw renderables

Raw material from ovine or bovine slaughter must be rendered within 24 hours of slaughter; chilled or frozen material from further processing must be processed within 24 hours of the time of delivery to the rendering plant unless suitably stabilised. If stabilisation is required then "EnviroXyde" (chlorine dioxide activated by citric acid) should be used and applied within 8 hours of slaughter or within 8 hours of the removal of the animal carcase from a chilled facility. (Condition18)

Normal processing achieves the requirement to process within the specified timeframes. It is confirmed by daily confirmation of the raw material age which is recorded in Rendering Process Control Checklist (Form LNV 2700). In the event that a process delay or failure is likely to cause a breach of this condition the Rendering Supervisor is required to inform the Production Manager who will instigate appropriate actions to minimise the non-compliance. The Environmental Coordinator should also be informed and if the situation cannot be rectified within an compliant timeframe they will notify Environment Southland and keep them informed with progress in resolving the problem. The Environmental Coordinator will complete an incident report when appropriate. Incident reports are documented in Compliance Issues Register (PRO 117)

If the delivery of bovine raw material from Mataura is to be delayed, or in hot conditions, the product is sprayed at the Mataura Plant pre-breaker with Enviroxyde at the suppliers (Orica) recommended dose rates. This preserves product quality as well as minimising any potential odours.

5.4.2 Fallen Stock Processing

Skinned fallen stock (slinks) are rendered on behalf of Slink Skins NZ who collect the dead stock from farms for retrieval and further processing of the skins. This generally occurs from early August to late October. This raw material cannot meet the criteria for being fresh or preserved but must be processed as soon as practicable on receipt at Lorneville. Close liaison should be maintained with Slink Skins NZ and limits put on the amount of material received should processing not be able to keep up with supply. (Condition 18)

5.4.3 Off-site Raw Material Receipt

The two receival bins for off-site material can potentially release odours. The doors should remain shut at all times other than during receival. The bins must be kept clean and free of any build-up of organic material. These aspects are checked by the Rendering Supervisors each shift and outcomes recorded on Form 2700. The potential release of a burst of odorous air when the doors are opened is avoided by the continuous extraction of the building air to the biofilter.

5.4.4 Process

No uncooked or partially cooked material is to be left in an uncooked or partially cooked condition overnight in the rendering process line. This condition is fully satisfied under normal operating conditions as all material has to be processed prior to the receipt of a new day's fresh material. It is the responsibility of the Rendering Supervisors to ensure the situation does not occur (Condition 19).

No blood older than 48 hours from slaughter is to be processed. Under normal processing conditions this cannot occur and it is addressed by the requirement in the blood processing section of the Rendering Operating Procedure to cook old blood first. It is the responsibility of the Rendering Supervisors to ensure the situation does not occur (Condition 20).

In the event that a process delay or failure is likely to cause a breach of these condition the Rendering Supervisor is required to inform the Production Manager who will instigate appropriate actions to minimise the non-compliance. Implementation of the documented contingency plan should be considered. The Environmental Coordinator should also be informed and if the situation cannot be rectified within an compliant timeframe they will notify Environment Southland and keep them informed with progress in resolving the problem. The Environmental Coordinator will complete an incident report when appropriate. Incident reports are documented in PRO 117.

5.4.5 Rendering Plant Cleaning and Maintenance

The Rendering Plant is to be maintained in a clean and functional state for the purposes of odour control (Condition 24). Routine daily and weekly cleaning schedules are documented in LNV REN 001. Daily checks of clean ups are carried out and faults identified are recorded on the Daily Clean Up Checklist (Form LNV 2712). Corrective actions are also recorded on LNV 2712.

All structures are observed daily during clean up and faults identified recorded on LNV 2712. A requisition should be made to the Engineering Manager for maintenance work to be carried out. Corrective actions are also recorded on LNV 2712.

Prior to a shut-down period the Rendering Supervisor is to prepare a maintenance list including:

- All maintenance work to be carried out during off -season.
- General cleaning all areas of department.

