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Proposed Contingency Biosolids/Sheep Manure Solids Monofill – Technical AEE

Alliance Group Limited – Lorneville Plant

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Prepared for

Alliance Group Limited – Lorneville Plant

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Limitations:

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Table of Contents

Table of Figures

Table of Tables

1.0 Introduction

Alliance Group Limited operates a sheep and lamb processing plant at Lorneville (Alliance Lorneville). All wastewater generated from onsite processes is treated in an onsite wastewater treatment plant.

As part of the re-consenting programme, Alliance Lorneville has undertaken extensive investigations of the likely requirements for the treatment of wastewater that could be proposed for future. To this end, Alliance Lorneville accepts that significant additional treatment will be required to allow nitrogen removal to occur prior to discharge to the Makarewa River.

Following feasibility studies, Alliance Lorneville is proposing to progress towards establishing a biological nutrient removal (BNR) system that will result in operating any future plant as an activated sludge plant. While significantly lowering the concentrations of nitrogen discharged to the Makarewa River, this upgrade route will produce large quantities of bacterial solids (biosolids) that will need to be managed at the site. Although, there would be an opportunity to manage the biosolids generation by diverting to the existing lagoon based treatment plant for further cold stabilisation as lagooned biosolids, Alliance Lorneville wishes to utilise the biosolids as a slow release fertiliser onto the company farmland as the biosolids are generated. This would mean that the biosolids would be dewatered and then disposed of onto land at sustainable nitrogen loading rates to ensure that the nutrients are utilised on the grazed pastoral land.

However, on occasions, the ability to dispose of the biosolids onto land may become limited due to antecedent precipitation resulting in saturated soil conditions or conversely when the farmland is required to hold large numbers of overflow stock when farmers are destocking their land as a result of drought.

During these periods, Alliance Lorneville needs to provide for either temporary field storage of biosolids or secure disposal to a landfill. Having assessed the implications for landfilling at a regional landfill, Alliance Lorneville has realised that it has capacity available in parts of its existing redundant wastewater treatment system that could be converted to dedicated field storage of biosolids or for permanent placement of biosolids in nominated cells (ponds).

In addition, Alliance Lorneville is progressing to separate the stockyards solids (sheep manure) so that the material can either be composted off-site or be disposed of onto company owned farmland. However, Alliance Lorneville is relying entirely on the continued acceptance of the material by an external party for off-site composting. The site is also relying on the suitability of disposal to land at certain times of the year where farming operations may conflict with land available for disposal of stockyards solids. In this proposal, Alliance Lorneville is proposing to utilise capacity available in its existing lagoon based wastewater treatment system to also utilise for disposal of stockyards solids.

This Technical Assessment of Environmental Effects (AEE) has been prepared by Pattle Delamore Partners Limited (PDP) to support the utilisation of existing disused ponds at the existing wastewater treatment system for a biosolids and sheep manure solids monofill operation.

2.0 Description of Proposal

2.1 Solid Wastes Generation

A new biological nutrient removal (BNR) wastewater treatment plant is planned to be constructed in future to reduce the nitrogen load discharged to the Makarewa River. The proposed treatment plant is likely to include a new covered anaerobic reactor and activated sludge based wastewater treatment system to achieve a high level of nitrogen removal. The activated sludge system is likely to comprise of an aerated lagoon and clarifier system.

Solids generation from the wastewater treatment plant is expected to be from the anaerobic lagoon on an infrequent basis and the activated sludge plant on a continuous basis. The anaerobically treated wastewater residual solids which accumulate at the bottom of any future covered anaerobic reactor will require to be removed periodically (4-6 years) and disposed of either into the existing crust covered anaerobic lagoon (or alternatively in the disused anaerobic lagoon) or dewatered and disposed to either a dedicated monofill or to a municipal landfill. Because of the infrequent nature of solids removal from the future new covered anaerobic lagoon, the management of the anaerobic reactor solids is not part of this proposal.

