BEFORE THE ENVIRONMENT COURT
I MUA I TE KOOTI TAIAO O AOTEAROA

Decision No. [2019] NZEnvC 66

IN THE MATTER	of the Resource Management Act 1991
AND	of an appeal under section 120 of the Act
BETWEEN	CANTERBURY LANDSCAPE SUPPLIES LIMITED
	(ENV-2018-CHC-169)
	Appellant
AND	CANTERBURY REGIONAL COUNCIL
	Respondent

Environment Judge J E Borthwick – sitting alone pursuant to section 279 of the Act

In Chambers at Christchurch

Date of Consent Order: 9 April 2019

DETERMINATION

A: Under section 279(1)(b) of the Resource Management Act 1991, the Environment Court, by consent, orders that:

(1) the appeal is allowed and CRC175345 and CRC175344 are granted, subject to:

(a) the amended application for resource consent dated 29 March 2019;
(b) the conditions marked Annexure I;
(c) Appendix 1: Design and Description of Aerated Static Pile (ASP) Compost Process;
(d) Appendix 2: Compost Production Manual;
(e) Appendix 3: Compost Management Plan dated 02 September 2018;
(f) Appendix 4: Stormwater Assessment, Canterbury Landscape Supplies – Diversion Road, Swannanoa dated 1 October 2018;
(g) Appendix 5: Design and Description of Maturation Pad Line System

— all of which attach to and form part of this determination.

(2) the appeal is otherwise dismissed.

B: Under section 285 of the Resource Management Act 1991, there is no order as to costs.

REASONS

Introduction

[1] This proceeding is an appeal by Canterbury Landscape Supplies Limited against a decision of the Canterbury Regional Council, declining consent to discharge contaminants to air[1] and land[2] from a composting operation at 97 Diversion Road, Swannanoa ("the site").

[2] I have read and considered the consent memorandum of the parties dated 25 January 2019,[3] the further information filed by Canterbury Landscape Supplies Limited on 29 March 2019 and the memorandum of the Regional Council dated 4 April 2019, which propose to resolve the appeal.

[3] The court issued a Minute on 22 March 2019, asking the parties to provide further information and clarification about a number of points. The Regional Council, by way of memorandum dated 3 April 2019, confirms that:

(a) each of the documents referenced in condition 1(a)-(e) was reviewed for the Regional Council by appropriately qualified persons and all have advised that they are satisfied that the mitigation proposed addressed the issues which led to the original decline of the application by the Regional Council;

(b) air quality issues were addressed by Cathy Nieuwenhuijsen, Senior Air Quality Consultant, Golder Associates. Advice on implementation of air quality conditions was also sought from Nathan Dougherty, Senior Resource Management Officer at Environment Canterbury;

[1] CRC175345.
[2] CRC175344.
[3] Subsequently there was some delay caused by counsel being unable to obtain the signatures of Cheryl and Ray Briggs, as they were at sea, but their signatures have now been obtained and were provided to the court on 19 February 2019.

(c) risk to groundwater and surface water quality, arising from overflow from ponds and sumps and runoff from compost piles during extreme rainfall events exceeding the system design capacity was addressed by Zeb Etheridge, Senior Scientist (Groundwater Science) at Environment Canterbury; and

(d) Planning Officer Tegan Wadworth and Dr Phillip Burge, Principal Consents Advisor attest that the current proposal is within the scope of the notified application and that it conforms to the relevant requirements and objectives of the Act, including in particular Part 2.

Background

[4] The site is zoned Rural under the Waimakariri District Plan with the applications considered jointly as a discretionary activity.

[5] Land use consent associated with the compost operation was granted by the Waimakariri District Council on 21 September 2018.[4]

[6] The principal reasons for the Council's decline of the applications were that the methods for avoiding, remedying and mitigating adverse effects – by removing the highly odorous anaerobic material from the site and using sawdust to absorb ponded water – were not sufficiently effective.[5] Additionally, given the high sensitivity of groundwater and surface water to any additional nitrogen inputs, there was not sufficient mitigation or avoidance of that effect.[6]

[7] The Hearing Commissioners noted in their decision that a different type of composting process (Aerated Static Pile or "ASP") had been proposed during the hearing, although there was insufficient evidence on the detail and design of the process to make a robust assessment of environmental effects or to provide assurance that the site could be redesigned to sufficiently maintain and control discharges to water and air within the context of the sensitivity of the receiving environment.[7]

[4] See [9] below.
[5] Report and decision of Hearings Commissioners dated 26 June 2018 at [293].
[6] Report and decision of Hearings Commissioners dated 26 June 2018 at [171].
[7] Report and decision of Hearings Commissioners dated 26 June 2018 at [296].

Other relevant matters

Section 274 parties

[8] The following persons have given notice of an intention to become a party under section 274 of the Resource Management Act ("the RMA" or "the Act") and have signed the memorandum setting out the relief sought:

(a) Silver Fern Farms Limited
(b) Eyre District Environmental Association Incorporated
(c) Louise Beswick
(d) Simon Beswick
(e) Cheryl Briggs
(f) Ray Briggs
(g) Robert Brittenden
(h) Alison Dodds
(i) Karl Dodds
(j) Louise Douglas
(k) Courtney Fraser
(l) Diane Fraser
(m) Noel Fraser
(n) Gregory Greenwood
(o) Janine Greenwood
(p) Ann Lewis
(q) Janet Madeley
(r) John Madeley
(s) Thomas McBrearty
(t) Alistair Millar
(u) Anton Nikoloff
(v) Damian O'Brien
(w) Daniel Power
(x) Michelle Power
(y) Jill Randle
(z) Melvyn Randle
(aa) Graham Rouse
(bb) Rosina Rouse
(cc) Keith Tannock

(dd) Sarah Waller.

Notes beside signatures

[9] It is recorded that Graham and Rosina Rouse have added handwritten notes beside their signatures disputing two factual matters in the introductory section of the consent memorandum, as follows:

(i) paragraph [4] of the consent memorandum does not give an accurate picture of the number of lifestyle blocks that are subject to the effects of the discharges to land and air;
(ii) paragraph [5] (should be [6]) relating to the land use consent granted by the Waimakariri District Council is challenged.

[10] Mr Cleary, counsel for Canterbury Landscape Supplies Limited, advises the court that, while it is considered that these paragraphs are of a background nature and it is not necessary to amend the consent memorandum, the appellant wishes to clarify:[6]

(i) there are approximately 30 rural lifestyle allotments of 4ha (more or less) within a 2km radius of the site; and
(ii) the land use consent granted to Canterbury Landscape Supplies Limited on 21 September 2018 was for a "bulk material storage and processing facility".

Authority to sign

[11] The following parties were unable to sign the consent memorandum and provided authority to Noel Fraser to sign on their behalf:

(a) Wayne Randle;
(b) Jillian Randle; and
(c) Courtney Fraser.

[12] The court has been provided with email correspondence from these parties, authorising Mr Fraser to sign on their behalf.

[6] Letter from Canterbury Landscape Supplies Limited, dated 4 February 2019.

Agreement reached

[13] The turned-pile system of composting has been replaced with the ASP system. Under the ASP system, windrows in the active stage of composting (weeks 1-6) will be established on a purpose built concrete pad and force fed with air via onsite compressors to ensure that the pasteurisation of the compost is reliably and efficiently completed in as short a period as possible.[9]

[14] The ASP process minimises the time when potentially offensive odours may be emitted from the windrows. All leachate run-off from windrows places on the concrete ASP pad will be directed to a lined retention pond. This will avoid the potential discharge of leachate to land and subsequently to groundwater.

[15] The court was provided a copy of the amended application dated 29 March 2019. Further, to this the following documents in support of the agreement reached were also produced:

(a) Appendix 1: Design and Description of Aerated Static Pile (ASP) Compost Process;
(b) Appendix 2: Compost Production Manual;
(c) Appendix 3: Compost Management Plan dated 2 September 2018;
(d) Assessment of Environmental Effects of Discharges to Air ("AEE");
(e) Review by Transform Compost Systems ("Review");
(f) Appendix 4: Stormwater Assessment, Canterbury Landscape Supplies – Diversion Road, Swannanoa dated 1 October 2018;
(g) Appendix 5: Design and Description of Maturation Pad Liner System.

[16] In particular, the court notes that the AEE prepared by Beca Limited concludes that any discharges will have less than minor effect on the surrounding environment. The Review has been prepared by Dr John Paul, an expert with 20 years' experience in the design of composting facilities. Dr Paul says that he is satisfied that the ASP design not only meets the requirement of the standard required for compost, soil conditions and mulches in New Zealand (NZS 4454:2005) but includes operational considerations that will provide additional assurances to reduce potential odour, improve process efficiency and product quality.[10]

[9] Consent memorandum, dated 25 January 2019, at [16].
[10] Review by Transform Compost Systems, dated 5 September 2018.

[17] The parties have agreed that with the use of the ASP system, and conditions to manage it, the effects can be mitigated to overcome the concerns identified by the Hearing Commissioners.[11]

[18] The amended application, together with the documentation referred to in the conditions are attached and form part of this decision to grant consent orders.

Outcome

[19] All parties to the proceeding have executed the memorandum requesting the orders. On the information provided to the court, I am satisfied that the orders will promote the purpose of the Act so I will make the orders sought.

J E Borthwick
Environment Judge

Annexures:

(a) Amended application for resource consent dated 29 March 2019;
(b) Conditions marked Annexure 1;
(c) Appendix 1: Design and Description of Aerated Static Pile (ASP) Compost Process;
(d) Appendix 2: Compost Production Manual;
(e) Appendix 3: Compost Management Plan dated 02 September 2018;
(f) Appendix 4: Stormwater Assessment, Canterbury Landscape Supplies – Diversion Road, Swannanoa dated 1 October 2018;
(g) Appendix 5: Design and Description of Maturation Pad Line System.

[11] Consent memorandum, dated 25 January 2019, at [24].

Loe Pearce & Associates Ltd
Resource Management Investigations
100 Weston Road Christchurch 8052
Telephone 03 356 2135
Mobile 0272063773
barryloe@xtra.co.nz

Application amended 297 March 2019 to identify extant content

Canterbury Landscape Supplies

Applications for Resource Consents from Canterbury Regional Council

Location: Diversion Road, Swannanoa

Legal Description: Part RS 33406 and Lot 2 DP25643

1. Establishment and Operation of Activities at Diversion Road Site

Canterbury Landscape Supplies (CLS) is one of the largest manufacturers and suppliers of landscaping and gardening products in the South Island. CLS provide products to a wide range of customers – home gardeners, landscapers, nursery growers, farmers with indoor animal housing systems, garden retailers, city and district councils, and large residential and commercial subdivision developers. CLS works in partnerships with several Canterbury businesses to recycle organic material produced from the growing and/or processing of; wood products, animals, poultry, and mushrooms, and off-cuts from gypsum plasterboard manufacture and installation. CLS is developing opportunities to use waste organic material by-products of waste treatment such as bio-solids and DAF treatment plant sludge, and compostable packaging in the composting operation.

CLS presently operate their bulk material processing and storage, wholesale and retail yard at 1250 Main North Road, Kainga, Christchurch. CLS has decided to move most of the material processing and storage from 1250 Main North Road to a new site located off Diversion Road, off South Eyre Road, Swannanoa.

2. Description of Site

The CLS Diversion Road site is 9.8 hectares of leased land from a property of 278 hectares. The property was, until September 2012, fully planted in production trees, however the wind storm at that time caused widespread damage to the trees across the property. The section of the plantation to the south of the CLS area has since then been harvested and the land renovated to pasture. Production trees remain on the north, east and west boundaries of the CLS area.

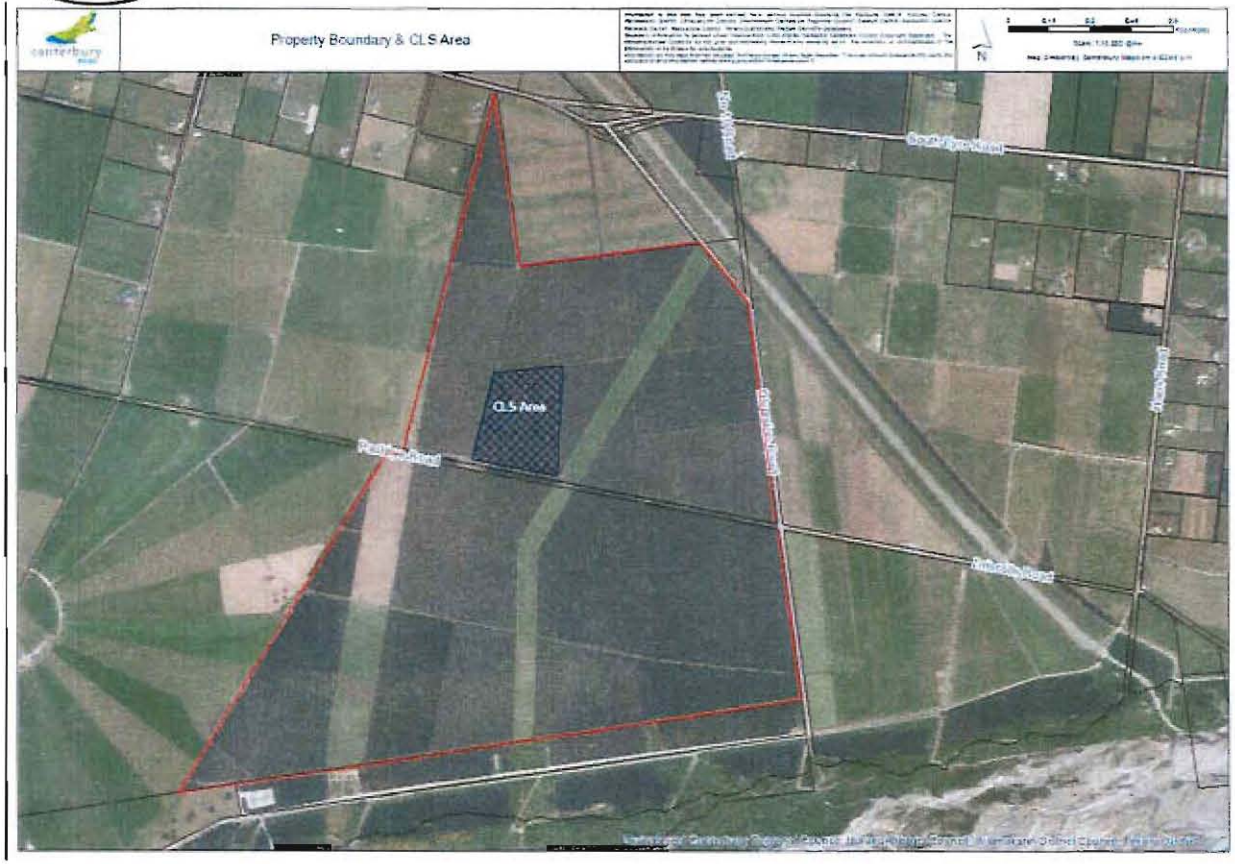

Figure 1 – Property Boundary (red line) and CLS Area (black hatch)

~~Figure2 Site Layout Plan~~

Proposed Activities

The activities at the site include both composting processes and the handling of bulk materials that are not part of any compost process.

3.1 Blending and composting organic materials

The scale of composting activity at the Diversion Road Site is described in Table 1.

Table 1: Rates and Volumes of Composting Materials on Site

Product	Handling Operation and Processes	Handling Rate	Particle Size (mm)	Quantity in Process or Stored on Site (max)
Bark fines, sawdust + organic materials	Blending & turning, composting	<20 t/hr	>3.5	40,000 m^3

The blending and composting of organic materials with sawdust and bark fines will be undertaken on the site. The organic materials include:

- commercial kitchen and industrial grease trap contents blended with sawdust
- vegetation (leaf mulch), vegetables and fruit
- chicken hatchery litter (egg shells, yolks)
- pressed (dewatered) paunch grass
- solids from meat and milk processing wastewater treatment
- solids from municipal sewage treatment (biosolids)
- wool fragments from scouring
- used bedding straw and sawdust from rearing of livestock indoors

3.1.1 Handling of organic material and compost

The waste organic material is trucked to the site from the premises where it is generated. The material is tipped out in the reception bay where it is immediately mixed with bark fines and/or sawdust. The mixing creates a relatively dry mix, approximately 50% moisture. ~~The blended material is then placed in windrows or extended piles located on the compacted gravel surface of the composting area of the site. The windrows or piles are turned using a loader about every four weeks until the composting process is complete, usually after about 12 – 16 weeks. This method of composting is known as a 'windrow' or 'turned pile' process and is recognised by the composting industry as a legitimate, generic composting process.~~

The management of the process follows the industry guidelines set out in NZS:4454-2005

(a) Ingredients:
- Organic wastes and bulking agents; sawdust, bark fines, straw.
- Details of all types of feedstock used for composting are recorded to ensure traceability from delivery through to release of end-product.
- The organic waste material is blended with the bulking agents; sawdust and bark fines.
- The optimum C:N ratio for the composting material is between 30:1 and 40:1. The organic waste materials are high in N (2 to 10%) and C (10 to 40%) , and the bulking material high in C (25 to 50%). Achieving the optimum ratio in the blended material requires the organic waste to be mixed with the sawdust/bark fines in a ratio of about 1:1.5.