Supervisor forwards a copy of the lists to the Production and the Engineering Managers and it is the responsibility of the Engineering Manager to ensure that all necessary maintenance is carried out.

5.4.6 Contingency Plan

A contingency plan is in place and this is also documented in LNV REN 001.

A 'preventative maintenance schedule' and process monitoring programme are in place for assessing potential problems and enabling them to be rectified before they occur. In all instances where equipment failure occurs, plant personnel shall respond immediately to resolve any issues in order to prevent lost time and minimise the effect on processing operations.
Where a minor mechanical breakdown occurs, every attempt shall be made to resolve the issue by replacing the failed equipment with additional or duplicate equipment.

Where major/multiple equipment failure occurs, processing shall cease on that line, with all material diverted to the duplicate line. The availability of two identical processing lines allows for flexibility of processing, with the ability to switch between lines. A single line has the capacity to process all of Lorneville's raw material.

The Lorneville Plant blow system and truck loading facility shall be utilised to remove slaughter waste from the Rendering department as well as boning waste from further processing rooms in the event that the rendering plant is unable to process the raw material. This gives the Plant the ability to transfer material offsite to an external rendering facility. Several companies are available to take additional further processing material for de–boning if required. The Mataura Plant has an arrangement in place with an external renderer for surplus bovine material to be transported to an external rendering facility, if or when required.

In the unlikely event of a full-scale shut-down due to, for example, a power failure or loss of steam, slaughter operations would be expected to cease at either or both plants.

Once operational, the oldest material must be processed first. If the issue is not going to be resolved within the required time frame for processing 'fresh' material, the raw material shall be transferred to an external rendering facility.

If a mechanical breakdown occurs which is likely to cause an odour impact, then Plant Management shall immediately contact Environment Southland staff and advise them of the potential problem. Management shall outline the actions to be taken to minimise the impact to the environment and to resolve the problem, and the timeframe expected.

5.5 Rendering Odour Management

A range of processes within the rendering operation have the potential to release odours that if not appropriately contained may cause odours that are noxious, dangerous, offensive or objectionable to the extent that they cause an adverse effect beyond the site boundary (Condition 26). The primary potential; sources are:

- Raw material
- Concentrated sources from the rendering process lines
- Meal solids dryer exhaust
- Meal solids milling and screening.

The primary odour mitigation mechanism is to pass potentially odorous air through a biofilter. Other mechanisms are used for specific areas as outlined below.

5.5.1 Biofilter

The two celled bark-bed biofilter treats the combined flows of cooled concentrated sources from the Rendering Plant and ambient air from the raw material reception building. The two cell biofilter is 12m X 35 m in area. The design air flow is 18,300 m^3/hr.

The odorous gases are pre-cooled through a shell and tube heat exchanger. Maintaining this cooled air stream generally below 35°C is a key operational parameter. The temperature must be maintained at less than 40°C at least 99% of the time (Condition 23).

The gas distribution system that feeds the pre-cooled gases to the biofilter comprises a large distribution pipe running the length of the biofilter with a number of lateral perforated pipes set in coarse gravel to ensure even distribution of the gases through the biofilter medium.

The media within the biofilter consists of a 1.5m layer of screened pinus radiata bark (3-10mm) on top of a 0.25 m layer of coarse bark (25-75mm). The total volume of media is approximately 735 m^3 and this gives a design loading rate of 25 m^3 air / hr / m^3 media.

The base of the biofilter is impermeable and leachate and stormwater run-off run into a drainage collection system terminating at a collection sump. The collected drainage is pumped to the North Drain and hence to the WWTP.

An irrigation system is associated with the biofilter to enable the moisture content of the media to be maintained in dry conditions.

5.5.2 Raw material

On-site raw material collection and grinding (IE: material from the Lorneville processing plant) involves the collection of fresh material and as long as this practice is maintained this activity only produces a low level of odours that are unlikely to have any effect off-site. The only mitigation required in this area is that only fresh product is processed (Refer Sect 5.4.1).

The receipt of off-site raw material reception has greater potential for the release of odours as delivery of material requires the large access doors to be opened. This combined with the dumping of new material results in raw offal odours potentially being discharged from the building.