Waste activated sludge (WAS) will be generated from the BNR treatment system (activated sludge plant) and will need to be removed and disposed of on a daily basis in order to maintain the efficiency of the BNR treatment system. WAS is likely to be wasted to a holding tank and then mechanically dewatered prior to disposal.

In addition, the stockyards solids will be generated on a daily basis. The rate of generation is based on the expected holding time sheep are held in stockyards with an allowance for the amount of feed the animals had prior to arriving to the processing plant. Stockyards solids collected from underneath the stockyards and/or screened from the stockyards wastewater are considered to be suitable for direct land application without any additional dewatering.

Table 1 outlines the annual production rates of solids anticipated once the new wastewater treatment system has been commissioned.

Table 1: Future Solid Waste Production Rates

Solids Generation	Dry tonnes/yr
Anaerobic Lagoon Solids	108
Stockyards Solids	280
Waste Activated Sludge (Biosolids)	700

Notes:

1. *Anaerobic lagoon solids is not part of contingency monofilling proposal;*
2. *Stockyards solids generation is based on a 12 hour holding time in stockyards with animals on average at half empty rumen and 40 kg live weight;*
3. *Further details of solids generation rates are outlined in the report Lorneville Plant Biosolids Management Options (PDP, 2014a).*

For convenience, all solids proposed for monofilling is collectively referred to as "***biosolids***" in this assessment. The use of term *biosolids* is not intended to confuse with the term utilised in the 2003 Biosolids Guidelines (MfE, 2003). The use of the term "biosolids" in the guidelines strictly applies to *bacterial solids and other stabilised solids generated from wastewater treatment plants that treat municipal wastewater or human derived wastewater* (note that the 2003 Biosolids Guidelines are only guidelines for management of sewage based sludge). The guidelines are not deemed as standards and/or regulations that require the restriction of the use of the term biosolids.

When assessing for the biosolids, reference is made to the 2003 Biosolids Guidelines specifically for contaminant limited application rate and receiving soil contaminant limit for metals.

2.2 Proposed Biosolids Disposal to Monofill

To allow for an alternative biosolids disposal site when farm operations and/or wet-weather conditions prevent land disposal, it is proposed that a biosolids monofill will operate as a contingency disposal site. It is proposed that the biosolids monofill would utilise the existing disused ponds (labelled A1, A2, B1 and B2) at the Alliance Lorneville wastewater treatment plant. The proposed monofill location is shown in Figure 1.

In order to establish the criteria when the contingency could be triggered, the basis is determined as follows:

i. The inability to dispose of the material to land when there is cumulative rainfall of 15-20 mm on the antecedent days and an allowance for the drying of the land for at least 1-2 days;

ii. The requirement by Alliance Lorneville to accept stock from its suppliers in the event there is an increase in the destocking rates by the supplier farmers from their own land;

iii. Additional allowance for avoidance for any land damage from farm machinery as a result of low intensity rainfall concurrent with land disposal operations;

iv. Non-acceptance of the stockyard solids to an off-site composting facility; and

v. Breakdown of the machinery associated with the land spreading of the sheep manure and biosolids.

On the basis of rainfall that may trigger diversion to occur to the proposed monofill, it is expected that monofill utilisation could occur between 20-25% of the time on a production season basis. Although Alliance Lorneville recognises that in some years, the diversion to the monofill could occur for more than 20% of the time that would shorten the life of the monofill.

For this assessment, the amount of solids that could be diverted is based on the seasonal utilisation rate of 20% of the time.

The proposed monofill will only receive solids produced at the site from the stockyards and as WAS from the biological treatment system. Based on the anticipated WAS and stockyards solids production rates outlined in Table 1 and assuming that 20% of biosolids generated on an annual basis will be monofilled as a contingency measure, the annual and peak gross biosolids load destined to monofill each year is outlined in Table 2.