- This ratio has proven in the CLS operations to produce high quality products without generating any significant odour or leachate from the windrows

(b) Initial mixing:

- Thorough mixing of ingredients minimises gradients in the composting mass and results in consistent processing. ~~Adverse effects of inadequacies of the initial mix can be minimised by frequent turning during processing.~~ Mixing by front-end loader gives satisfactory results.

~~(c) Dimensions:~~

- ~~Windrow or pile heights up to 3.5 metres are suitable, and result in increased temperatures, but increased turning frequency may be needed to maintain oxygen levels at the centre of the window or pile. The windrows will be between 5 and 7 metres wide at the base.~~

~~(d) Turning:~~

- ~~The frequency of turning is determined by the parameters for moisture, temperature and oxygen. Experience of this material has shown that, following initial mixing, turning every four weeks is adequate.~~

(e) Temperature.

- High temperature achievement is a function of pile dimensions, moisture content and available nutrient levels. Pasteurising temperatures of SS°C or higher for at least 1S days is optimal for this composting process~~, with a minimum of three turnings during the composting process~~.

~~(f) Duration.~~

- ~~Active composting duration will be between 12-16 weeks. A curing period of at least two months follows to ensure that compost is mature. Recent analysis of finished product showed a C:N of 18:1.~~

Composting at the site is undertaken in compliance with NZS44S4:2005 New Zealand Standard Composts, Soil Conditioners and Mulches. This Standard is to ensure that the products produced under it do not present a hazard to the environment nor to public health. The Standard prescribes compositional requirements, compliance requirements, sampling and testing methods for composts, soil conditioners and mulches. This Standard applies to organic products and mixtures of organic products that are to be used to amend the physical, biological and chemical properties of natural or artificial soils and growing media. It specifies physical, chemical, biological and labelling requirements for composts, mulches, soil conditioners and related products that have been derived largely from compostable organic materials and which meet the minimum requirements as set out in the Standard. It covers materials marketed or distributed both in bags and in bulk. ~~A Management Plan for the composting operation is attached, Appendix 1.~~

Any organic waste material from human waste treatment sources will be certified to meet Grade Ab, under the classification Guidelines for the Safe Application of Biosolids to Land in New Zealand (2003) before arriving at the site. The grade A, of Grade Ab, means the biosolids have been subjected to treatment and sampling to verify that micro-organism concentrations in the waste do not present a hazard to human health. The grade b, of Grade Ab, means the waste material has been tested for metals and organics and the concentrations are compliant with the maximum concentrations in the Guidelines for these contaminants.

At the site, the organic material is received into the reception area. This area is 12 metres x 17 metres comprising a concrete forecourt apron and bays with concrete floor and walls. The organic material will be mixed with sawdust or bark fines in the reception area. The reception area is

contained and will drain to a collection sump, capacity 8 cubic metres. Any liquid from the sump is picked up with a loader bucket and poured back into the stockpiles. The mixed bulk material is formed into windrows. ~~The windrows will be a maximum of 4 metres high, and will be turned using a loader or digger every 4 weeks until the compost process is complete. The compost windrows will be located on compacted gravel surface of the area.~~

Figure 3 Reception area and mixing bay

Figure 4 Reception area and mixing bay (left), with drain and sump (right)

Figure 5 Drain from reception area and mixing bay to the sump

~~A Management Plan for the composting operations at the site is attached, Appendix 1.~~

3.2 Handling of bulk materials

The bulk materials, not part of any composting process, and the scale of the handling operation of each material are given in Table 2:

Table 2: Rates and Volumes of Materials not part of composting process on the site,

Product	Handling Operation or Process	Handling Rate	Particle Size (mm)	Quantity Stored (max)
Bark	Screening:	<35 t/hr	>3.5	20,000 m^3
Spent mushroom growing compost +sawdust	Blending	<20 t/hr	>3.5	30,000 m^3
Wood	Shredding	<1 t/hr	>3.5	3,000 m^3 shredded wood
Plasterboard	Shredding	<1 t/hr	>3.5	5,000 t
Gypsum	Bagging	<1 t/hr	<3.5	500 t (in bags)
Sawdust	No processing	0	>3.5	15,000 m^3
Soil	No processing	0	>3.5	15,000 m^3

The handling operations will occur in the open on the site.

Spent mushroom growing compost is brought to the site and blended with sawdust before being formed into windrows. The blended material does not undergo further composting and has no further processing before being used in landscaping and garden soil conditioning products.

Sawdust and soil is stored on the site without further processing.

Tree bark, sourced from wood processing, is screened on the site before being stored in various size grades, that are then sold for different uses. The smallest grade fines are either removed from the site or blended in with organic material being composted.

Wood from broken-up pallets made from untreated timber is shredded and screened into graded sizes, each sold for different uses.

Gypsum plasterboard offcuts from the board manufacturing and from new building construction are shredded to separate the gypsum (calcium sulphate) from the paper casing. The shredded paper is blended in with other composting material, while the gypsum is bagged and sold off-site as a soil conditioner and fertiliser.

3. Analysis of Resource Consents Required

4.1 Nature of the site and activity

The site is an industrial and trade premises, and the activity on the site an industrial or trade process, because materials are processed to produce commercial products for sale. This is a waste management process as all material have been removed from the waste stream to be recycled into useable commercial products. Handling and processing includes; size reduction, screening, turning, blending, conveying, and storage of materials. The bulk material is all organic matter. Some material in stockpiles will be decaying.

4.2 Scale and effects on the environment of the activity

The rate of handling/processing will not exceed 100 tonnes per hour.

The amount of material stored that has a particle size or average particle size less than 3.5 mm will not exceed 1000 tonnes.

There is no sensitive activity or site of significance to Ngai Tahu within 200 metres of the site.

~~3.3 Waimakariri District Council~~

~~There are no rules in the District Plan that will be contravened by the activities prosed for the site. No resource consent is required from Waimakariri District Council.~~

4.4 Canterbury Regional Council

There are regional rules for discharge to air and land use from the activities that involve commercial processing of waste, use of land for stockpiling of decaying organic matter, and handling and storage of bulk materials.

5.0 Regional Plans

5.1 Definitions:

Bulk materials *includes all materials consisting of, or including, fragments or particles that could be discharged as dust or particulate. These materials include, but are not limited to: gravel, quarried rock, fertiliser, coal, cement, flour, rock aggregate, grains and wood chips.* [defined in ~~NRRP Ch 1, and~~ pCARP Decisions version].

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Bulk materials on the site include; bark fines, sawdust, compost, soil, and gypsum.

Handling *means ...processing, screening, conveying...or crushing of any material* [defined in pCARP Decisions version~~, but not in NRRP~~].

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Handling at the site would include; blending and turning of materials, composting, shredding wood and plasterboard, screening bark, soil and compost, and bagging gypsum.

Industrial or trade premises *means*
(a) any premises used for any industrial or trade purposes; or
(b) any premises used for the storage, transfer, treatment, or disposal of waste materials or for other waste-management purposes, or used for composting organic materials; or
(c) any other premises from which a contaminant is discharged in connection with any industrial or trade process;
but does not include any production land. [defined in the RMA]

The site is an industrial or trade premises.

Stormwater *means runoff that has been channelled, diverted, intensified or accelerated by human modification of the land surface or runoff from the external surface of any structure as a result of precipitation and includes entrained contaminants and sediment including that generated during construction or earthworks.* [defined in LWRP]

The site is flat. Rainfall will soak into the land, and there will be no run-off. There will be no stormwater generated from the site.

~~**Waste** *means materials which are unwanted or surplus to process requirements that the holder discards, or intends to, or is required to discard.* [defined in NRRP, but not in pCARP].~~

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The materials on site are waste, as they are unwanted or surplus to process requirements, and, were they not taken by CL5, would be discarded by the processor.

Waste management *means the transportation, resource recovery, recycling, storage, treatment and disposal of wastes. It includes (but is not limited to) composting, the disposal of effluent and solid animal waste, the disposal of human sewage, the disposal of offal into pits, disposal of waste at a landfill, waste transfer facilities, disposal of waste in a waste incineration device [and cremation][1]; but excludes outdoor burning of waste.* [defined in NRRP, deleted from pCARP in Decisions version]

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Some of the processes on site are waste management, as waste materials are being recovered (gypsum), recycled (composting) and stored (stable compost). There is also handling of bulk materials.

5.2 Regional Plans Rules:

5.2.1 Discharge to Air

Regional Plan Rule	Conditions or specification of the rules	Does the Rule Apply? Does the Activity comply?	
NRRP			Formatted: Strikethrough
Rule AQL42B discharge of contaminants to air from…handling, processing, conveying, or storage of bulk materials…	• rate of size reduction, screening, processing <100 t/hr • quantity handled is <100 t/hr • amount of bulk material stored <1000 t when particle size < 3.5 mm • no objectionable or offensive effect beyond boundary • > 200 m from a sensitive activity	Rule AQL42B applies. Activity complies as a Permitted Activity	Formatted: Strikethrough Formatted: Strikethrough
AQL57 The discharge of contaminants into air from: (a) any industrial or trade premises or any industrial or trade process explicitly excluded from Rules AQL38 to AQL56; (b) any industrial or trade premises or industrial or trade process that does not comply in all respects with the conditions specified in Rules AQL38 to AQL56 as applicable for a permitted activity; or (c) any industrial or trade premises that is not otherwise expressly provided for by the rules of the NRRP; is a discretionary activity;	(a) Premises/processes not excluded by Rules AQL38 to AQL56; (b) Premises/processes comply with AQL42B as a permitted activity (c) Premises expressly provided for by Rule AQL42B	Rule does not apply	Formatted: Strikethrough
Rule AQL69 The discharge of contaminants into air from any waste management process that: (a) does not comply in all respects with the conditions specified in Rules AQL63 to	Rules AQL63 to AQL67 do not authorise the proposed activity, so rule conditions cannot be 'complied with', (although not breached either).	Rule AQL69 applies. Discharge to air from waste management	Formatted: Strikethrough

[1] NRRP only

Regional Plan Rule	Conditions or specification of the rules	Does the Rule Apply? Does the Activity comply?
~~AQL67 as applicable for a permitted activity;~~ ~~is a discretionary activity,~~		~~process requires consent – discretionary activity~~
pCARP (decisions version)		
Rule 7.3 The discharge of odour, dust or smoke into air that is not managed by any other rule in this Plan is a permitted activity provided the conditions are met:	• The discharge does not cause or is not likely to cause an adverse effect beyond the boundary of the property of origin; and • No offensive or objectionable effect beyond the boundary of the property of origin.	Rule does not apply as Rule 7.63 applies.
Rule 7.36 The discharge of contaminants to air to air from handling of bulk solid materials – Permitted Activity provided the conditions are met:	• No offensive or objectionable effect beyond the boundary of the property of origin. • rate of handling outdoors <100 t/hr • if rate of handling outdoors >20 t/hr, Dust MP required • > 200 m from a sensitive activity or place of significance to Ngai Tahu	Activity could comply as a Permitted Activity, but Rule 7.63 applies
Rule 7.37 The discharge of contaminants to air from outdoor storage of bulk solid materials – Permitted activity provided the conditions are met.	• No offensive or objectionable effect beyond the boundary of the property of origin. • amount of bulk material stored <1000 t when average particle size < 3.5 mm • storage >200 t, Dust MP required • > 100 m from a sensitive activity or place of significance to Ngai Tahu	Activity could comply as a Permitted Activity, but Rule 7.63 applies.
Rule 7.63 The discharge of contaminants into air: (a) that does not comply with one or more of the conditions of Rules 7.47 to 7.62, excluding condition 1A; or (b) that is from an industrial or trade premise and is not managed by Rules 7.47 - 7.62; and is not a prohibited activity, is a discretionary activity.	The site is an industrial or trade premise. Rules 7.47 – 7.62 do not manage the discharge to air from this site. The discharge is not a prohibited activity.	This rule applies. The discharge of contaminants into air from the site is a Discretionary Activity.

5.2.2 ~~Land Use and associated~~ discharge of contaminants to land.

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LWRP	Conditions or specification of the rules	Does the Rule Apply? Does the Activity comply?
~~5.38 The use of land for the stockpiling of decaying organic matter (including compost) and any associated discharge into or onto land~~	~~Any decaying organic matter does not originate from an industrial or trade process.~~	~~Activity does not comply – refer Rule 5.39~~
~~5.39 The use of land for the stockpiling of decaying organic matter (including compost) and any associated discharge into or onto land not permitted by Rule 5.38~~	~~Any decaying organic matter does not originate from an industrial or trade process.~~	~~Activity does not comply – refer Rule 5.40~~

LWRP	Conditions or specification of the rules	Does the Rule Apply? Does the Activity comply?
~~5.40 The use of land for the stockpiling of decaying organic matter (including compost) and any associated discharge into or onto land, that does not meet one or more of the conditions in Rule 5.39 is a restricted discretionary activity where the following condition is met:~~	~~The stockpile and discharge is the subject of a Farm Environment Plan that has been prepared in accordance with Schedule 7 Part A.~~	~~No FEP so activity does not comply.~~ ~~Rule contravened, so land use consent required. Activity status not classified so defaults to discretionary activity~~
5.91 The discharge of any wastewater, liquid waste or sludge waste from an industrial or trade process, including livestock processing, excluding sewage, into or onto land, or into or onto land in circumstances where a contaminant may enter water is a permitted activity,	1.The volume of the discharge does not exceed 10 m3 per day; and 2.The discharge is at a rate not exceeding 5 mm per day; and 3.The discharge does not contain any hazardous substance; and 4.The discharge is not: (a) directly to a surface water body, or within 50 m of a surface water body, a bore used for water abstraction, a dwelling house, school, community facility or the Coastal Marine Area; or (b) within a Group or Community Drinking-water Protection Zone as set out in Schedule 1; or (c) within the Christchurch Groundwater Protection Zone as shown on the Planning Maps; or (d) onto or into land over an unconfined or semi-confined aquifer, where the land has less than 0.3 m depth of soil; or (e) within any area or zone identified in a proposed or operative district plan for residential or commercial purposes; or (f) within a Nutrient Allocation Zone identified as "At Risk" (Orange) or "Water Outcomes Not Met" (Red) on the Planning Maps, unless the discharge contains no nitrogen or phosphorus, or otherwise causes a limit in Schedule 8 to be exceeded; or (g) onto or into contaminated or potentially contaminated land.	There may be very small volumes of liquid generated from stockpiles. This liquid could contain some nitrogen or phosphorus. The NAZ at the site is "Water Outcomes Not Met" (Red) ~~'At Risk' (Orange)~~, so Condition 4(f) not complied with, so Rule 5.92 applies.
5.92 The discharge of any wastewater, liquid waste or sludge waste from an industrial or trade process, including livestock processing, excluding sewage, into or onto land, or into or onto land in circumstances where a contaminant may enter water that does not meet one or more of the conditions in Rule 5.91 is a discretionary activity.	Discharge does not meet condition 4(f) of Rule 5.91	Rule applies **Discharge to land consent required for any liquid waste – discretionary activity**
5.98 Any discharge of water or contaminants onto or into land in circumstances where a contaminant may enter	Discharge to land classified by Rule 5.92	Rule does not apply

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LWRP	Conditions or specification of the rules	Does the Rule Apply? Does the Activity comply?
groundwater that is not classified by any of the above rules, is a permitted activity, provided the following conditions are met: ...		