As described in Sect 5.4.3 the access doors are to be kept closed at all times other than during the delivery of raw material.

To mitigate the release of any odours from the raw material reception building when trucks are unloading, a building air extraction system discharges to the biofilter. The inlet manifold extends across the full building width near to the ceiling. Two sub-manifolds extend to the lower basement and floor sump areas.150mm openings are spaced along the primary and sub-manifolds. The building extraction fan and associated VSD motor removes any build-up of odorous air when the building is sealed and this avoids a sudden release of odours when the doors are open.

5.5.3 Concentrated Sources

Concentrated sources are those that have sufficient odour concentration to require containment and treatment. The enclosed solids transfer conveyors that connect material flows between the cookers, presses, decanters, dryers and the meal processing plant provide a potential fugitive odour escape route for all the main process stages.

The concentrated odour sources in each processing line that are ducted to the biofilter include: raw material surge bin; pre-cook feed conveyor; pre-cooker; drainer conveyor; solids press; decanter; press cake conveyor; dryer feed conveyor; separators; stickwater mixing tanks and WHE.

The 45 kW VSD biofilter fan drives the concentrated sources extraction system. A key parameter for the effective operation of the system is the vacuum within the inlet to the fan as if this is great enough (target -500 Pa gauge) it ensures a good level of vacuum throughout the extraction system.

A water cooled vertical shell and tube heat exchanger receives all the concentrated source flows including the non-condensable dryer exhaust flows from the WHEs, condenses the vapours and cools the humid air stream. The inlet gas temperature to the biofilter is a critical operating parameter as elevated temperatures will destroy the microorganisms required for the effective operation of the biofilter. Ideally the temperature should routinely remain below 35°C but shall be kept at < 40°C for at least 99% of the time (Condition 23). The temperature is continuously recorded on the SCADA.

5.5.4 Meal Solids Dryer Exhaust

The hot exhaust air from the solids dryers is the largest and most significant potential source of odour from the rendering plant. It is used in the WHE to evaporate water from stick liquor under vacuum. This process cools the hot exhaust gases. The non-condensable gases are pulled from the WHE and further cooled through the shell and tube heat exchanger as described above. The key parameters for the effective operation of this part of the system are the evaporator vacuum, the stickwater level within the WHE and the final stickwater concentration. The evaporator vacuum and the stickwater level are continuously monitored; the stickwater level is automatically controlled and the stickwater concentration is manually measured and the concentrate discharge pump rate adjusted to achieve the target value.

Other operational parameters that provide key information and that are continuously monitored include the following:

- Stickwater recirculation pump amps; (high levels warn of possible pump issues or excessive concentration of stickwater
- Condenser hot water outlet temperature; (low levels warn of poor heat transfer in condenser or the WHE
- Condenser cold water inlet temperature; (high levels on hot days warn of reduced condensing capacity)
- Non condensable gas (NCG) temperature; (high values indicate poor heat transfer in the WHE)
- Stick liquor temperature in WHE; (low values indicate poor heat transfer in the WHE)
- WHE vapour temperature; (low values indicate poor heat transfer in the WHE)

5.5.5 Biofilter Monitoring

The following table summarises the monitoring associated with the performance of the biofilter, the frequency of monitoring, the targeted values, the recording systems and the responsibilities.