Table 2: Estimate of Annual Biosolids Loads to Monofill

Parameter	Unit	WAS	Stockyards Solids
Solids Concentration	(% DS)	18	25
Solids Deposition (wet)	(t/yr)	780	220
Peak Solids Deposition (wet)	(t/d)	45	11

Notes:

1. *This assessment has assumed that 20% of biosolids produced annually will be to monofill with remaining biosolids to land;*
2. *Solids concentration of WAS has been obtained from sampling and analysis of Alliance Pukeuri biosolids in September 2014;*
3. *Solids concentration of stockyards solids has been obtained from Functional Design Handbook for Australian Farm Buildings (Redding, 1981);*
4. *Extended peak loads are based on a processing rate of 28,000 lamb equivalents per day;*
5. *Peak solids deposition is based on all material generated from the site diverted to monofill.*

WAS and stockyards solids are expected to meet biosolids classification under the *Guidelines for the safe application of Biosolids to land in New Zealand* (MfE, 2003) for the metal limits. Details of the WAS and stockyards solids characteristics are outlined in Section 3.1.

Under normal operating conditions, dewatered WAS and stockyards solids will be spread to land using specialised biosolids spreading equipment. When farming operations or wet-weather prevent application to land, dewatered WAS and stockyards solids will be transferred by tipper truck/trailer to the onsite monofill. Longer term disposal of biosolids at the monofill could also be undertaken.

2.3 Alternatives Considered

2.3.1 Onsite Land Disposal

Monofilling of biosolids generated from the Alliance Lorneville site and future wastewater treatment plant is the contingency alternative to the routine direct land application of solids to Alliance Lorneville land.

2.3.2 Off-site Landfilling

Although off-site disposal of biosolids to Southland regional landfill can provide an option for Alliance Lorneville, the use of the landfill is deemed as a last resort because of the high costs involved with cartage and gate fees. On occasions, the landfill may not accept the wastes as it may not meet the solids content.

IMAGE:

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PROJECT: PROPOSED CONTINGENCY BIOSOLIDS/SHEEP MANURE SOLIDS MONOFILL - TECHNICAL AEE

TITLE: PROPOSED MONOFILL LOCATION

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3.0 Monofill Waste Acceptance

3.1 Monofill Capacity

Approximate dimensions and capacities of the 4 No. monofill cells which will utilise the disused ponds identified in Figure 1 are outlined in Table 3. Separate monofill cells will be used for WAS and stockyards solids disposal, and it is proposed that the larger cells ("A1" and "A2") will be used for WAS disposal and smaller cells ("B1" and "B2") for stockyards solids disposal.

Table 3: Capacities of Existing Ponds for Monofill Operations

Monofill Cells	Area (m^2)	Depth (m)	Capacity (m^3)
A1	3,500	2.0	7,000
A2	3,500	2.0	7,000
B1	1,200	2.0	2,400
B2	1,200	2.0	2,400
		Total Capacity	**18,800**

Notes:

1. *These capacities make no allowance for freeboard or volume required for soil capping.*

Based on 20% of the annual biosolids being diverted to the monofill, the capacity of the monofill cells is likely to be exhausted at around 15 to 20 years, therefore a conservative estimate of the active service life of the monofill is 15 years. This assessment is considered to be conservative as it does not allow for consolidation and subsequent removal of stored biosolids for land application.

3.2 Biosolids Deposition Rate

3.2.1 Waste Activated Sludge

When disposal to land is not feasible, dewatered WAS from the dewatering facility will be transported to the active monofill using a tipper truck or tractor hauled tipper trailer. Based on a maximum diverted WAS deposition rate to monofill of 45 wet t/d (all material diverted to monofill during peak processing), up to 9 truck/tractor loads will be required per day for monofill disposal.

3.2.2 Stockyards Solids

Although stockyards solids are to be applied to land for useful soil augmentation, monofill disposal of stockyards solids will provide a contingency disposal site. In addition, providing for some stockyards solids to land allows for management of nitrogen loading rate onto land in the event the WAS production is higher at certain times of the year and the requirement to dispose of the WAS to land is preferred by the site.