S.2.3 Summary of Consents Required from CRC:

Discharge to air:

The discharge of contaminants to air from the activities on the site requires resource consent under pCARP (Decisions version) Rule 7.63. ~~The discharge of contaminants to air from waste management processes on the site requires consent under NRRP Rule AQL69.~~

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~~Land use and~~ discharge to land:

~~The use of land for stockpiling decaying organic matter requires consent as it contravenes LWRP Rule 5.40.~~ The discharge of liquid waste onto land requires consent under LWRP Rule 5.92.

Activity Status:

All activities that require resource consent are Discretionary Activities.

6 Description of the Environment

The site is located in a rural area, 1.5km north of the Waimakariri River, and 1 km west of the Eyre River Diversion channel. The elevation of the site is approximately 42 metres above sea level. The predominant land use in the area is now pastoral dairy farming on land recently converted from Eyrewell Forest. The plantation on the property within which the CLS operation is located is some of the last remaining forest planting on the north bank of the Waimakariri River. The property within which CLS has leased land is in private ownership.

6.1 Settlement

The area is sparsely settled. The dwelling closest to the perimeter of the CLS site is 820 metres to the north-west, with the next closest dwellings being 1000 metres west, and 1000 metres north-east (see Figure 9). To the south-east, in the direction of katabatic air movement, there are no dwellings for over 7 kilometres from the site.

6.2 Soils

The soils on the site are described as Darnley stony silt loams (ref. S-maps CRC GIS maps). These are moderately shallow, 25 – 40 cm deep, stony soils that have low permeability.

6.3 Groundwater

Groundwater in the vicinity is in an unconfined or semi-confined aquifer. The groundwater flow direction is from west to east. There is a long record of groundwater level data for some wells in the locality of the site. These wells are located on Figure 10 and described in Table 3.

Table 3

Well	Depth of well (metres)	Distance from CLS and groundwater flow direction	Elevation of well head (masl)	Highest Water Level Recorded (mbgl) and date recorded	Use of well
M35/0197	22.3	650m up gradient	46	3.2 (26/09/1978)	No longer in existence
M35/8558	15	850m down gradient	39	3.9 (16/06/2010)	Water level observation
M35/0658	5.90	2000m downgradient	31	0.9 (23/09/1978) [2.2 (16/06/2010)]*	Water level observation

*Included for comparative purposes

The water level in well M35/0658 has been recorded since 1955 (see Figure 7), and in M35/0917 water levels were recorded from 1977 to 1987. The water level in both wells was recorded in September 1978, showing a difference in groundwater level of 2.1 metres over the 2.5 kilometres between the two wells. The water level in wells M35/8558 and M35/0658 were also recorded on the same day, 16 June 2010. The difference in groundwater levels over the 1150 metres between these wells was 1.7 metres.

This data provides a sound basis for predicting that highest groundwater levels beneath the CLS site in 1978 would have been about 3 metres below ground level, and in 2010 the highest level would have been about 4.2 metres below ground level. As shown on the plot of data for groundwater levels for M35/0658 in Figure 6 below, the highest groundwater level on record was in 1978. Such high levels have not been recorded since.

The ECan State of Environment Report for 2010 reported below average rainfall but average groundwater levels, in the Waimakariri zone. Therefore, as 2010 was an average year, the average seasonal high groundwater level beneath the site is reasonably expected to be not less than 4 metres below ground level.

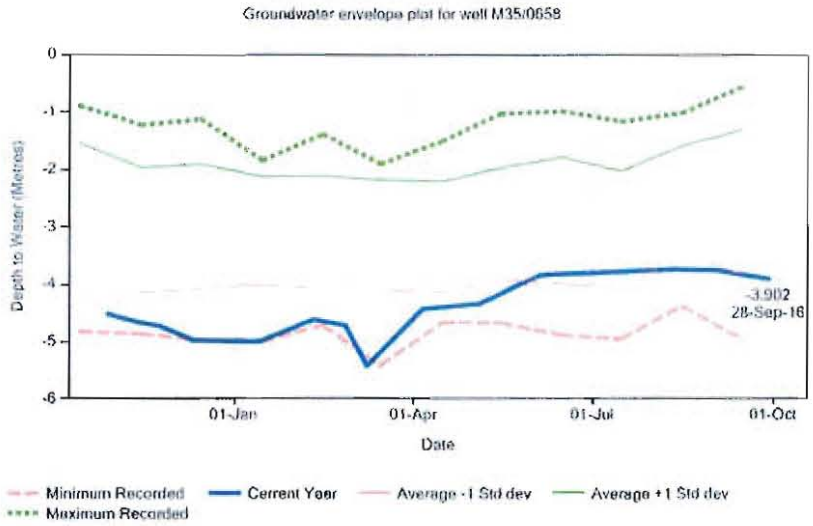

Figure 6

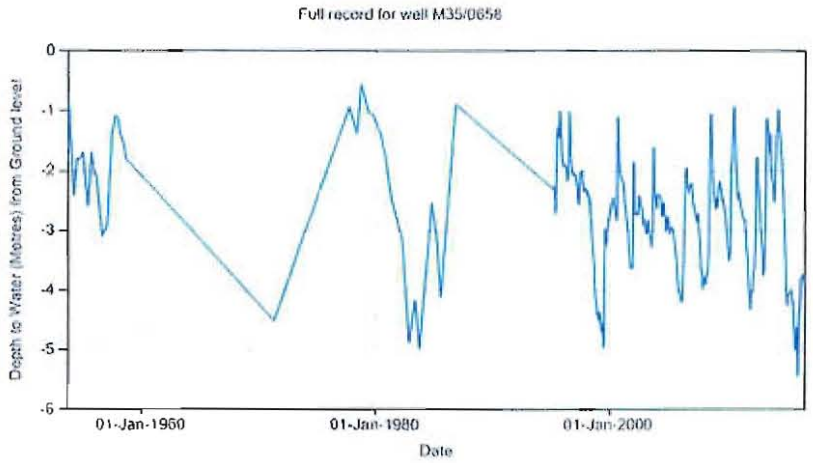

Figure 7

Groundwater use down-gradient of the site is predominantly for individual household domestic supply. The closest domestic wells are located to the east of Harrs Road, over 2000 metres downgradient of the site.

6.4 Wind direction, strength and frequency at the site

The proposed site is 7.5 km north of Christchurch airport, and could be expected to experience every similar wind patterns to the airport. A wind rose for Christchurch Airport is shown in Fiugure X.

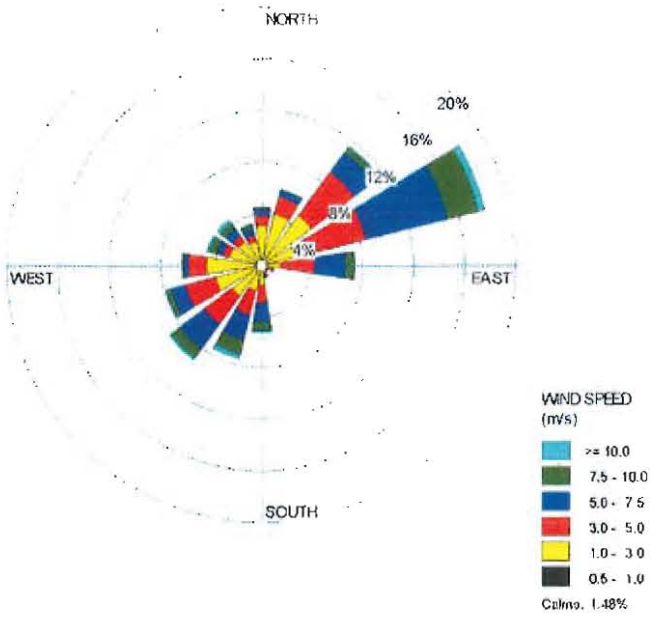

Figure 8 – Christchurch Airport AWS Windrose [data period 01 February 2007 – 31 January 2012]

The predominate winds are from north-easterly quarter (approximately 40% of the time), followed by winds from the south-westerly quarter (30% of the time) and north-westerly quarter (20% of the time). The lightest winds, below 3 m/s, tend to blow from the north-east, and west to south-west. Note the absence of winds recorded from the south-east.

The distances to property boundaries are 250 m to west boundary, 400 m to north boundary, 700 m to the east boundary and 1000 m to the south boundary.

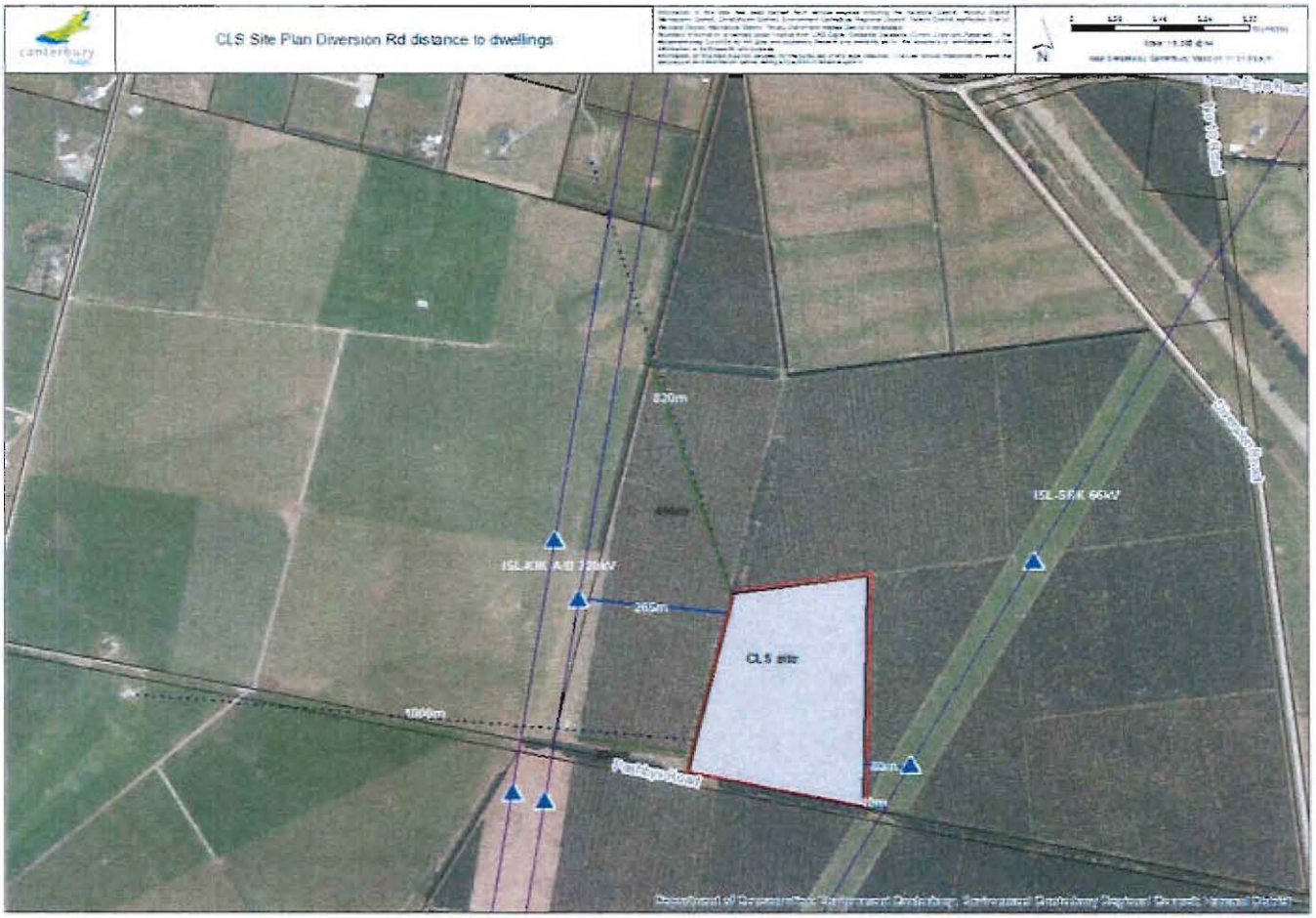
CLS Site Plan Diversion Rd distance to dwellings
820m
ISL-SFK 66kV
265m
CLS site
1004m
Pattersons Rd

Figure 9

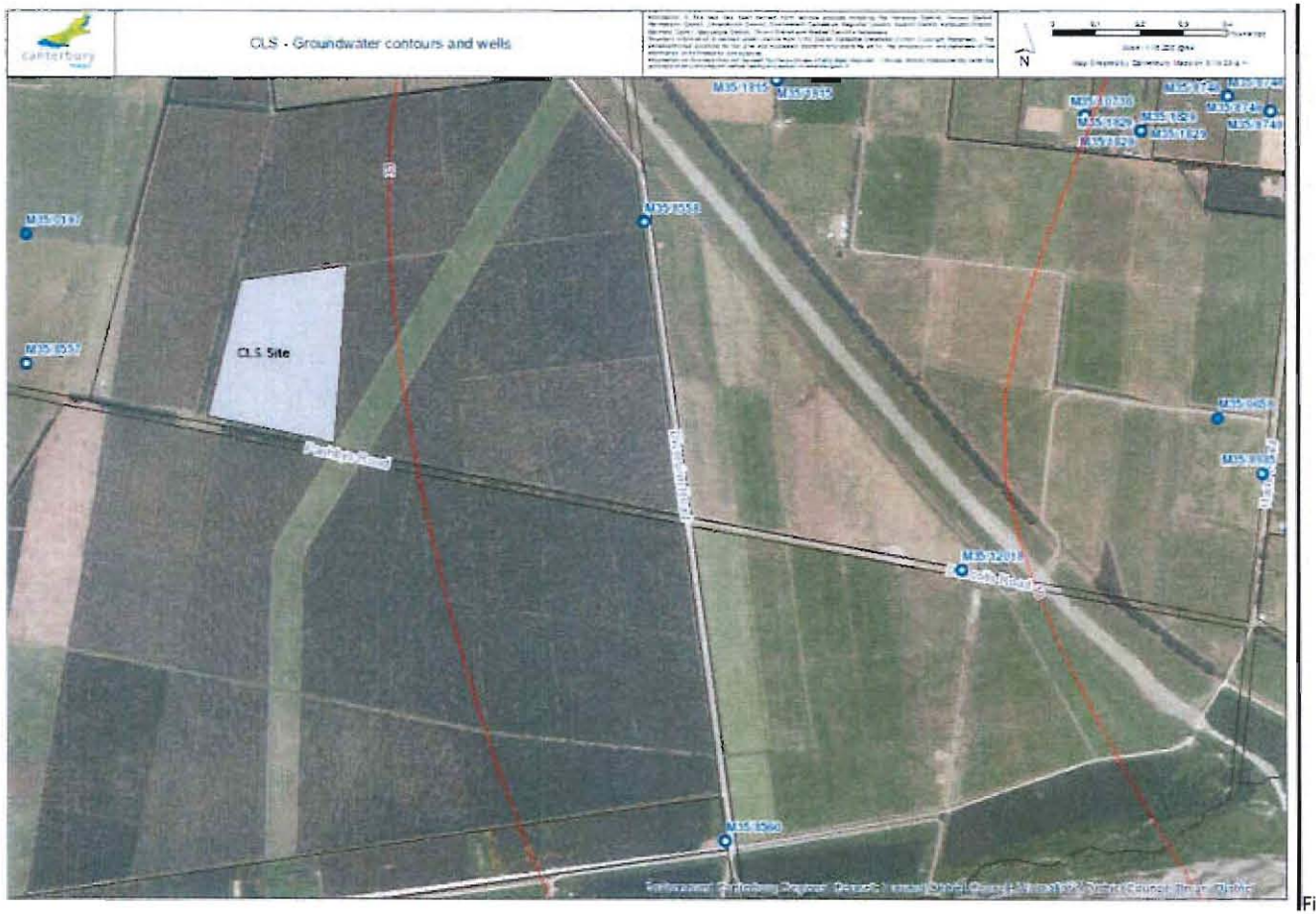

Figure 10

7. Assessment of Effects on the Environment

7.1 Discharge to Air

7.1.1 Odour

Most of the material that will be stored and processed on the site will not generate odour.

The composting of waste organic matter mixed with bark fines and sawdust will comprise only about 15% of the total volume of material on the site. The reception and mixing of these materials will occur in the concreted reception and mixing bay. The waste organic materials will be unloaded into the reception area when they arrive on site, mixed with the bulking agents and the removed to the windrow. Should the organic water material be odorous upon arrival, the period of exposure, when a discharge to air is likely, before the material is blended with bark fines or sawdust, will be very short.