Component	Method and frequency	Target value	Records	Responsibility
Fan inlet manifolds to biofilter and material reception building fans	Installed Vacuum Gauge ***Weekly***	- 500 Pa gauge (-50 mm WG)	Process Emissions Form 2736	Rendering Supervisor
Discharge Ducts from LTRP Biofilter and Material Reception Building Fans	Installed Pressure Gauge or handheld Differential Pressure meter ***Weekly***	1500 Pa gauge (150 mm WG)	Process Emissions Form 2736	Rendering Supervisor
Discharge Ducts from LTRP Biofilter and Material Reception Building Fans and Motor	Fan motor amps Motor and fan hours		SCADA	Rendering Supervisor
Manifold Connections to process equipment, conveyors, and bins.	Handheld Differential Pressure Meter (manometer)	-100 Pa gauge (-10mm WG)	Biofilter Monitoring Spreadsheet	Rendering Supervisor
Biofilter Inlet Duct				
Inlet Flow	Pitot tube* (access via 2 x Ø100mm BSP fittings to be installed at 90° from each other) ***Annual***	Nominal Design Flow 18,300 m^3/hr	Biofilter Monitoring Spreadsheet	Engineering Manager
Back Pressure	Installed U-tube manometer on biofilter inlet duct ***Weekly***	< 150 mm water gauge	Process Emissions Form 2736	Rendering Supervisor
Temperature	Continuous temperature probe ***Continuous***	< 35°C for more than 95% time; **< 40°C for more than 99% time; (Consent Limit)** Maximum: 50°C	SCADA	Rendering Supervisor
Biofilter Media				
Back Pressure	Installed U-tube manometer or handheld DP meter ***Weekly***	<50 mm water gauge	Process Emissions Form 2736	Rendering Supervisor
Moisture Content	Oven drying at 100°C ***Monthly***	50 wt. % to 65 wt. %	Biofilter Monitoring Spreadsheet	Env Coordinator / Laboratory
pH	Soil pH ## ***3-Monthly***	pH 5 or higher (top 2/3 layer)	Biofilter Monitoring Spreadsheet	Env Coordinator / Laboratory
Air Loading Rate	From annual flow data ***Annual***	25 m^3_{air}/hr per m^3 media	Biofilter Monitoring Spreadsheet	Env Coordinator
Media Depth	Dig / auger down to washed river gravel layer and measure depth ***Biannually (2 Years)***	1.5 m screen bark 0.25 m coarse bark	Biofilter Monitoring Spreadsheet	Env Coordinator
Media Composition & Size Distribution	Mass-size distribution of Bark: Bark oven dried, sieved using a Fritsch analysette 3 at 2mm amplitude 5 minutes. ***Biannually (2 Years)***	Top layer: screened bark, 3-10 mm (1.5 m depth), Bottom layer: coarse bark, 25-75 mm (0.25 m depth)	Biofilter Monitoring Spreadsheet	Env Coordinator
Organic Carbon:Nitrogen Ratio	Landcare method 114 ***Biannually (2 Years)***	50:1	Biofilter Monitoring Spreadsheet	Env Coordinator
Process emissions	Record presence / absence of any steamy discharge ***Daily***	None	Process Emissions Form 2736	Rendering Supervisor
Rendering Odour ex biofilter	Record presence / absence of recognisable rendering odour	None	Biofilter Monitoring Form 2735	Env Coordinator

	Weekly			
Biofilter bed flow distribution	Assessed visually on cold morning ***Monthly***	Even dispersion	Biofilter Monitoring Form 2735	Env Coordinator
Odour assessment	Downwind VDI ***Annually***	Not detectable	Biofilter Monitoring Spreadsheet	Env Coordinator
Odour complaints	Review ***Annually***		Infoleader Form PRO 117	Env Coordinator

The Biofilter Monitoring Spreadsheet is located on P Drive / Public / Env Data / Rendering / Lorneville / Biofilter Monitoring.

5.5.6 Biofilter Maintenance

pH: If the measured pH values are consistently below the target values and continuing to trend downwards, lime should be applied. Initial application rate should be in the order of 0.7 kg/m^2 (240kg in total). This application should be evenly spread, worked into the media and heavily watered. Should subsequent sampling and analyses not indicate an improvement the application should be repeated.
Moisture: Maintaining adequate moisture content is critical to the operation of the biofilter. Water should be routinely irrigated to its surface, at least three 4 hour periods a week over the entire biofilter during extended spells with no rain. Should the measured moisture content drop below target values, then additional water should be applied. Awareness should be maintained during non-production periods such as Christmas and irrigation should be continued during these periods in the absence of rain.