Disposal of stockyards solids is likely to be 11 wet t/d if all generated stockyards solids is diverted to the monofill and will involve transporting using a tipper truck/trailer unit. This may involve up to 2 truckloads per day.

3.3 Biosolids Characteristics

Characterisation of WAS that is likely to be generated from the proposed Alliance Lorneville wastewater treatment plant is unavailable. However, site processes at the Alliance Pukeuri meat processing site are similar to those at Alliance Lorneville, and the future wastewater treatment plant at Alliance Lorneville is likely to generate WAS not too dissimilar to that generated at Alliance Pukeuri. The typical WAS characteristics expected out of future BNR plant at Alliance Lorneville are outlined in Table 4.

Characterisation of stockyards solids are also outlined in Table 4 and are based on typical sheep manure characteristics suggested in literature (ASAE, 2003; Redding, 1981).

Table 4: Expected Biosolids Characteristics

Parameter	WAS	Stockyards Solids
Total Nitrogen	6.0	4.5
Total Phosphorus	1.2	0.7
Total Sulphur	0.9	0.5
Total Potassium	0.8	3.3
Total Calcium	1.5	2.5
Total Magnesium	0.2	0.7
Total Sodium	4.0	0.7
Total Zinc	0.03	14.5
Biochemical Oxygen Demand	1.1	8.9

Notes:

1. *All units in g/100g DS dry solids;*
2. *Characterisation for WAS (excluding the biochemical oxygen demand) has been obtained from sampling and analysis of Alliance Pukeuri biosolids in September 2014;*
3. *Biochemical oxygen demand for WAS from the proposed wastewater treatment plant has been assumed to be similar to that from an activated sludge plant treating meat processing plant effluent;*
4. *Characterisation for stockyards solids has been obtained from Redding (1981) and ASAE (2003).*

3.4 Leachate Characteristics

Leachate from the active monofill cells will result from rainwater infiltration through the biosolids. Leachate generated will be pumped to the existing lagoon system for biological treatment. In future as the lagoon based wastewater treatment system is progressively decommissioned, the leachate will be re-directed to the future wastewater treatment plant.

The key contaminant parameter associated with the monofill leachate will be nitrogen, and to a lesser extent, phosphorus. The biochemical oxygen demand and solids load to the existing lagoon system will have a negligible effect on the final effluent quality. Therefore only nitrogen is discussed in this report as a key contaminant parameter associated with the monofill leachate.

The nitrogen content of WAS is typically 6% on a dry solids basis and the nitrogen content of the stockyards solids is typically 4.5% on a dry solids basis. As reported in earlier assessment for biosolids (PDP, 2014a), only a portion of this nitrogen content will mineralise over time (principally converting to ammoniacal-nitrogen) and impose a load on the treatment system. Literature sources suggest that up to 55% of the nitrogen content in WAS and stockyards solids will mineralise to ammoniacal-N, after which time the nitrogen content will be similar to that of typically organic laden soil matter.

Assuming that 20% of biosolids will be diverted to monofill as a contingency measure and based on nitrogen mineralisation rates as suggested in literature, the expected daily nitrogen loads in the leachate (based on 250 days of processing in a year) are outlined in Table 5.

Table 5: Expected Nitrogen Loads in Monofill Leachate

	Total Nitrogen (kg-N/d)
Waste Activated Sludge	18
Stockyards Solids	6

Notes:

1. *This assessment has assumed that 20% of biosolids will be to monofill with remaining biosolids to land;*
2. *The total annual nitrogen load has been averaged over a 250 day period;*
3. *This assessment has assumed that the nitrogen content of the WAS biosolids is 6% and that 55% of this nitrogen would mineralise and discharge to the WWTP in the leachate;*
4. *This assessment has assumed that the nitrogen content of the stockyards solids is 4.5% and that 55% of this nitrogen would mineralise and discharge to the WWTP in the leachate.*

4.0 Monofill Operation and Management

4.1 Site Operation

Dewatered WAS and stockyards solids will be tipped into the respective cells. The tipped material is unlikely to slump unless there is an extended period of incident rainfall. The incident rain is likely to runoff to the leachate collector sump and pumped either to the existing lagoon treatment system or in future pumped back to the upgraded wastewater treatment plant.