From the reception area the mixed material is formed into piles or windrows. ~~These are passively composted, with turning occurring every four weeks, until composting is completed at about 16 weeks. The mature compost is cured for a further 8 weeks before use. The maximum volume of this material on the site will be 15,000 cubic metres. The volume of the windows is about 10 m^3 per metre length, so at maximum capacity there will be about 1500 metres of windrows of material at various stages of composting. At any time, there will be up to 2500 m^3 of material actively composting at each 4 week stage of the process, a total of 10,000 m^3, plus up to 5000 m^3 of compost in the curing phase.~~

~~Turning of compost occurs on average about 5 days per month. The potential for odour discharge is limited to the instances when the compost is turned.~~

The maturing plantation trees, up to 10 metres high, on the north, west and east sides of the composting area will assist with the dispersal of odour before it reaches property boundaries. The closest boundary is to the west, 250 m from the CLS area. The closest sensitive activities (dwellings) are 820 m to the north west, and 1000 west of the CLS area. If any odour was to reach the site boundary, the closest sensitive activity to the site boundary is over 350 metres to the northwest. This dwelling is not down wind of the composting area for any of the expected wind conditions at this site. The next closest dwelling is 750 metres west of the site boundary. This dwelling will only be down wind of the composting area in winds from the east. The wind patterns records indicate a low incidence of light winds from the east, with a very low percentage of winds of less than 3 metres per second from the east. It is these very low velocity winds that are likely to carry odour for any distance.

The FIDOL assessment for potential for odour generated to create adverse effects beyond the boundary of the site is described.

Frequency

~~Odour has potential to be generated only when compost is turned during the active decomposition process. This occurs only on a few days each month.~~ Newly exposed compost will quickly oxidise and cease to smell. Site management will also respond to odorous material and cover this with fresh sawdust. Overall frequency of odour generation will be low.

Intensity

While freshly turned compost can emit Intense odours of decomposing organic matter, any odour generated will be diluted and dispersed before it reaches the property boundary. Should odour escape the property boundary this odour will be diluted and dispersed, and be of low intensity.

Duration

Any odours generated will not persist as exposed odorous material will quickly oxidise, or can be covered in fresh sawdust, and cease to generate odours.

Offensiveness

While the odour from the freshly decomposing organic material could be considered offensive by sensitive receptors in close proximity to the material, the distances between this material, the property boundaries and sensitive activities will ensure that if any odour is detected it will not be offensive. The human receptors in the vicinity are rural workers or residents for whom odours from organic waste can be common place, so they are not sensitive to odours of this nature.

Location

The composting site is located within a larger property in a rural area. The composting site is isolated from sensitive activities. The activities on the site are handling of natural materials and composting of waste materials largely derived from processing of products from primary industries – farming and forestry. The location is appropriate and well suited to the nature and impacts of this activity.

7.1.2 Dust

The surface of the site will be conciliated in situ natural material occurring, gravel and silt. There may be some dust generated from vehicle movements and unconsolidated surfaces, particularly during strong winds. The surrounding vegetation will, to a large extent, moderate the wind speeds experienced at the site, and act as an effective dust trap. A water cart will be used on the site to dampen the access ways for vehicles, to suppress dust and enhance working conditions on the site.

The surrounding vegetation and the distance to property boundaries, of over 250 metres, will mean that any dust generated from the site will not reach the property boundary. The separation distances and the surrounding vegetation will also protect the Transpower transmission lines that pass to the west of the property boundary and pass through the property to the east of the CLS site, from any adverse effects of dust (see Figure 8).

~~**7.2 Use of land for stockpiling decomposing organic matter and any associated discharge onto or into land**~~

~~The composting organic matter will be in windrows approximately 5 -7 metres wide at the base. With 2000 metres of windrows the area of land used to store composting organic matter will be about 1.5 hectares. The site is located in the Waimakariri Nutrient Management Zone of the LWRP. This is an orange zone, where water quality outcomes are 'at risk' of not being achieved.~~

7.2.1 Leachate

The composting material when managed using best practice will not produce significant amounts of leachate. The following information from Cornell Waste Management Institute, Department of Crop and Soil Sciences, Cornell University, New York, USA supports this approach.

Nitrate is most easily controlled by maintaining an appropriate C:N ratio in the composting mixture. Raw materials should normally be blended to approximately 30:1 carbon to nitrogen ratio by weight. The ratio between these key elements is based on microbial biomass and energy requirements. Inadequate nitrogen (a high C:N ratio) results in limited microbial biomass and slow decomposition, while excess nitrogen (a low C:N ratio) is likely to leave the composting system as either ammonia (odors) or nitrate (water pollution). In a nitrogen limited system microorganisms efficiently assimilate nitrate, ammonia and other nitrogen compounds from the aqueous phase of the compost, thus limiting the pollution threat.

The ideal ratio of carbon to nitrogen will depend on the availability of these elements to microbial decomposition. Carbon availability is particularly variable, depending on the surface area or particles and the extent of lignification of the material. Composting occurs in aqueous films on the surfaces of particles, so greater surface area increases the availability of carbon compounds. Lignin, because of its complex structure and variety of chemical bonds, is resistant to decay. For both of these reasons the carbon in large wood chips is less available than that in straw or paper, so greater quantities of wood chips would be required to balance a high nitrogen source like manure.

The data from experimental studies indicates low C:N ratio mixtures can generate nitrate levels above the groundwater standard (Rymshow et al.; 1992, Cole, 1994) Much of this nitrate in runoff and leachate will infiltrate into the ground. While microbial assimilation and denitrification may somewhat reduce these levels as water passes through the soil, these processes will have a limited effect and are difficult to control. Proper management of the C:N ratio is perhaps the only practical way to limit nitrate contamination site short of installing an impermeable pad and water treatment system.

The other important factor to consider when creating a composting mixture is water content. From a microbial standpoint, optimal water content should be in the 40 to 60% range. This moisture content is a balance between water and air filled pore space, allowing adequate moisture for decomposition as well as airflow for oxygen supply. The ideal water content will vary somewhat with particle size and density, and fine, dense organic substrates should be drier if adequate aeration is to be assured. Excess water, in addition to increasing the odor potential via anaerobic decomposition, will increase the runoff and leachate potential of a composting pile during rainfall events.

~~*With both C:N ratios and moisture content, the optimum water and nitrogen levels for rapid composting may create a greater than necessary water pollution threat. Increasing the C:N ratio from 30:1 to 40:1 and decreasing the water content from 60 % to 50% may slow down decomposition somewhat, but can provide an extra margin of safety in protecting water quality.*~~

~~*Once the materials are mixed and formed into a compost pile windrow management becomes an important factor. Windrows should be oriented parallel to the slope, so that precipitation landing between the windrows can move freely off the composting area. Pile shape can have a considerable influence on the amount of precipitation retained in a pile, with a flat or concave top retaining water and a convex or peaked shape shedding water, particularly in periods of heavy rain. These effects are most pronounced when the composting process is just starting or after a period of dry weather. In the early phases of composting a peaked windrow shape can act like a thatched roof or haystack, effectively shedding water. Part of this effect is due to the large initial particle size, and part is due to waxes and oils on the surfaces of particles. Both of these initial effects will diminish over time as the material decomposes. During dry weather the outer surface of even stabilized organic material can become somewhat hydrophobic, limiting absorption and encouraging runoff.*~~

~~*If a pile does get too moist, the only practical way to dry it is to increase the turning frequency. The clouds of moisture evident during turning release significant amounts of water, and the increased*~~

~~*porosity which results from turning will increase diffusion and convective losses of moisture between turnings. This approach can be helpful during mild or warm weather, but caution must be exercised in winter when excessive turning can cool the pile.*~~

Source: http://compost.css.cornell.edu/waterqual.html

Achieving the optimum C:N ratio of about 30:1 and ensuring moisture levels are about 50% in the compost will minimise the generation of leachate. The groundwater beneath the site is protected from contamination by the low permeability soil and subsoil overlying the groundwater. ~~Contaminants in leachate will be adsorbed or attenuated in the soil and subsoil, protecting groundwater quality.~~ In the very unlikely event that a contaminant enters groundwater the low rate of discharge combined with the distance to any receptors, wells or springs, will ensure that there will be no adverse effects from any minor discharge to land.

~~**7.2.3 Run-off from rainfall**~~

~~In periods of heavy or continuous rainfall, run-off from the surface of the windrows can pond on the land surface for short periods before soaking into the land. The quality of this run-off is affected as it picks up some contaminants from the composting material. CLS collected a sample of this run-off and had it analysed for pH and nutrients. The results are presented in Appendix 2. The run-off is only slightly alkaline (pH 7.5), and had low concentrations of organic nitrogen and plant available phosphorus.~~

~~The movement of these contaminants through the soil and unsaturated zone will result in the reduction of concentrations as nutrients are utilised by bacteria in soils and subsoils. Any contaminants that enter groundwater in this location will be quickly diluted and dispersed. There is very little risk of any impact on groundwater quality.~~

8. Policies and Objectives of Policy Statements and Plans

8.1 Regional Policy Statement

Air Quality

Objective 14.2.2 — localised adverse effects of discharges on air quality

Enable the discharges of contaminants into air provided there are no significant localised adverse effects on social, cultural and amenity values, flora and fauna, and other natural and physical resources.

Policy 14.3.3 — Avoid, remedy or mitigate localised adverse effects on air quality

To set standards, conditions and terms for discharges of contaminants into the air to avoid, remedy or mitigate localised adverse effects on air quality.

Policy 14.3.5 – Relationship between discharges to air and sensitive land-uses

In relation to the proximity of discharges to air and sensitive land-uses:

...

(3) New activities which require resource consents to discharge contaminants into air are to locate away from sensitive land uses and receiving environments unless adverse effects of the discharge can be avoided or mitigated.

Analysis: The discharge to air from the waste management processes to be undertaken on the site will not result in significant localised adverse effects, as the site is located sufficiently far from sensitive land uses to avoid adverse effects occurring.

Soils

Policy 15.3.1 – Avoid remedy or mitigate soil degradation

In relation to soil:

(1) to ensure that land-uses and land management practices avoid significant long-term adverse effects on soil quality, and to remedy or mitigate significant soil degradation where it has occurred, or is occurring; and

(2) to promote land-use practices that maintain and improve soil quality.

Analysis: The stockpiling of organic matter will maintain and improve soil quality and will not result in significant degradation of soil quality on the site.

Waste

Objective 19.2.1 – Minimise the generation of waste

Adverse effects on the environment are avoided by minimising the generation of waste.

Principal reasons and explanation

The most effective way of avoiding adverse effects of waste is to minimise the amount of waste generated. Reducing the amount of waste generated in the first place is key to the minimisation of waste being disposed of. The reuse and recycling of waste materials will also minimise the overall amount of waste being disposed of.

Policy 19.3.1 – Waste management hierarchy

To apply the principles of the 5Rs (Reduce, Reuse, Recycle, Recover, Residual waste management) hierarchy to the management of all waste streams.

Analysis: The waste management processes undertaken on the site will assist to minimise the volume of waste that is disposed to landfill in the region, and will provide for the beneficial reuse and recycling of waste organic material into horticultural and agricultural production and the generation of energy for processing primary production.

8.2 ~~Canterbury Natural Resources Regional Plan (NRRP) – Air Quality~~

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~~***Objective AQL1*** *Objective for localised air quality Localised contaminant discharges into air do not, either on their own or in combination with other discharges, result in significant adverse effects on the environment, including:*~~
~~*(a) the loss of air as a taonga to Tāngata Whenua; and*~~
~~*(b) adverse effects on human health and safety; and*~~
~~*(c) offensive or objectionable odours; and*~~
~~*(d) diminished visibility, as a consequence of human activities; and*~~
~~*(e) corrosion and soiling of structures, not being property owned by those causing the discharge; and*~~
~~*(f) adverse effects on health and functioning of ecosystems, plants and animals; and*~~
~~*(g) contamination of water.*~~

~~***Policy AQL5*** *Odour nuisance*~~

~~*(a) The discharge to air of odour from new activities shall not be offensive or objectionable to the extent that it has or is likely to cause an adverse effect on the environment beyond the boundary of the site where the discharge originates.*~~
~~...~~
~~*For the purposes of this policy: new activities are those activities which are established after 1 June 2002 or not lawfully established on or before 1 June 2002; and existing activities are those activities which are lawfully established on or before 1 June 2002.*~~

~~***Policy AQL6*** *Avoid dust nuisance*~~

~~*(a) The discharge to air of dust shall not be corrosive, noxious, dangerous, objectionable, or offensive to the extent that it has or is likely to cause an adverse effect on the environment beyond the boundary of the site where the discharge originates.*~~

~~...~~

~~Analysis: The proposed waste management activities are appropriately located to ensure that offensive or objectionable effects will be avoided. Any discharge of contaminants to air will not impinge on the air quality outcomes that are currently enjoyed at and near the site. The activities at this site are compatible with surrounding land use and cumulative and reverse sensitivity effects will be avoided.~~

8.3 Proposed Canterbury Air Regional Plan (pCARP) Decisions version 01.10.2016

Relevant Objectives

5.1 Air quality protects the mauri and life supporting capacity of the environment.
5.2 Ambient air quality provides for the health and wellbeing of the people of Canterbury.
...
5.5 Air quality is managed in a way that provides for the cultural values and traditions of Ngāi Tahu.
5.6 Amenity values of the receiving environment are maintained.
5.7 Discharges from new activities are appropriately located to take account of adjacent land uses and sensitive activities.
...

5.9 Offensive and objectionable effects and noxious or dangerous effects on the environment are generally avoided.

...

Relevant Policies

Central Policies

6.1 Discharges of contaminants into air, either individually or in combination with other discharges, do not cause:

(a) adverse effects on human health and wellbeing; or

(b) adverse effects on the mauri and life supporting capacity of ecosystems, plants or animals.; or

(c) significantly diminished visibility; or

(d) significant soiling or corrosion of structures or property.

6.5 Offensive and objectionable effects are unacceptable and actively managed by plan provisions and the implementation of management plans.

6.6 Discharges into air from new activities are appropriately located and adequately separated from sensitive activities taking into account land use anticipated by a proposed or operative district plan and the sensitivity of the receiving environment.

6.7A When evaluating resource consent applications recognise locational constraints on activities, when imposing terms and conditions.

6.8 Where activities locate appropriately to mitigate adverse effects on air quality a longer consent duration may be available to provide on-going operational certainty.

6.10 Minimise the cumulative effects of discharges of contaminants into air by requiring:

(a) permitted discharges to apply good environmental practices; and

(b) discharges allowed by a resource consent to apply the best practicable option.

Industrial and trade activities and large scale discharges to air fuel burning devices

6.20 Applications for resource consent for discharges of contaminants into air from large scale fuel burning devices, and industrial or trade activities shall identify the best practicable option to be adopted to minimise effects.

6.22B Applications for resource consent for discharges into air from industrial or trade activities or large scale fuel burning devices classified as discretionary shall address:

...

(b) localised effects of the proposed discharge and the location of sensitive receptors; and

(c) available mitigation and emission control options; and

(d) the duration of consent being sought and the practicability for the effects of the discharge to be reduced over time.

6.22C When considering applications for resource consent for the discharge of contaminants into air from large scale fuel burning devices or from industrial, trade or commercial activities, the CRC will consider the combined effect of all consented discharges into air occurring on the property.

...

6.24 Manage discharges of odour and dust from the storage, transfer, handling, treatment or disposal of liquid or solid waste, by ensuring that any discharges from those activities are appropriately located.

Analysis:

The activities at the industrial and trade premises will not result in any discharge of contaminants to air that would impinge on the air quality that is currently enjoyed at and near the site. The activities are appropriately located to ensure that offensive or objectionable effects will be avoided. The activities will be managed using the best practical option, and industry best practice methods, to minimise any adverse effects. Any minor discharge that may be generated will not result in adverse effects on human health and safety, ecosystems, or property. The activities at this site are compatible with surrounding land use and cumulative and reverse sensitivity effects will be avoided.

8.4 Canterbury Land and Water Regional Plan (LWRP)

Relevant Objectives

3.1 Land and water are managed as integrated natural resources to recognise and enable Ngāi Tahu culture, traditions, customary uses and relationships with land and water.

3.5 Land uses continue to develop and change in response to socio-economic and community demand.

3.6 Water is recognised as essential to all life and is respected for its intrinsic values.

3.13 Groundwater resources remain a sustainable source of high quality water which is available for abstraction while supporting base flows or levels in surface water bodies, springs and wetlands and avoiding salt-water intrusion.