Pressure Differential and Flow Distribution: If the pressure differential across the media bed is trending up and exceeds the target, and visual assessments of the gas flow distribution indicate short circuiting then a plan should be made to turn the layer of fine bark. In practice this can be achieved with a long reach digger, removing a proportion of the media (~50m^3) and then moving the remaining media along the bed. Care needs to be taken to not disturb the coarse layer of bark below.

Media: If the media surveys indicate that the bark is significantly breaking down and becoming too fine or condensed then a plan should be made to replace the media. Prior to implementation of this plan the bark quality should be supported by other measurements such as the pressure differential across the biofilter.

5.5.7 Blood Processing

Blood generated at the Lorneville and Makarewa sites is processed by in-line coagulation with steam, cooling, decanting to produce a wet solid for drying in an indirect contact steam dryer prior to screening and bagging. The most significant source of odour is the hot wet exhaust air from the dryer. This exhaust stream is cooled by a water jacket heat exchanger with a resultant odorous non-condensable air stream. This air stream is extracted to the coal fired boiler house where it is mixed with inlet combustion air for odour destruction via combustion. This system is to be checked at least annually to ensure it is working effectively.

5.5.8 Wool Hydrolysing

The two hydrolysers associated with rendering are used to remove the wool from heads, hocks and skin pieces in a caustic bath prior to rendering. The exhaust gases from the hydrolysers are extracted to the coal fired boiler house where they are mixed with inlet combustion air for odour destruction via combustion. This system is to be checked at least annually to ensure it is working effectively.

5.5.9 Meal Room

The meal processing room's building air is discharged to air via roof vents. Hoods are in place over the meal screens with canvas curtains on three sides and this air is extracted to a meal holding bin. The air from surge and the meal holding bins is extracted and passed through a bag-house filter prior to discharge. The fiklters are replaced 6 monthly. Weekly cleaning and checking is performed and maintenance carried out as required.

5.6 Wastewater Odour Management

5.6.1 Fellmongery Process Drum Discharge

The weekend skin processing pattern can result in the simultaneous discharge to drain of de-liming process liquors from a number of processing drums on a Monday morning. To reduce the intensity and rate of odour emissions that may be liberated from the reticulation at this time, the de-liming process and subsequent discharge from the operative drums is staggered.

5.6.2 Current Wastewater Treatment Plant Operation

The operation of the wastewater treatment plant (WWTP) and its associated activities are described in the Effluent Treatment Plant Operating Procedure (LNV EFT 001), the Environmental Monitoring Plan (LNV EFT 005) and the Lorneville Land Irrigation Management Plan (LNV EFT 002)

The main potential sources of odour from the WWTP are the anaerobic pond and to a lesser extent the first stage of the mechanically aerated Loop pond.

Any reduction in the organic load to the WWTP will assist in reducing odour from the treatment plant.

A key mitigation of odour is the natural scum cover on the anaerobic pond and any targeted reduction in organic load should target protein rather than floatable fats which are a key component of the scum cover.

Organic load reduction has been targeted recently with the new rendering plant that recycles stickwater and recovers it as product rather than losing it to drain. Maintaining this operation effectively, as described above, is a key measure for minimising WWTP odours.

Previously the existing DAF plant was overloaded both hydraulically and with pollutant loads and its operation was compromised because of this. In 2014 / 2015 an additional DAF plant (the mini-DAF) was installed associated with the rendering plant. The high strength low volume wastestreams (screw and hopper drainage, blood centrate, hydrolyser waste, soup stock waste) are now treated through the mini-DAF removing a greater proportion of the organic load and assisting the performance of the main DAF. The performance of the mini-DAF is still to be optimised and ensuring and verifying its performance is also a key measure for reducing the organic load to the WWTP and so minimising odours. A further plan is being developed to remove the blood centrate stream from the mini-DAF and capture its solids through the WHE. This will allow the ovine raw material drainings to be further treated through the mini-DAF.

The reduction of sulphides and sulphates loads into the WWTP would reduce the potential odour that is generated from the conversion of these compounds into odorous hydrogen sulphide. There are two primary methods of reducing these loads:

1) Diverting the acidic fellmongery pickle liquor away from the anaerobic pond and discharging it directly to the aerated loop section of the WWTP. This proposal is being assessed internally (2015).
2) Catalytic oxidation of the high strength fellmongery sulphide waste streams. The success of this operation is dependent on the ability to maintain the oxidised liquors in an aerobic state to prevent reversion to odorous sulphides. With the current configuration this is not possible but oxidation is planned as part of a future WWT upgrade.