The deposition of material further into the cells would be by creating temporary earthen ramps over the deposited material so that an excavator can push the newly deposited material further into the monofill cell. This herring-bone approach would result in uneven distribution, but will allow drying of the material as the deposited material will be in windrow formation.

In the event that there is rainfall onto the monofill results in mobilisation of solids, then remedial measures such as pumping the mobilised solids onto a drying bed may be required. Alliance Lorneville already has a sludge dewatering cell available for use.

4.2 Site Access Management

Existing internal access roads and Boyle Road will allow tipper truck access to the monofill site from the dewatering facility and from the stockyards. Although Boyle Road is a public road, it is very rarely used by others outside of Alliance personnel as it only provides access to Alliance Lorneville.

The transport distance from the proposed dewatering facility (to be located within the future wastewater treatment plant) to the monofill is approximately 0.8 km. The distance between the stockyards (located within the processing plant) and the monofill is approximately 2 km. Any other type of waste will be prohibited access to the monofill site by Alliance personnel.

4.3 Surface Water Runoff and Leachate Management

All rainfall that falls on the active monofill cells and the resultant leachate will be collected by a sump established at a low point of the monofill cell. The sump is likely to comprise of reinforced concrete manhole risers excavated to form a low point at one end of each monofill. Duty and standby submersible pump-sets will operate on flow switches to automatically pump any leachate to the adjacent existing aerated lagoon system where it will receive biological treatment.

Temporary bunding in the monofill cell at the end of production season will prevent rainwater mobilising the monofilled biosolids and clogging the leachate collection system during the winter shutdown period. Soil will be placed to form baffles and/or straw bales will also be installed when required to mitigate clogging of the leachate collection system.

4.3.1 Contaminant Loading in Leachate

The contaminant load associated with the leachate will be significantly less than the load associated with the raw effluent from the processing plant. Nitrogen loads that will be discharged to the existing WWTP associated with the monofill leachate are outlined in Table 6. For comparison purposes, the current nitrogen load to the existing WWTP has also been outlined.

Table 6: Nitrogen Loads to Existing WWTP

Nitrogen Sources	Current System (kg-N/d)	Proposed System (kg-N/d)
Influent from Processing Plant	1,800	450
WAS Leachate	n/a	18
Stockyards Solids Leachate	n/a	6

Notes:

1. *This assessment has assumed that the future nitrogen load to the existing WWTP will be reduced by 75% will implementation of the new BNR WWTP;*
2. *The total annual nitrogen load has been averaged over a 250 day period;*
3. *This assessment has assumed that 20% of biosolids will be to the monofill with remaining biosolids to land;*
4. *This assessment has assumed that the nitrogen content of the WAS biosolids is 6% and that 55% of this nitrogen would mineralise and discharge to the WWTP in the leachate;*
5. *This assessment has assumed that the nitrogen content of the stockyards solids biosolids is 4.5% and that 55% of this nitrogen would mineralise and discharge to the WWTP in the leachate.*

Monofilling operations will only commence when the new biological nutrient removal treatment plant is commissioned and the load contributed by leachate to the existing lagoon system will be minimal. Given that rainfall are predominant during winter when there is no or little production at the Lorneville processing plants, the impact of monofill leachate on the performance of the existing lagoon system will be minimal.

In the event that the load associated with the monofill leachate did impact on the performance, the leachate would be pumped to the new upgraded wastewater treatment plant.

4.3.2 Estimate of Seepage from Monofill Cells

The monofill cells would generally be clay-lined (compacted in-situ material with additional import from local on-farm quarry in the vicinity of the existing wastewater treatment plant).