3.23 Soils are healthy and productive, and human-induced erosion and contamination are minimised.

3.24 All activities operate at good environmental practice or better to optimise efficient resource use and protect the region's fresh water resources from quality and quantity degradation.

Relevant Policies

4.4 Groundwater is managed so that:

...

(e) overall water quality in aquifers does not decline; and

...

4.8A [From NPS-FM 2014]

1. When considering any application for a discharge the consent authority must have regard to the following matters:

(a) the extent to which the discharge would avoid contamination that will have an adverse effect on the life-supporting capacity of fresh water including on any ecosystem associated with fresh water and

(b) the extent to which it is feasible and dependable that any more than minor adverse effect on fresh water, and on any ecosystem associated with fresh water, resulting from the discharge would be avoided.

2 When considering any application for a discharge the consent authority must have regard to the following matters:

(a) the extent to which the discharge would avoid contamination that will have an adverse effect on the health of people and communities as affected by their secondary contact with freshwater; and

(b) the extent to which it is feasible and dependable that any more than minor adverse effect on the health of people and communities as affected by their secondary contact with fresh water resulting from the discharge would be avoided.

3 This policy applies to the following discharges (including a diffuse discharge by any person or animal):

(a) a new discharge or

(b) a change or increase in any discharge –

of any contaminant into fresh water, or onto or into land in circumstances that may result in that contaminant (or, as a result of any natural process from the discharge of that contaminant, any other contaminant) entering fresh water.

4.12 There are no direct discharges to surface water bodies or groundwater of:

...

(d) organic waste or leachate from storage of organic material; and

...

4.13 For other discharges of contaminants into or onto land where it may enter water ... the effects of any discharge are minimised by the use of measures that:

(a) first, avoid the production of the contaminant;

(b) secondly, reuse, recovers or recycles the contaminant;

(c) thirdly, minimise the volume or amount of the discharge; or

...

4.14 Any discharge of a contaminant into or onto land where it may enter groundwater (excluding those passive discharges to which Policy 4.26 applies):

(a) will not exceed the natural capacity of the soil to treat or remove the contaminant; and

(b) will not exceed available water storage capacity of the soil; and

(c) where meeting (a) and (b) is not practicable, the discharge will:

(i) meet any nutrient limits in Schedule 8 or Sections 6 to 15 of this Plan; and

(ii) utilise the best practicable option to ensure the size of any contaminant plume is as small as is reasonably practicable; and

(iia) ensure there is sufficient distance between the point of discharge, any other discharge and drinking-water supplies to allow for the natural decay or attenuation of pathogenic micro-organisms in the contaminant plume; and

(iii) not result in the accumulation of pathogens, or a persistent or toxic contaminant that would render the land unsuitable for agriculture, commercial, domestic, cultural or recreational use or water unsuitable as a source of potable water or for agriculture; and

(iv) not raise groundwater levels so that land drainage is impeded.

LWRP Schedule 8 – WQ limits

Groundwater

Contaminant	Measurement	Limit
Nitrate-N	Maximum concentration	<11.3 mg/L
Nitrate-N	Annual average concn	<5.65 mg/L
E coli	any sample	<1 organism/100 millilitres
Other contaminants[2]	any sample	<50% MAV[3]

[2] Other contaminants of health significance as listed in NZ Drinking-water Standards.

[3] Maximum acceptable value (as listed in [2] above)

Analysis:

The use of land to store the blended materials while composting proceeds (decaying organic matter), ~~and any run-off or leachate from the composting material that may soak into land (associated discharge of contaminants onto or into land where they may enter groundwater)~~ will not have any significant impact on the land, soils or groundwater quality. The storage of the composting materials will have no adverse impact on the land, and the volume of discharge that may be generated will be small, contain only low concentrations of contaminants, and will soak into the land surface, where the contaminants will be attenuated by natural processes. The risk of contaminants entering groundwater will be very low, and any risk to groundwater quality will be negligible. The land use and associated discharge will occur in accordance with the objectives and policies of the regional plans.

8.5 Iwi Management Plans -

Ngai Tahu are tangata whenua, and the site is located in the takiwa of Ngāi Tūāhuriri Rūnanga. Iwi resource management documents for this area include Mahaanui Iwi Management Plan (IMP). This IMP identifies in Section 5.4, that land uses and adverse effects on water quality can have adverse effects on Ngāi Tahu values such as mauri, mahinga kai, wāhi tapu, and wāhi taonga, and the health

of the people and communities. The mauri, or life supporting capacity, of land and water must be protected, and land must be used with respect and passed on to the next generation in a healthy state.

Sites of Significance to Ngai Tahu

There are no Ngai Tahu sites of significance or values that will be impacted by this application.

Relevant Policies of Mahaanui Iwi Management Plan

R1.4- discharge to air
To support the use of indigenous plantings and restoration projects as a means to offset and mitigate industrial, agricultural and residential discharges to air.

P8.1- discharge to land
To require that discharge to land activities in the takiwā:
(a) Are appropriate to the soil type and slope, and the assimilative capacity of the land an which the discharge activity occurs;
(b) Avoid over-saturation and therefore the contamination of soil, and/or run off and leaching; and
(c) Are accompanied by regular testing and monitoring of one or all of the following: soil, foliage, groundwater and surface water in the area.

Analysis:

The discharge to air does not result in adverse effects that require offset or mitigation. The discharge to land associated with the composting is appropriate to the characteristics of the site, and will not result in contamination of soil or run-off or leaching that will have any adverse effects. The low level of impact on water quality does not justify regular testing of soil or groundwater.

~~9.0 Proposed Conditions of Consent~~

~~9.1 Discharge to Air~~

1. ~~The discharge of contaminants to air shall only be from an organic waste composting and bulk handling operation located at Diversion Road, Swannanoa, at or about map reference NZ TopoS0 , as shown on Plan CRC , attached to and forming part of this consent.~~

2. ~~The volume of material on site at any one time shall not exceed a combined volume of 90,000 cubic metres.~~

3. ~~The discharge shall not cause odour or particulate matter which is offensive or objectionable beyond the boundary of the property, as identified on Plan CRC....., attached to and forming part of this consent.~~

~~Operation and Monitoring~~

4. ~~The activity at the site shall be operated in accordance with the Compost Management Plan (CMP). The CMP shall:~~

a. set out the measures used to minimise odour and dust emissions caused by the composting activity;

b. reflect best practice guidelines for commercial composting in New Zealand;

c. include but not be limited to:

i. a location and site plan.

ii. a list of on-site management and monitoring procedures; and

iii. a procedure for recording and addressing odour complaints.

d. be prepared and submitted to the Canterbury Regional Council, Attention: Regional Leader – Monitoring and Compliance, within 20 working days of exercise of this consent; and

e. be displayed on site.

5. The CMP may be amended at any time. Amendments shall be:

a. only for the purpose of improving the efficacy of the composting process and shall not result in a decrease in air quality;

b. consistent with the conditions of this resource consent; and

c. submitted in writing to the Canterbury Regional Council, Attention: Regional Leader – Monitoring and Compliance, prior to any amendment being implemented.

6. The contact phone number of the site manager shall be notified to all land owners within 500 metres of the site. Any complaint shall be investigated and necessary corrective action taken within 24 hours of receipt of the complaint.

7. Composting activity shall follow best practice guidelines for the operation, as set out in Appendix K of NZS4454:2005 or any replacement. Best practice guidelines include:

a. maintaining aerobic conditions in the compost at all times;

b. achieving and maintaining the temperature of the material within the windrows of active compost between 35°C and 65°C;

c. achieving and maintaining the moisture content of the material within the windrows of active compost between 45 and 65 percent;

d. turning windrows as necessary to meet a, b and c above.

8. Temperature and moisture content of the compost windrows shall be measured:

a. in accordance with procedures described in the CMP; and

b. at least once in each seven day period for the first three weeks following the initial windrow formation; and

c. at least once per each fourteen day period until the composting is completed.

9. Windrows and stockpiles shall be managed to avoid creating conditions that may lead to spontaneous combustion of the compost.

Records

10. The monitoring undertaken in accordance with Condition 10 shall be recorded and the records shall detail the:

    a. location of the measurement;

    b. temperature of the location sampled;

    c. moisture content of the location sampled;

    d. name of the operator; and

    e. date and time of the monitoring.

    The records shall be retained until the composted material is removed from the site. A copy of the recorded entries shall be submitted to The Canterbury Regional Council, Attention: Regional Leader – Monitoring and Compliance, within 20 working days of written request by the Canterbury Regional Council.

11. The consent holder shall maintain records of the amount, source and condition of all materials processed on site. A copy of the records shall be provided to the Canterbury Regional Council, Attention: Regional Leader – Monitoring and Compliance, within 20 working days of written request by the Canterbury Regional Council.

12. The consent holder shall maintain records of any odour, dust or litter complaints that have been received. The records shall include, but not be limited to:

    a. The name and address of complainant, if supplied;

    b. The date and time that the contaminant was detected;

    c. The nature and duration of the reported effect;

    d. The location where the contaminant was detected;

    e. A general description of the weather conditions, including the wind speed and wind direction, when the contaminant was detected;

    f. The most likely cause of the contaminant; and

    g. Any corrective action undertaken by the consent holder to avoid or mitigate the contaminant detected by the complainant.

    These records shall be made available to the Canterbury Regional Council, Attention: Regional Leader – Monitoring and Compliance, within 20 working days of written request by the Canterbury Regional Council.

~~9.2 Land Use and Discharge to land~~

~~1. The land use shall only be for the stockpiling of compost and other decaying organic matter, and any discharges into or onto land, associated with a composting activity located at Diversion Road, Swannanoa , at or about map reference NZ Topo50, as shown on Plan CRC , attached to and forming part of this consent.~~

~~2. The volume of decaying organic matter on site shall not exceed a combined volume of 40,000 cubic metres at any time.~~

~~3. The material to be composted and/or compost being stockpiled shall not be located:~~

~~a. Within 10 metres of any property boundary;~~

~~b. Within 20 metres of any surface water body;~~

~~c. Within 20 metres of an existing bore.~~

~~4. The composting process shall not result in the ponding of liquid containing contaminants on the ground surface.~~

~~5. All practicable measures shall be undertaken to prevent oil and fuel leaks from vehicles and machinery used on site.~~

~~6. The activity at the site shall be operated in accordance with the Compost Management Plan (CMP). The CMP shall:~~

~~a. set out the measures used to minimise leachate caused by the composting activity;~~

~~b. reflect best practice guidelines for commercial vegetative waste composting in New Zealand;~~

~~c. include but not be limited to:~~

~~i. a location and site plan.~~
~~ii. a list of on site management and monitoring procedures; and~~
~~iii. a procedure for recording and addressing complaints.~~

~~d. be prepared and submitted to the Canterbury Regional Council, Attention: Regional Leader – Monitoring and Compliance, within 20 working days of exercise of this consent; and~~

~~e. be displayed on site.~~

~~7. The CMP may be amended at any time. Any amendments shall be:~~

~~a. only for the purpose of improving the efficacy of the composting process and shall not result in a decrease in groundwater quality;~~

~~b. consistent with the conditions of this resource consent; and~~

~~c. submitted in writing to the Canterbury Regional Council, Attention: Regional Leader Monitoring and Compliance, prior to any amendment being implemented.~~

Appendix 1

Canterbury Landscape Supplies
Diversion Road, Swannanoa

Management Plan for Organic Waste Composting

The following procedures are based upon *Introduction to Composting Science and Management for Industry Training An overview of the scientific principles of the composting process* (CompostNZ 2007) and Appendix K of NZS 4454:2005 *Composts, Soil Conditioners and Mulches.* The procedures are best practice guidelines for commercial composting in New Zealand.

The best practice guidelines in NZS4454:2005 are aimed firstly at the compost facility operator, by outlining the requirement to consider factors such as ingredients, type of compost processing, care with mixing, dimensions of the composting mass, composting duration, moisture content, temperature and oxygenation throughout the composting process. Secondly, these guidelines are designed to assist others in monitoring and assessing composting operations.

Odours and leachate generation can be minimised by correct compost processing as described in these best practice guidelines.

1. Best Practices for Turned Pile or Windrow Composting of Organic Waste Materials

(a) Ingredients

Details of all types of feedstock used for composting shall be recorded to ensure traceability from delivery through to release of end product.

All feedstock is to be blended with carbon sources (sawdust, bark fines) as soon as practicable after it arrives on site. Stockpiling of feedstock is to be avoided.

(b) Nutrients

Carbon and nitrogen are the primary elements that organisms need for food. Bacteria and fungi get their energy from carbon found in carbohydrates, such as the cellulose in bark and sawdust. Nitrogen, a component of protein, is necessary for the population growth of the micro-organisms active in the composting process.

The availability of nutrients in the organic material is a limiting factor in the composting process. Accelerated decomposition requires a proper balance of these macronutrients. If the carbon to nitrogen ratio is too far out of balance, the microbial system will suffer.

The optimum range of the carbon-nitrogen ratio for active aerobic composting is 20:1 to 30:1.

Mixing the organic waste material with sawdust or bark fines in a ratio of about 1 part organic waste material to 1.5 parts sawdust or bark fines will create the C:N in the optimum range.

The more the carbon-nitrogen ratio deviates from this range, the slower the decomposition process becomes. With a ratio of greater than 40:1, nitrogen represents a limiting factor and the reaction rate slows. With a carbon-nitrogen ratio lower than 15:1, rapid microbiological activity results, with possible oxygen deficiency, and excess nitrogen is driven off as ammonia. While this loss of nitrogen is not detrimental to the process of decomposition, it lowers the nutrient value of the end product and can contribute to odours generating from the compost site.

The C:N ratio of the finished product should be approximately 20:1.

(c) Initial mixing.

Thorough mixing is important, but periodic turning during processing can redress initial mixing problems. Good mixing of ingredients minimises variations in the composting mass and results in consistent processing.

(d) Pile/Windrow formation

Piles/windrows should initially be piled up to 4.5 metres with a bottom width of 7 metres. The length of the pile/windrow should not exceed 30 – 40 metres, to allow for separation between piles. Piles/windrows are to be placed to allow sufficient room for turning the pile/windrow and to allow access for machinery. Volume reduction during the composting process may necessitate periodic combining of piles.

(e) Pile/Windrow turning.

Frequency of turning is determined by the parameters for moisture, temperature and oxygen. Experience has shown that turning a pile/windrow every 4 weeks is sufficient to achieve rapid, odour-free composting.

(f) Moisture content.

For turned piles/windrows, dry mixes are best, e.g. 45 – 65 % moisture content in the feedstock at starting. Water is added as needed during turning to achieve about 50% moisture content throughout the composting process.

Higher moisture contents reduce oxygen diffusion rates. This increases the possibility of foul odour production and a slower processing rate because of lower temperature.

Moisture content that is too low can minimise evaporative cooling so that the pile overheats, unless it is so dry that microbiological activity is inhibited (e.g. 30 – 35 % at starting).

Monitor moisture when measuring temperature or when a pile/windrow is being turned

Moisture monitoring using the squeeze test:

(i) Grab a compost sample from at least 30 cm into the pile

(ii) Squeeze a handful of the composting material into a closed fist.

(iii) If any moisture is squeezed from the material it is too wet – turn the pile.

(iv) When the hand is opened, if the material retains the squeezed shape, the moisture content is right, at about 50 – 55%.

(v) If the material falls apart it is too dry – turn the pile, adding water when turning.

(vi) Record the moisture status: (i) too wet (ii) OK (iii) too dry

(h) Temperature.

The temperature should reach 55 °C for at least 15 days, then gradually stabilise around 40 – 50°C

High temperature achievement is a function of pile dimensions, moisture content and available nutrients.

Temperature gradients exist within piles. Cooler temperatures occur both in the outer zones and the inner, anaerobic zones (when present) in non-aerated piles. A temperature profile should be recorded to ensure that optimal processing is occurring.

Measure temperature in a pile/windrow once per week for the first 3 weeks following initial pile/windrow formation, then once per month until the composting is completed. Measure temperature approximately every 20 metres along the pile/windrow. Insert temperature probe into the pile/window at 1/3 of the pile/windrow height from the ground. Record the temperature, pile number, time and date, and operator.

If the temperature in the pile is less than 40°C, or more than 75°C, the pile must be turned.