5.6.3 Future Wastewater Treatment Plant Operation

An upgrade to the WWTP is planned to be fully operational by 2030. The proposed upgrade is likely to consist of a new covered anaerobic lagoon, a Biological Nitrogen Removal Lagoon (aerated) with clarifier and biosolids handling systems. It is proposed that approximately one third of the raw wastewater is diverted through this upgraded section for targeted nutrient reduction before entering the existing WWTP beyond the anaerobic pond.

A risk to odour management is if the reduced organic load to the anaerobic lagoon allows the deterioration of the scum cover. It is not predicted to do so but if it does and manipulation of fat loads was ineffective, then consideration would be given to using a smaller pond (disused anaerobic pond 2) and installing an artificial cover and gas capture and flare system.

The new anaerobic pond will be covered and emitted gases captured and either flared or used as an energy source. This should ensure that odours from the new anaerobic pond will be adequately mitigated.

The new BNR pond must be operated and maintained with good quality instrumentation and automatic oxygen control to avoid abnormal operating conditions and the associated generation of odours.

The discharge of dewatered biosolids to land is proposed. Odour management of this activity will be detailed in a Biosolids Management Plan to be prepared and incorporated into this document before this activity commences. (Condition 29)

A Wastewater Treatment Upgrade Plan is to be prepared and submitted to Environment Southland by XXXX. (Condition 12 of Consent No XX). This up-grade plan is to address measures to manage odours from the wastewater treatment upgrade including from the proposed disposal of biosolids (Condition 29). It should:

(i) 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 could include but not be limited to the oxidation of sulphides within the waste lime wash liquors.
(ii) 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:
    a. A description of the potential sources of odour associated with the wastewater treatment plant upgrade;
    b. 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;
    c. Ongoing monitoring of the wastewater treatment upgrade with respect to potential odour sources and reporting requirements.

Any necessary actions identified as part of the wastewater treatment upgrade plan are to be implemented (Condition 30).

A review of the effectiveness of odour reduction measures is to be carried out within 12 months of the up-graded WWTP being fully operational. It is the responsibility of the Environmental Coordinator to ensure this is carried out and reported to Environment Southland. If the report identifies that any changes are necessary these must be implemented in agreement with ES and within 3 months of reporting. (Condition 31)

5.7 Odour Compliance

5.7.1 Off-site Odours

Plant activities are to be managed to ensure that there are no 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 Environment Southland. (Condition 26)

If a non-compliance with this condition is confirmed, the likely source of the odour is to be investigated and reported to Environment Southland along with any actions to be implemented to reduce or manage the odour. This report is to be provided to Environment Southland within 25 days of the identification of the non-compliance. (Condition 27)

5.7.2 Odour Complaints

A log of all odour complaints received by the Plant is to be maintained on Form PRO 117. This record is to include:

- The location where the odour was detected by the complainant
- The date and time when the odour was detected
- A description of the odour character, intensity and duration of exposure
- The most likely cause of the odour detected
- Note if there were any abnormal activities at or discharges from the Plant that may have resulted in the complaint
- Weather conditions at the time of the complaint

This log is to be provided to Environment Southland upon request. (Condition 28)

The primary point of contact for receipt of complaints is the Environmental Coordinator. If a complaint is received within a timeframe that allows it to be meaningfully investigated, the Environmental Coordinator should visit the location where the odour was detected and attempt to confirm character and intensity, and particularly wind direction, in order to identify a source if possible. If the complainant's identity is known a response should be provided to them.

Outside normal working hours contact can be made with the security watchman at the plant. A list of personnel to respond to complaints is retained in the watch-house and one will be contacted by the watchman as appropriate. This list generally includes the Environmental Coordinator, Water Services Supervisor, Engineering Manager, and Plant Manager.