The existing wastewater treatment system at Alliance Lorneville is a series of in-situ material lined lagoons. The lagoons have been operating for a long period of time and there has been no significant loss from the lagoons as a result of seepage into the ground. Recent groundwater investigations undertaken in the vicinity of the wastewater lagoons have shown that there is very little impact seepage from the lagoons into the local groundwater.

Based on no previous actual field permeability and compaction information, a conservative estimate of the amount of seepage based on the in-situ clay/silt liner at 2 x 10^{-9} m/s with a hydraulic gradient of 10 and a total surface area of the monofill cells of 9,400 m^2 is likely to be less than 9 m^3/d.

Since the lagoons are located in the floodplain and surrounded by existing wastewater treatment lagoons, it is likely that any seepage would be combined with the seepage from existing treatment plant and finally discharge into the Makarewa River.

4.4 Final Closure

Progressive closure and rehabilitation will be undertaken at each monofill cell once it has reached its volume capacity. The final capping of each monofill cell will involve placement of a 0.3 m thick clay/soil layer.

5.0 Assessment of Environmental Effects

The utilisation of existing ponds at Alliance Lorneville to operate as contingency biosolids monofill is not expected to create additional effects above which are currently associated with the WWTP operation. These effects are discussed in the following sections.

5.1 Effects on Surface Water

Rainfall events will be managed by the leachate management system described in Section 4.3. The submersible pump-sets used to pump rainfall collected from the monofill into the adjacent WWTP will be specified to meet the maximum rainfall intensity.

The proposed monofill will utilise existing ponds at the Alliance Lorneville WWTP and therefore the flood protection level of the monofill will be the same as for the existing wastewater treatment lagoons at the WWTP.

5.2 Effects on Groundwater

The lagoon system at Alliance Lorneville was formed in approximately 1968, and it is understood that no engineered compacted clay or synthetic liner was installed. However, continuous use of the lagoon for sludge dewatering and contingency overflow of the wastewater has provided a natural sealing of the bottom of the lagoons.

Alliance Lorneville undertook a pond draw-down test in January to February 2015 in order to investigate the seepage and backflow at the proposed monofill site. Standing water from proposed monofill cell “A1” was pumped out to the adjacent Loop pond to investigate seepage from adjacent ponds and groundwater. After complete pump-out of the pond, the invert remained empty with no observable seepage.

Groundwater and surface water monitoring was undertaken by PDP at Alliance Lorneville to determine any effects on groundwater and surface water arising from the wastewater treatment lagoons. The results of this investigation are outlined in the report *Groundwater and Surface Water Monitoring at Alliance Group Lorneville Plant* (PDP, 2015). An absence of elevated concentrations of nitrate and phosphorus was detected in boreholes immediately south of the wastewater treatment lagoons where groundwater elevations indicated to the general groundwater movement. These results indicate that there are no observed effects on the surrounding groundwater from the lagoons and that there is likely a reasonable barrier which is containing contaminants within the lagoon system. It is therefore likely that this same barrier will contain contaminants within the monofill cells.

5.3 Odour

Odour effects are expected to be localised and minimal. Waste will be deposited into the monofill incrementally (maximum loads of 20 wet t/d, if all diverted on a given day) with minimal disturbance to the existing material and therefore minimising odour generation.

In the event if odour issues do arise, application of hydrated lime to the surface of the disturbed monofill area will be used. Hydrated lime is available at all times at the site as it is utilised at the fellmongery for pelts processing.

5.4 Aesthetics and Nuisance

5.4.1 Vector Attraction

Vector refers to potential carriers of disease, such as flies, mosquitoes, birds and rodents.

Dewatered WAS is relatively stable and non-putrescible and will not be attractive to vector. In the event at the time of deposition, there is risk of vector nuisance, the dewatered WAS will be augmented with hydrated lime to allow further stabilisation and avoid the potential for vector nuisance.