Thorough mixing during turning ensures that colder, outer zones are turned into the pile, where higher temperatures are achieved. Covering with finished compost (approximately a 30 cm deep layer) can be used to maintain higher temperatures, if necessary in very cold weather.

(i) Aeration and Oxygenation.

Aeration is primarily managed through pile size and frequency of turning. Oxygen depletion can result from: high microbiological activity (because of high nutrient levels), compactness of mass (related to size of particles), the ratio of air to water filled spaces (depending on moisture content), bulking agent size and length of diffusion pathway (related to dimensions of pile). Oxygen concentrations of at least 12 – 14 % (and never less than 5 %) should be maintained throughout the pile. At oxygen levels below 5% anaerobic decomposition commences, producing foul-smelling odours.

Conditions leading to foul-smelling anaerobic decomposition are: - Piles that do not reach target temperatures; - Piles that are not turned frequently enough; - Piles that are too wet.

(j) Maturing

As composting progresses, the material will begin to resemble humus and soil. The material is moving toward a stable product. The carbon-nitrogen ratio is approaching 20:1 and the volatile nitrogen is being captured in organic compounds.

After about 12 – 15 weeks begin to monitor the level of stabilisation of the compost. Two simple procedures can be used for this purpose. The first test involves turning the pile and monitoring the internal temperature. If the pile reheats, the product is not yet stable enough for curing. In the second test, a sample of the compost can be placed in a plastic bag and sealed for 24 to 48 hours. If significant odour is given off as the bag is opened, the product is not yet stable.

(k) Screening.

The particle size to be screened is determined by the type of end product to be produced.

(l) Curing

When the material appears to have ceased active composting, it can be moved to a curing pile. The curing piles should not exceed 4.5 metres high, as the risk of spontaneous combustion increases with large piles. The compost should remain in a curing a pile for at least 6 weeks and up to 12 weeks. This will allow final stabilisation and the curing period will allow organisms that are compatible with soil environments to re-inoculate the compost.

2. Water Supply

Water for use in the composting operation is sourced from the well on the property.

3. Odour Complaint Response

In the event of an odour complaint being received by Company, staff shall investigate, as soon as practicable, the likely cause of the odour. Once the source or cause of the odour has been identified, immediate action shall be undertaken to eliminate or minimise the odour. These actions include:

- Ceasing any actions that are exposing odorous material e.g. turning a pile
- Covering the odorous material with a layer of cured compost or shredded green waste at least 30 cm thick.
- Measure temperature and estimate moisture of pile to establish reason for odour.
- Wait until wind direction is away from dwellings before turning the odorous material.
- Immediately after turning the pile, cover pile with at least 30 cm of cured compost or shredded green waste.
- Record the following information:
  (a) The date and time that odour was detected by the complainant;

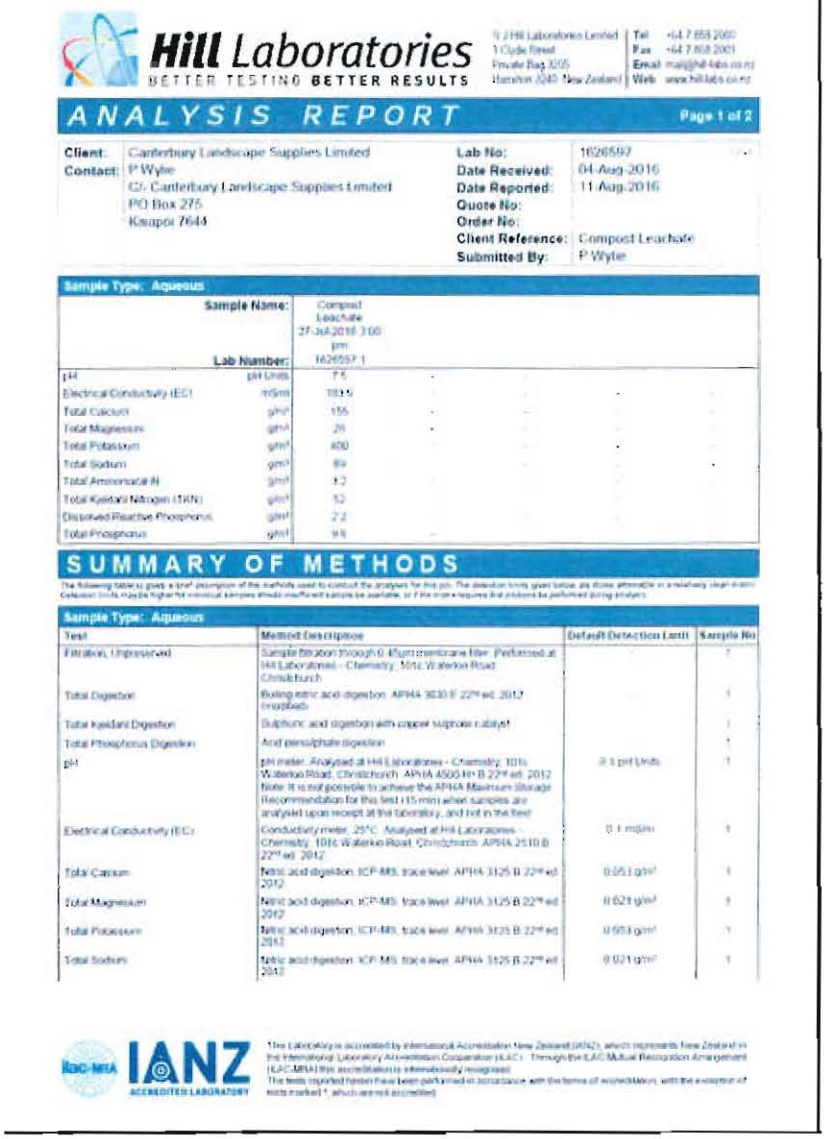
  (b) The location where odour was detected;

  (c) A description of the wind speed and wind direction when the odour was detected;

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

  (e) Any corrective action undertaken to avoid or mitigate the odour detected by the complainant.
- Report back to the complainant about the corrective action taken.

Appendix 2



Hill Laboratories
BETTER TESTING BETTER RESULTS

© 2 Hill Laboratories Limited
1 Clyde Street
Private Bag 3205
Hamilton 3240 New Zealand

Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web www.hill-labs.co.nz

ANALYSIS REPORT

Page 1 of 2

Client:	Canterbury Landscape Supplies Limited	**Lab No:**	1626597
Contact:	P Wyte	**Date Received:**	04-Aug-2016
	C/- Canterbury Landscape Supplies Limited	**Date Reported:**	11-Aug-2016
	PO Box 275	**Quote No:**	
	Kaiapoi 7644	**Order No:**	
		Client Reference:	Compost Leachate
		Submitted By:	P Wyte

Sample Type: Aqueous

Sample Name:	Compost Leachate 27-Jul-2016 3:00 pm
Lab Number:	1626597.1
pH (pH Units)	7.5
Electrical Conductivity (EC) (mS/m)	1815
Total Calcium (g/m³)	155
Total Magnesium (g/m³)	26
Total Potassium (g/m³)	400
Total Sodium (g/m³)	89
Total Ammoniacal-N (g/m³)	1.2
Total Kjeldahl Nitrogen (TKN) (g/m³)	10
Dissolved Reactive Phosphorus (g/m³)	2.2
Total Phosphorus (g/m³)	9.6

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that analysis be performed using dilution.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter. Performed at Hill Laboratories - Chemistry, 1016 Wallenbo Road, Christchurch	-	1
Total Digestion	Boiling nitric acid digestion. APHA 3030 E 22nd ed. 2012 (modified)	-	1
Total Kjeldahl Digestion	Sulphuric acid digestion with copper sulphate catalyst	-	1
Total Phosphorus Digestion	Acid persulphate digestion	-	1
pH	pH meter. Analysed at Hill Laboratories - Chemistry, 1016 Wallenbo Road, Christchurch. APHA 4500-H+ B 22nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field.	0.1 pH Units	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. Analysed at Hill Laboratories - Chemistry, 1016 Wallenbo Road, Christchurch. APHA 2510 B 22nd ed. 2012	0.1 mS/m	1
Total Calcium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012	0.053 g/m³	1
Total Magnesium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012	0.021 g/m³	1
Total Potassium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012	0.053 g/m³	1
Total Sodium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012	0.021 g/m³	1

IANZ ACCREDITED LABORATORY

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * which are not accredited.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Total Ammoniacal-N	Filtered sample from Christchurch. Phenol/hypochlorite colorimetry. Discrete Analyser. (NH3-N = NH4+-N x NH3-N) APHA 4500-NH3 F (modified from manual analysis) 22nd ed. 2012.	0.010 g/m³	1
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-Norg D (modified) 4500 NH3 F (modified) 22nd ed. 2012	0.5 g/m³	1
Dissolved Reactive Phosphorus	Filtered sample from Christchurch. Molybdenum blue colorimetry. Discrete Analyser. APHA 4500-P E (modified from manual analysis) 22nd ed. 2012	0.004 g/m³	1
Total Phosphorus	Total phosphorus digestion, ascorbic acid colorimetry. Discrete Analyser. APHA 4500-P B & E (modified from manual analysis) 22nd ed. 2012. Also modified to include the use of a reductant to eliminate interference from arsenic present in the sample. NWASCA. Water & soil Miscellaneous Publication No. 38 1982.	0.2 g/m³	1

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

This report must not be reproduced, except in full, without the written consent of the signatory.

Peter Robinson MSc (Hons), PhD, FNZIC
Client Services Manager - Environmental

ANNEXURE I

CONDITIONS: RESOURCE CONSENT CRC175344

Discharge to land of contaminants that may enter water, as a result of stockpiling mature compost on land

Limits

1. The discharge of contaminants to land that may enter water from the activities located at 97 Diversion Road, Swannanoa, at or about map reference NZTM2000 1560289 mE, 5192108 mN, as shown on **Plan CRC175344A,** attached to and forming part of this consent ("the Site"). Discharges may include discharges from the Aerated Static Pile (ASP) composting process; the maturation process; stockpiling of mature compost and other materials; and discharges from sumps/ponds as described in the application dated 05 April 2017, as substituted or amended by the ~~information provided on 7 September 2018, 24 September 2018 and 1 October 2018.~~ following documentation:

   a. Appendix 1: Design & Description of Aerated Static Pile (ASP) Compost Process;

   b. Appendix 2: Compost Production Manual;

   c. Appendix 3: Compost Management Plan dated 02 September 2018;

   d. Appendix 4: Stormwater Assessment, Canterbury Landscape Supplies – Diversion Road, Swannanoa dated 01 October 2018;

   e. Appendix 5: Design and Description of Maturation Pad Liner System

2. Except where necessary to comply with the following conditions, the organic composting operation shall be managed in accordance with the information and plans submitted with the consent application dated 05 April 2017, as amended by the information provided on 7 September 2018, 24 September 2018 and 1 October 2018.

3. The volume of compost on-site at any one time shall not exceed 40,000 cubic metres including:
   a. a maximum of 2,000 cubic metres for the ASP phase; and
   b. a maximum of 3,200 cubic metres for the Maturation Phase.

4. The composting materials shall be only:
   a. Sawdust from untreated timber and bark;

b. Dewatered paunch grass, which may be mixed with meat processing wastewater treatment solids, all of which shall be no more than 48 hours old;
c. Scoured wool fragments;
d. Egg shell;
e. Compostable packaging with some residual food waste;
f. Grease trap waste;
g. Dewatered solids from meat and milk processing wastewater treatment which shall be no more than 48 hours old at the time of delivery;
h. Bio solids that meet Grade A or B of the *Guidelines for the Safe Application of Biosolids to Land in New Zealand* 2003 or any replacement;
i. Paper from gib-board offcuts;
j. Green waste; and
k. Leaf litter.

Definition

5. For the purposes of this consent, mature compost is material that has been processed using an aerated static pile composting system (the ASP System (as described in the information supplied to the consent authority on 7 September 2018)) for a minimum of six weeks, followed by a maturation process (the Maturation Process (as described in the information supplied to the consent authority on 7 September 2018)) for a minimum of eight weeks. Mature compost also includes existing compost stored on the Site as of 10 December 2018.

Design

6. The report entitled: *'Design and Description of Aerated Static Pile Compost Process'* (dated *September 2018)* ("the Design Plan") shall be reviewed and certified as appropriate by a suitably qualified person who is approved by the consent authority.

7. The works required for the ASP system shall be constructed in accordance with the Design Plan.

8. The consent holder shall appoint a suitably qualified person to act as an independent certifier to ensure the works on the Site comply with the Design Plan (the *Certifier).*

9. The ASP composting process shall not commence until:
   a. all of the components of the works required to manufacture compost using the ASP system and maturation process and collection pond/sumps have been constructed by the consent holder, and inspected and certified by the Certifier; and
   b. all certifications required under condition 10 have been delivered to the consent authority for the attention of the Canterbury Regional Council, Regional Leader – Monitoring and Compliance.

10. The certifications required are as follows:

Concrete Pad

The 1000 m^2 concrete pad, shall certified as constructed in accordance with

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the Design Plan.

Maturation Pad

b. Each layer of the 2,400 m^2 maturation pad shall be inspected and certified before the next layer is added as follows:

i. The base layer of 300 mm compacted soil and clay is constructed in accordance with the Design Plan.

ii. The impermeable liner of welded 1.5 mm double texture HDPE geomembrane liner is installed in accordance with the Design Plan and the manufacturer's instructions.

iii. The compacted aggregate top layer is constructed of a 300 mm layer of compacted aggregate (SAP65 or similar) in accordance with the Design Plan.

Collection Pond

c. Each layer of the collection pond (capacity of at least 386.4 $m^{3)}$ shall be inspected and certified before the next layer is added as follows:

i. The 100 mm deep AP40 compacted aggregate shall be certified as being in accordance with the Design Plan.

ii. The 25 mm layer of sand on top of the base shall be certified as being in accordance with the Design Plan.

iii. The HDPE geomembrane pond liner shall be certified as installed in accordance with the Design Plan and the manufacturer's instructions.

Site Management Plan

11. a. The ASP composting process shall not commence until:

i. A Site Management Plan (SMP) has been provided to the Canterbury Regional Council, attention Regional Leader – Monitoring and Compliance; and

ii. That SMP has been certified in writing by the Canterbury Regional Council, Regional Leader – Monitoring and Compliance as addressing all the matters listed in condition 12;

except that if certification is not provided within 10 working days of the SMP being provided, or is refused after 10 working days have expired then the consent holder may commence the ASP composting process subject to compliance with conditions 33 and 35.

b. If certification is refused with reasons within 10 working days of provision to the consent authority the reason for refusal must be addressed by way of resubmission of an amended SMP for certification under condition 11(a).

12. The SMP shall include, but not be limited to:

a Procedures to be followed to ensure compliance with the conditions of this consent, including all practical measures to avoid or minimise the

discharge of contaminants to land on the Site including from the ASP pad, the Maturation Pad the mature compost and the sumps and pond;

b. Details of how the consent holder will train staff in the process of the ASP composting operation; and monitor their performance;

c. The measures to be used to minimise odour and dust emissions caused by the composting activity;

d. Practices that are in accordance with best practice guidelines for commercial composting in New Zealand, including but not limited to Appendix K of NZS4454:2005 or any variation or replacement;

e. A location and Site plan, to identify but not be limited to:
   i. Areas where the storage of raw materials is to occur;
   ii. Location of composting rows;
   iii Areas where composting will not occur including, but not necessarily limited to, the north-east corner of the Site identified on **Plan CRC175344B**, attached to and forming part of this consent;

f. A list of on-site management and monitoring procedures, including but not limited to addressing:
   i. The potential to generate odours from composting materials listed in condition 4 (b.– g.);
   ii. Minimum oxygen concentrations within composting rows;
   iii. Maintenance of optimum temperature requirements within composting rows in the active stage of composting;
   iv. Turning frequencies of composting rows in the ASP and Maturation Phases;
   v. Management procedures to avoid windrow turning when wind conditions may increase the potential for effects on sensitive receptors;
   vi. Minimum and maximum moisture content within composting windrows;
   vii. Maintenance of carbon to nitrogen ratios of composting windrows located within the ASP Phase;
   viii. Maximum height of composting windrows;
   ix. Minimum separation distances between mature compost windrows;
   x. Measures to be used to minimise the discharge of contaminants caused by the mature compost storage;
   xi. Water management procedures to minimise odour including maximum storage time of water and ensuring water is maintained in an aerobic state;
   xii. Methods to reduce discharges to land from stored gib;

g. A contingency plan in the event of breakdowns or malfunctions;

h. A procedure for recording and addressing odour complaints;

i. Methods for avoiding the tracking of material off-site on vehicles;

Water management infrastructure design including the capacity of pumps;

Appendices within the *Compost Management Plan* (Beca Limited dated 2 September 2018), the *Design and Description of Aerated Static Pile (ASP) Compost Process* (dated September 2018); and the *ASP Compost Production Manual* (dated September 2018).

13. The SMP and appendices shall be kept accessible on the Site at all times.

14. Activities at the Site shall be carried out in accordance with the SMP, including the appendices, at all times.

15. The SMP outlined in condition 12 may be amended at any time and any amendments shall be:
    a. consistent with the conditions of this resource consent; and
    b. for the purpose of reducing discharges from the Site which are controlled by this consent; or
    c. improving the efficacy of the composting process and shall not result in an increase in the discharge of odour or particulate matter or leachate from the Site.

16. The draft amended plan shall be submitted to the Canterbury Regional Council, Attention: Regional Leader – Monitoring and Compliance, for certification in accordance with condition 11.

Site Operation

17. The consent holder shall provide a copy of this consent, and the SMP prepared and certified in accordance with condition 11 and/or updated in accordance with conditions 15 and 16, to all persons undertaking activities authorised by this consent, and explain to those persons how to comply with the conditions and SMP.

18. There shall be at least one person present on the Site during all hours of operation who has been trained in the correct operation of the ASP system. A record of the person's training shall be kept on Site and made available to the consent authority on request.

19. Mature compost shall be placed on a bed of sawdust and/or bark fines, with a minimum depth of 0.5 metres at the time of formation; and the layer of sawdust/bark fines shall also extend 0.5 metres from the base of each mature compost pile; as shown on attached **Plan CRC175344C**.

20. All practicable measures shall be taken to prevent oil and fuel leaks from vehicles and machinery used on site.

21. All practicable measures shall be taken to avoid spills of fuel or any other hazardous substances within the Site including:

    a. In the event of a spill of fuel or any other hazardous substance, the spill shall be cleaned up as soon as practicable, the stormwater system shall be inspected and cleaned and measures taken to prevent a recurrence;

    b. The Canterbury Regional Council, Attention: Regional Leader - Monitoring and Compliance, shall be informed within 24 hours of a spill event and the following information provided:

i. The date, time, location and estimated volume of the spill;
ii. The cause of the spill;
iii. The type of hazardous substance(s) spilled;
iv. Clean up procedures undertaken;
v. Details of the steps taken to control and remediate the effects of the spill on the receiving environment;
vi. An assessment of any potential effects of the spill; and
vii. Measures to be undertaken to prevent a recurrence.

Monitoring

22. On not less than one occasion in any six-month period a representative sample of water shall be taken from:
    a. the leachate in the storm water collection sumps on the ASP Pad; and
    b. the Maturation pad; and
    c. from any water ponded between rows of mature compost.

23. All samples taken in accordance with condition 22 shall be analysed as follows:
    a. The analyses shall use the most appropriate method by a laboratory that is certified for that method of analysis by an accreditation authority such as International Accreditation New Zealand (IANZ);
    b. Samples taken in accordance with condition 22 shall be analysed for the following contaminants:

Nitrate Nitrogen
Ammonia Nitrogen
Dissolved Inorganic Nitrogen

    c. Records of the sampling and analysis undertaken in accordance with conditions 22 and 23 shall be recorded and shall detail:
        i. location;
        ii. name of the person taking the samples and the date and time;
        iii. results of the analyses;
        iv weather conditions, including but not limited to rainfall information at the Site for the seven days preceding the taking of the samples.

24. The records referred to at condition 23 shall be provided to the Canterbury Regional Council, Attention Regional Leader – Monitoring and Compliance, upon request.

25. An annual report of the records shall be submitted annually to the Canterbury Regional Council, Attention: Regional Leader – Monitoring and Compliance.

26. If the sampling results under condition 23(b.). show that the two-year rolling average concentration of dissolved inorganic nitrogen in the water ponded between the rows of mature compost exceeds 1.50 grams per cubic metre, the consent holder shall:
    a. Prepare an Action Management Plan (AMP) which details measures to be taken to investigate and if necessary remediate, the cause of the dissolved inorganic nitrogen concentration exceeding the two-year rolling average;

b. The AMP shall be submitted to Canterbury Regional Council, Attention Regional Leader – Monitoring and Compliance within one month of the sample which exceeded the limits occurred;
c. The AMP shall be reviewed and approved by Canterbury Regional Council, Attention Regional Leader – Monitoring and Compliance before implementing any of the measures identified in the AMP;
d. Once the AMP is approved the consent holder shall implement the measures within the AMP within the timeframe defined in the AMP;
e. Measures in the AMP to reduce the contaminants in the receiving environment may include, but are not limited to:
    i. Installation of additional treatment methods;
    ii. Revision of compost management procedures;
    iii. Removal of contaminant source(s).

27. The SMP may be amended at any time. Any amendment shall be:
    a. Only for the purpose of improving efficacy of the storage of mature compost process and shall not result in a decrease in groundwater quality;
    b. Consistent with the conditions of this resource consent and any other consent relating to the composting activity at the Site; and
    c. Submitted in writing to the Canterbury Regional Council, Attention: Regional Leader - Monitoring and Compliance, prior to any amendment being implemented.

Records

28. Each load of material shall be recorded in a log book or on a spread sheet by the Site Manager.

29. The log book shall include a detailed record of all materials deposited at the Site and shall be provided to the Canterbury Regional Council upon request.

30. The consent holder shall maintain records of the amount, source and conditions of all materials composted on-site and the records shall be retained for at least one year after the composted material is removed from the Site.

31. A copy of the records shall be provided to the Canterbury Regional Council, Attention: Regional Leader – Monitoring and Compliance, within 20 working days of a written request by the Canterbury Regional Council.

32. An annual report of the records shall be submitted annually to the Canterbury Regional Council, Attention: Regional Leader – Monitoring and Compliance.

Operational Advisory Group

33. The ASP composting process shall not commence until the consent holder has formed an Operational Advisory Group ("OAG") to meet at least quarterly to:
    a. review the ongoing operation of the Site; and
    b. to meet on Site as soon as practically possible if requested by the consent authority due to the consent authority receiving odour complaints attributable

to the Site.

34. The OAG shall include as a minimum four members comprised of:
    a. two consent holder representatives;
    b. a representative of the Canterbury Regional Council; and
    c. an invited representative who is a person with expertise in the operation of the ASP Composting System approved by the consent authority.

Community Liaison Group

35. The ASP composting process shall not commence until, the consent holder has invited as a minimum the following parties to participate in a Community Liaison Group ("CLG") and, subject to the invitations being accepted, held at least one meeting with those parties:
    a. Two representatives of landowners within two kilometres of the Site and who are also submitters to the consent application;
    b. A representative of the Eyre District Environmental Association Incorporated;
    c. A representative of the Mandeville Resident's Association;
    d. A representative of the Canterbury Regional Council addressed to Canterbury Regional Council, Attention: Regional Leader – Monitoring and Compliance;
    e. The technical expert on the OAG;

    however, if invitations to the initial meeting are not accepted, the activity authorised by this consent may commence subject to compliance with conditions 9 and 11.

36. The consent holder's responsibilities shall include:
    a. Attendance of two senior managers at the meetings of the CLG;
    b. Convening the meetings of the CLG and offering the opportunity for meeting at least twice annually during the term of the consent;
    c. Keeping and distribution of the CLG's minutes to all participants of the group.

37. The purpose of the CLG shall include, but not be limited to, the following:
    a. to be an ongoing point of contact between the consent holder and the community;

    b. to consult on an ongoing and regular basis about matters associated with the operation of the composting operation where they affect the community and are of mutual interest to the representative parties;

    c. to promote the free flow of information between the local community and the consent holder so as to, wherever possible, resolve any issues that may arise;

    d. to distribute and discuss the results of all monitoring and reports as required by the conditions of this consent.

38. In the event of an overland flow from the sumps or collection pond the consent holder shall notify the members of the CLG within 12 hours.

Administration

39. The Canterbury Regional Council may annually, on the last working day of May or November, serve notice of its intention to review the conditions of this consent for the purposes of:

    a. Dealing with any adverse effect on the environment which may arise from the exercise of this consent and which is appropriate to deal with at a later stage; or

    b. Requiring the adoption of the best practicable option to remove or reduce any adverse effect on the environment.

40. If this consent is not exercised before 31 December 2023 then it shall lapse in accordance with Section 125 of the Resource Management Act 1991.

    Advice note: 'Exercised' is defined as implementing any requirements to operate this consent and undertaking the activity as described in these conditions and/or application documents.

41. This consent shall have a duration of 6 years from the commencement of the consent.

42. Compliance with any condition of this consent is deemed compliance with the same condition on CRC175345.

Plan CRC175344A

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Scale: 1:13,759 @A4

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Map Created by Environment Canterbury on 9/05/2019

Site Location:
97 Diversion Road, Swannanoa
Part RS 33406
Approximately 10 hectares

Canterbury Maps, Environment Canterbury, Land Information New Zealand

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Plan CRC175344B

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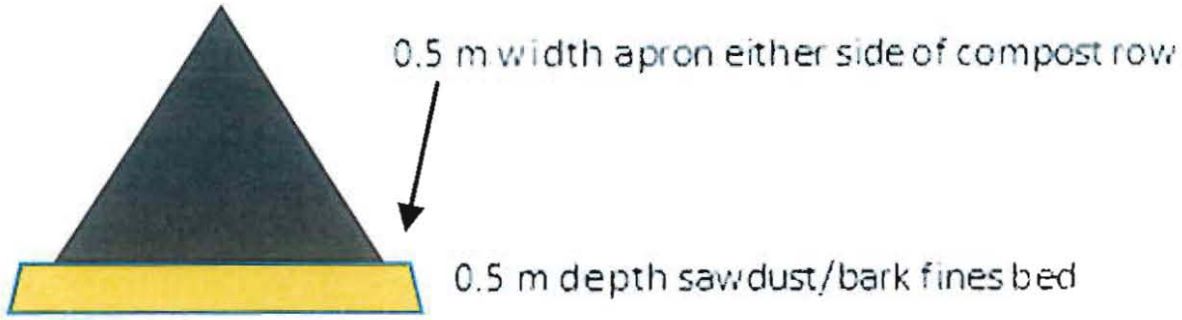
Map Created by Environment Canterbury on 6/09/2018

Plan CRC175344C



THE SEAL OF THE ENVIRONMENT COURT OF NEW ZEALAND

ANNEXURE I (Continued)

CONDITIONS: RESOURCE CONSENT CRC175345

Discharge to air of contaminants (odour and particulate matter) from an industrial premise

Limits

1. The discharge to air shall be only odour and particulate matter from an organic waste composting operation, located at 97 Diversion Road, Swannanoa, at or about map reference NZTM2000 1560289 mE, 5192108 mN, labelled as "Site Location" on **Plan CRC175345A,** attached to and forming part of this consent ("the Site"). Discharges may include discharges from the Aerated Static Pile (ASP) composting process; the maturation process; stockpiling of mature compost and other materials; and discharges from sumps/ponds as described in the application dated 05 April 2017, as substituted or amended by the ~~information provided on 7 September 2018, 24 September 2018 and 1 October 2018.~~ following documentation:

   a. Appendix 1: Design & Description of Aerated Static Pile (ASP) Compost Process;

   b. Appendix 2: Compost Production Manual;

   c. Appendix 3: Compost Management Plan dated 02 September 2018;

   d. Appendix 4: Stormwater Assessment, Canterbury Landscape Supplies – Diversion Road, Swannanoa dated 01 October 2018;

   e. Appendix 5: Design and Description of Maturation Pad Liner System

2. Except where necessary to comply with the following conditions, the organic composting operation shall be managed in accordance with the information and plans submitted with the consent application dated 05 April 2017, as amended by the information provided on 7 September 2018, 24 September 2018 and 1 October 2018.

3. The volume of compost on-site at any one time shall not exceed 40,000 cubic metres including:
   a. a maximum of 2,000 cubic metres for the Aerated Static Pile (ASP) phase; and
   b. a maximum of 3,200 cubic metres for the Maturation Phase.

There shall be no odour, suspended or particulate matter caused by discharges from the composting activity which are noxious, offensive or objectionable beyond the boundary of the property where the composting activity is located, identified as "*Part*

RS 33406 and Lot 2 DP 25643" on **Plan CRC175345B**, ("the Property") attached to and forming part of this consent.

Advice Note: *Assessment of whether or not odours are noxious, offensive or objectionable shall be carried out in accordance with Schedule 2 to the Canterbury Air Regional Plan October 2017.*

5. The composting material shall only be:
   a. Sawdust from untreated timber and bark;
   b. Dewatered paunch grass which may be mixed with meat processing waste water treatment solids, all of which shall be no more than 48 hours old;
   c. Scoured wool fragments;
   d. Egg shell;
   e. Compostable packaging with some residual food waste;
   f. Grease trap waste;
   g. Dewatered solids from meat and milk processing wastewater treatment which shall be no more than 48 hours old at the time of delivery;
   h. Bio solids that meet Grade A or B of the *Guidelines for the Safe Application of Biosolids to Land in New Zealand* 2003 or any replacement;
   i. Paper from gib-board offcuts;
   j. Green waste; and
   k. Leaf litter.

6. The proportion of grease trap waste within the composting windrows shall be a maximum of one percent.

Site Management Plan

7. a. The ASP composting shall not commence until:
      i. A Site Management Plan (SMP) has been provided to the Canterbury Regional Council, attention Regional Leader – Monitoring; and
      ii. That SMP has been certified in writing by the Canterbury Regional Council, Regional Leader – Monitoring and Compliance as addressing all the matters listed in condition 8;

   except that if certification is not provided within 10 working days of the SMP being provided, the consent holder may commence the ASP composting process subject to compliance with conditions 37 and 39;

   b. If certification is refused with reasons within 10 working days of provision to the consent authority, the reason for refusal shall be addressed by way of resubmission of an amended SMP for certification under condition 7(a.).

8. The SMP shall include, but not be limited to:
   a. Procedures to be followed to ensure compliance with the conditions of this consent;
   b. Details of how the consent holder will train staff in the process of the ASP composting operation; and monitor their performance;
   c. The measures to be used to minimise odour and dust emissions caused by the

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composting activity;

d. Practices that are in accordance with best practice guidelines for commercial composting in New Zealand, including but not limited to Appendix K of NZS4454:2005 or any variation or replacement;

e. A location and Site plan, to identify but not be limited to:
   i. Areas where the storage of raw materials is to occur;
   ii. Location of composting rows;
   iii Areas where composting will not occur including, but not necessarily limited to, the north-east corner of the Site identified on **Plan CRC175345C**, attached to and forming part of this consent.

f. A list of on-site management and monitoring procedures, including but not limited to addressing:
   i. Potential to generate odours from composting materials listed in condition 5(b.- g.);
   ii. Minimum oxygen concentrations within composting rows;
   iii. Maintenance of optimum temperature requirements within composting rows in the active stage of composting;
   iv. Turning frequencies of composting rows in the ASP and Maturation Phases;
   v. Management procedures to avoid windrow turning when wind conditions may increase the potential for effects on sensitive receptors;
   vi. Minimum and maximum moisture content within composting windrows;
   vii. Maintenance of carbon to nitrogen ratios within composting windrows undergoing the ASP Phase;
   viii. Maximum height of composting windrows;
   ix. Minimum separation distances between mature compost windrows;
   x Measures to be used to minimise the discharge of contaminants caused by the mature compost storage;
   xi. Water management procedures to minimise odour including maximum storage time of water and ensuring water is maintained in an aerobic state.

g. A contingency plan in the event of breakdowns or malfunctions;

h. A procedure for recording and addressing odour complaints;

i. Methods for avoiding the tracking of material off-site on vehicles;

j. Water management infrastructure design including the capacity of pumps;

k. Appendices within the *Compost Management Plan* (Beca Limited dated 2 September 2018), the *Design and Description of Aerated Static Pile (ASP) Compost Process (*dated September 2018*);* and the *ASP Compost Production Manual* (dated September 2018).