Stockyards solids are likely to be more attractive to vectors than dewatered WAS due to the high volatile solids content of this material. However, the level of vector attraction would be limited to the deposition area for a short period of time. If required, hydrated lime addition to the top of the stockpile will reduce the potential for vector attraction.

Preference will be for land application of stockyards solids over deposition in the monofill in order to minimise the risk of vector attraction and localised odour at the monofill.

5.4.2 Noise

Noise produced at the monofill will be generated by:

- Truck movements to and from the monofill;
- Earthmoving operations during monofill operation, e.g. the intermittent removal of material stored in the monofill for land application and capping of the cells.

For the majority of the time works at the monofill will be at or below the existing allowable noise limits. Machinery used will be those generally associated with wastewater treatment plant activities. In addition the receptors for noise are well beyond the boundary and the operations are unlikely to affect these receptors.

5.4.3 Aerosols/Dust

It is acknowledged that landfills can produce particulate dust, particularly during earthmoving operations in high wind conditions. However, dewatered WAS (12-18% DS) and stockyards solids (25% DS) will still be relatively wet during deposition, therefore, dust generation will be minor.

6.0 Effects Monitoring and Reporting

6.1 Operational Monitoring

Regular monitoring will be undertaken during monofill operations.

The number of truck movements and hence the volume of the waste disposed of to the monofill will be recorded daily. Periodic weight per volume validations of waste will also be undertaken. Periodic or as on a required basis, visual surveys of the operating monofill will be undertaken to provide an indication of the rate of fill into the monofill.

The groundwater, surface water and dust/noise monitoring proposed are outlined below.

6.1.1 Groundwater Quality Monitoring

Groundwater quality monitoring of the five new groundwater monitoring bores installed in November 2014 will be undertaken on an annual basis. Monitoring to assess for any groundwater contamination from the existing wastewater treatment system operations (including future contingency monofill leachate) will involve collection of samples to be analysed for parameters including electrical conductivity, pH, nitrogen and phosphorus.

6.1.2 Surface Water Quality Monitoring

Regular surface water quality monitoring will be undertaken for surface water entering the Makarewa River as a requirement for the discharge of treated wastewater. No additional monitoring is proposed from the contingency monofill.

6.1.3 Noise, Dust and Odour Monitoring

Noise, dust and odour will be monitored when contingency disposal activities are undertaken. Alliance Lorneville acknowledges that appropriate mitigation measures including dust control, and liming for odour control will be implemented as required, should any unforeseen issues arise.

6.2 Post Closure Monitoring

It is envisaged that the operational monitoring regime of surface and groundwater monitoring will continue on an annual basis for approximately 3 years following closure of the monofill. A final capping survey will be undertaken after 3 years to ensure that contours are prepared over the surface to avoid any seepage of rain into the monofill.

After approximately 3 years, enough post closure information will be available to report on the:

- Cover stability of the monofill and the drainage system;
- Groundwater quality; and
- Final cover shape to allow surface run-off.

At that time, a decision can be made as to whether there is a need to continually monitor any leachate from the fill. It may also be possible at this time to demonstrate that the monofill does not pose any adverse effect to the receiving environment and therefore have the ability to cease all after care activities including the monitoring programme.

6.3 Reporting

Reporting and review of the monofill operations and after care reporting will be undertaken in accordance with any resource consent requirements and also be incorporated into the environmental review process for the site.

This will ensure that the monofill operation is included as an integral part of the overall site environmental management plan, system, auditing process and accountability.

7.0 Conclusion

This Technical Assessment of Environmental Effects has been prepared to support the utilisation of existing disused ponds at the Alliance Lorneville wastewater treatment plant to operate as active monofill cells, receiving stockyards solids and dewatered WAS generated from the proposed BNR upgrade.

In summary it is concluded that the proposed monofill will generate environmental effects that are no more than minor.

It is anticipated that these monofill cells will only be used on a contingency basis, with the preferred disposal method for spreading to land for nutrient augmentation.

8.0 References

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