9. The SMP and appendices shall be kept accessible on the Site at all times.

10. Activities at the Site shall be carried out in accordance with the SMP, including the appendices, at all times.

11. The SMP outlined in condition 8 may be amended at any time and any amendments shall be:

a. consistent with the conditions of this resource consent; and
b. for the purpose of reducing discharges from the Site which are controlled by this consent; or
c. improving the efficacy of the composting process and shall not result in an increase in the discharge of odour or particulate matter or leachate from the Site.

12. The draft amended plan shall be submitted to the Canterbury Regional Council, Attention: Regional Leader – Monitoring and Compliance, for certification in accordance with condition 7.

Site Manager details

13. Prior to the first exercise of this consent, the consent holder shall provide the contact details of the Site Manager for the Site, or nominated person(s), to the CRC, Regional Leader - Monitoring and Compliance.

14. Should the contact details for the Site Manager change, these shall be provided to the CRC, Regional Leader - Monitoring and Compliance within 5 working days of that change.

15. The contact phone number of the Site Manager shall be displayed on a sign located at the entrance to the Site off Diversion Road, and notified to submitters on the consent and to members of the Community Liaison Group ("CLG").

Site Operation and Monitoring

16. The consent holder shall provide a copy of this consent, and the SMP prepared and certified in accordance with condition 7 and/or updated in accordance with conditions 11 and 12, to all persons undertaking activities authorised by this consent, and explain to those persons how to comply with the conditions and SMP.

17. There shall be at least one person present on the Site during all hours of operation who has been trained in the correct operation of the ASP system. A record of the person's training shall be kept on Site and made available to the consent authority on request. The Site Manager or other nominated person shall undertake two separate inspections every working day for odour emissions at the boundary of the Site. Any findings, mitigation and improvements implemented shall be recorded.

18. The Site Manager specified in conditions 13 to 15 inclusive, shall be available at all times (including outside site operation hours) to respond to odour emission complaints, and shall act promptly to co-ordinate a response to manage odour where there is an ongoing after-hours nuisance.

19. Any complaint received by the Site Manager shall be investigated by the consent holder and necessary corrective action taken as soon as practicable after receipt of the complaint.

20. Composting materials shall be deposited in accordance with the SMP prepared and certified in accordance with condition 7 and any subsequent amendments in

accordance with condition 12.

21. Corrective action referred to in condition 19 shall include, but not be limited to:
    a. Identifying the materials or activities that may be the source of odours;
    b. Ceasing any actions that are generating odours;
    c. Covering exposed odorous material with sawdust, bark fines, cured or mature compost;
    d. Not recommencing the activity until the wind is in the direction away from sensitive receptors or the material that is the source of the odour has been removed.

22. The composting activity shall follow best practice guidelines for the operation, as set out in Appendix K of NZS4454:2005 or any variation or replacement.

23. Monitoring of the composting process undertaken on Site shall be in accordance with the procedures and criteria described in the SMP and shall include:
    a. Continuous temperature monitoring of all windrows located on the ASP pad;
    b. Oxygen concentration monitoring of all windrows located on the ASP pad once per week;
    c. Weekly temperature monitoring of Maturation Phase piles for one month after establishment and monthly temperature monitoring thereafter. Final temperature monitoring of Maturation Phase piles to be undertaken immediately prior to moving to mature stockpiles;
    d. Moisture testing of mixed raw material content prior to formation of each windrow located on the ASP pad;
    e. Moisture testing of each windrow located on the ASP pad at the time of turning.

24. All runoff or ponding water on-site shall be managed to minimise the duration of standing water adjacent to the compost piles.

25. Organic materials listed in condition 5(b.- g.) delivered to the Site shall be either mixed in composting rows or covered with bark fines and/or sawdust on the day of receipt.

26. Windrows and stockpiles shall be managed to avoid creating conditions that may lead to spontaneous combustion of the compost.

27. The consent holder shall install and maintain in good working order at a suitable location within the area shown on **Plan CRC175345A** instruments capable of continuously monitoring and recording wind speed, wind direction, rainfall and temperature.

28. Dust discharges from the composting operation shall be controlled with the use of water sprays, including but not limited to:
    a. On the surface of any windrows or stockpiles;
    b. When any windrows or stockpiles are disturbed;
    c. When screening of compost occurs.

29. The consent holder shall establish within the first planting season after the commencement of this consent and maintain, a shelterbelt of at least one row of *Pinus radiata* trees, or other similar evergreen species, planted at no more than 1.5 metres spacing along the western, northern and eastern boundaries of the Site. The shelterbelt shall be kept trimmed to a hedge up to 2m in depth with foliage maintained from ground level to the top and kept to a height of approximately 8 metres.

Records

30. Each load of material shall be recorded in a log book or on a spread sheet by the Site Manager.

31. The log book shall include a detailed record of all materials deposited at the Site and shall be provided to the Canterbury Regional Council upon request.

32. The monitoring undertaken in accordance with condition 23 shall be recorded and the records shall detail the:
    a. Batch number and location of the compost windrow being measured;
    b. Temperature of the compost sampled;
    c. Moisture content of the compost sampled;
    d. Oxygen concentration of the compost sampled;
    e. Name of the operator undertaking the monitoring; and
    f. Date and time of the monitoring.

33. The consent holder shall maintain records of the amount, source and conditions of all materials composted on-site and the records shall be retained for at least one year after the composted material is removed from the Site.

34. A copy of the records shall be provided to the Canterbury Regional Council, Attention: Regional Leader – Monitoring and Compliance, within 20 working days of a written request by the Canterbury Regional Council.

Complaints

35. The consent holder shall maintain a record of any odour or dust complaints that have been received by the consent holder. The records shall include, but not be limited to:
    a. The name and address of complainant, if supplied;
    b. The date and time that the contaminant was detected;
    c. The nature and duration of the reported effect;
    d. The location where the contaminant was detected;
    e. A general description of the weather conditions, including the wind speed, wind direction, cloud cover when the contaminant was detected;

    The most likely cause of the contaminant;

    Any corrective action undertaken by the consent holder to avoid or mitigate the contaminant detected by the complainant.

36. These records shall be made available to the Canterbury Regional Council, Attention: Regional Leader – Monitoring and Compliance, within 20 working days of a written request by the Canterbury Regional Council.

Operational Advisory Group

37. The ASP composting process shall not commence until, the consent holder has formed an Operational Advisory Group (OAG) to meet at least quarterly to:
    a. review the ongoing operation of the Site; and
    b. to meet on Site as soon as practically possible, if requested by the consent authority due to the consent authority receiving odour complaints attributable to the Site.

38. The OAG shall include as a minimum four members comprised of:
    a. two consent holder representatives;
    b. a representative of the Canterbury Regional Council; and
    c. an invited representative who is a person with expertise in the operation of the ASP Composting System approved by the consent authority.

Community Liaison Group

39. The ASP composting shall not commence until, the consent holder has invited as a minimum the following parties to participate in a Community Liaison Group ("CLG") and, subject to the invitations being accepted, hold at least one meeting with those parties:
    a. Two representatives of landowners within two kilometres of the Site and who are also submitters to the consent application;
    b. A representative of the Eyre District Environmental Association Incorporated; and
    c. A representative of the Mandeville Resident's Association;
    d. A representative of the Canterbury Regional Council addressed to Canterbury Regional Council, Attention: Regional Leader – Monitoring and Compliance;
    e. The technical expert on the Operational Advisory Group;

    however, if invitations to the initial meeting are not accepted, the ASP composting process may commence subject to compliance with condition 7.

40. The consent holder's responsibilities shall include:
    a. Attendance of two senior managers at the meetings of the CLG;
    b. Convening the meetings of the CLG and offering the opportunity for meeting at least twice annually during the term of the consent;
    c. Keeping and distribution of the CLG's minutes to all participants of the group.

41. The purpose of the CLG shall include, but not be limited to, the following:
    to be an ongoing point of contact between the consent holder and the community;

b. to consult on an ongoing and regular basis about matters associated with the operation of the composting operation where they affect the community and are of mutual interest to the representative parties;

c. to promote the free flow of information between the local community and the consent holder so as to, wherever possible, resolve any issues that may arise;

d. to distribute and discuss the results of all monitoring and reports as required by the conditions of this consent.

Administration

42. The Canterbury Regional Council may annually, on the last working day of May or November, serve notice of its intention to review the conditions of this consent for the purposes of:

a. Dealing with any adverse effect on the environment which may arise from the exercise of this consent and which is appropriate to deal with at a later stage; or

b. Requiring the adoption of the best practicable option to remove or reduce any adverse effect on the environment.

43. If this consent is not exercised before 31 December 2023 then it shall lapse in accordance with Section 125 of the Resource Management Act 1991.

Advice note: *'Exercised' is defined as implementing any requirements to operate this consent and undertaking the activity as described in these conditions and/or application documents.*

44. This consent shall have a duration of 6 years from the commencement of this consent.

45. Compliance with any condition of this consent is deemed compliance with the same condition on CRC175344.

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Plan CRC175345A

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Map Created by Environment Canterbury on

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Plan CRC175345B

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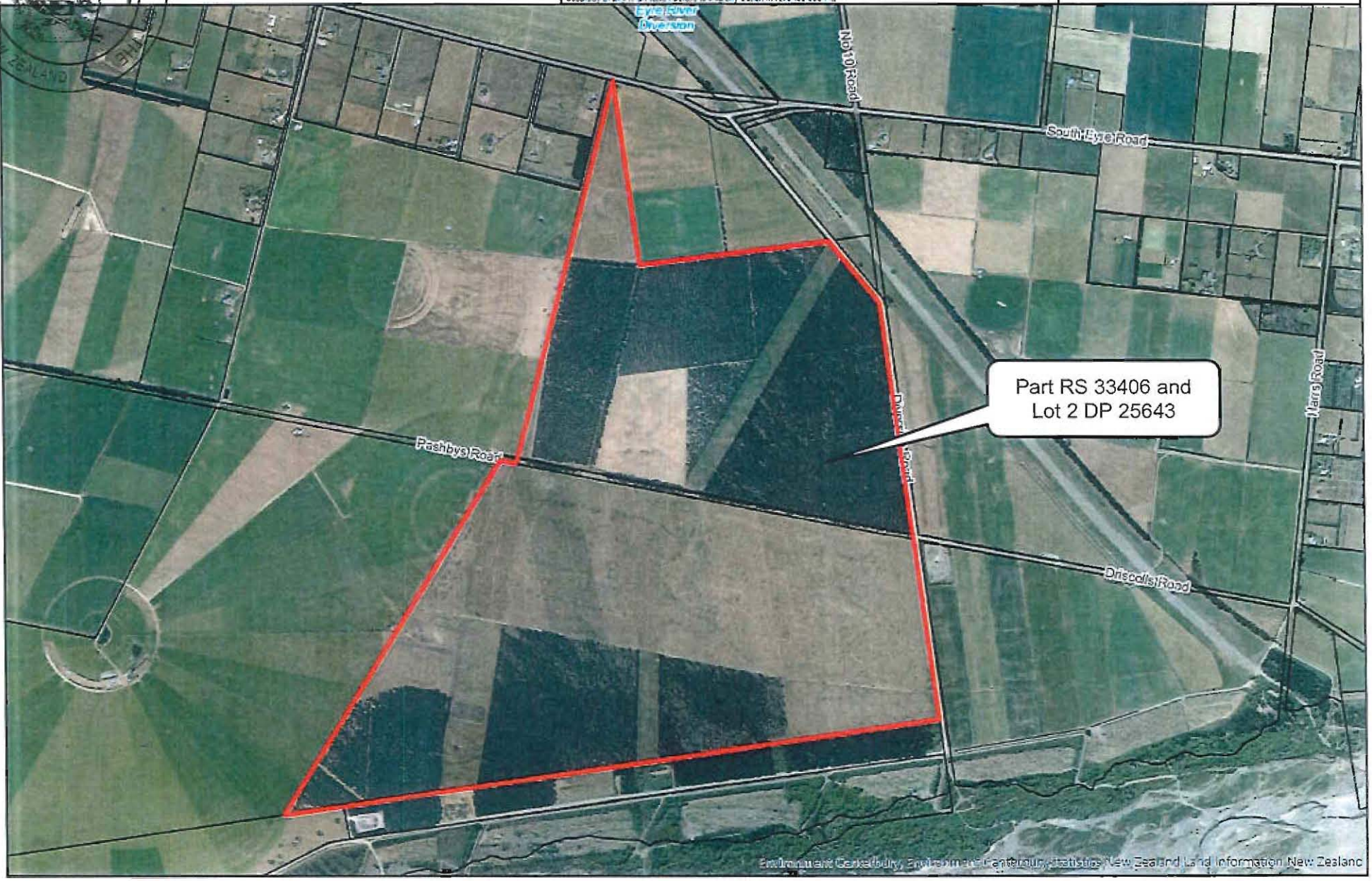

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Plan CRC175345C

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0 0.035 0.07 0.105 0.14 Kilometres

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Map Created by Environment Canterbury on 5/03/2018

North-east corner - no composting to occur

Pashbys Road

Canterbury Maps, Environment Canterbury, Land Information New Zealand

Description of ASP Compost Process

DESIGN AND DESCRIPTION OF AERATED STATIC PILE (ASP) COMPOST PROCESS

Table of Contents

1. Aerated Static Pile (ASP) System Design

1.1 Design drawings

Design details for the proposed ASP system are included in Appendix A.

1.2 ASP Pad

The ASP system will be situated on a concrete pad measuring 40 metres wide x 25 metres long (1'000 square metres), and will consist of 8 aeration beds. The concrete pad will be constructed on a base of compacted aggregate (AP65) 150mm deep, with a layer of sand 25mm deep placed on top of the compacted aggregate.

A 150mm deep concrete pad will be placed using 25mpa concrete, containing 688 reinforcing mesh, and 12mm deformed rods will be placed into the concrete to add additional strength for the safe of operation of heavy machinery (eg, wheel loaders).

The concrete pad will contain 16 channels running the length of the pad, measuring 200mm wide and 25 metres long; which will contain the PVC aeration pipes used for blowing air into the compost piles.

The pad will be sloped to fall 1:100 from North to South, ensuring that any storm water or leachate will run off the pad, towards the collection area and avoid any ponding.

The ASP pad will be bunded on the East and West sides of the pad with interlocking concrete blocks, to avoid any run off being able to leave the pad.

A drainage channel will be situated on the south side of the pad and run along the 40 metre length of the pad, to collect storm water or leachate. The drainage channel will be sloped to fall 1:100 towards the centre of the ASP pad, where any leachate will be directed to the stormwater retention area for collection and reuse in rehydrating the compost piles while they undergo the aeration process, to ensure optimum moisture levels are maintained in the rows.

An area of compacted aggregate measuring 6 metres long x 40 metres wide will be placed on the North side of the ASP pad. It will consist of 350mm deep compacted aggregate, and will provide an area of access to the ASP pad for wheel loaders to place and remove the compost material, without any product coming into contact with the ground.

1.3 Aeration Pipes

Aeration pipes will be placed in each of the 16 channels in the ASP concrete pad and connected via a manifold to fans to provide air into the base of the compost piles, this constant source of air ensures the compost remains in an aerobic (with oxygen) state; maximising the rate of decomposition and reducing potential offensive odours.

The Aeration Pipes are 150mm PVC pipes, with 8 x 12mm holes per metre drilled in the top side of the pipe. One x 12mm hole per metre is drilled on the bottom of the pipe for drainage.

The pipes will be surrounded by shingle to provide protection to the pipe for heavy machinery operating on the ASP pad. The shingle will be 20/40mm river stones, both above and below the 150mm diameter aeration pipes. Shingle of this size is used so that good air pathways for oxygen and drainage for any storm water or leachate is maintained.

PVC pipes are widely used in ASP systems and are referenced in many composting guides including the On-Farm Composting Handbook (page 33) and the Compost NZ Introduction to Compost Science (page 6 under definition of Passively Aerated Windrow). Parts for PVC pipes are readily available and damaged sections can be immediately replaced.

1.4 Fans

Air is provided to each of the 8 aeration beds via 8 fans, situated on the south side of the ASP concrete pad. Each fan is connected by a central manifold to 2 aeration pipes, and is controlled using temperature feedback. The fans switch on and off depending on pre-determined temperature settings; to control the temperature within the pile (maintained in the range of 55-65^{0}C).

Each fan is a 3-5 horse power unit, and the fans supply air into the aeration pipes at a minimum velocity of 13metres/second (m/s).

1.5 Stormwater/Leachate Retention Pond

The drainage channels situated on the south boundary of the ASP Pad are designed to collect any stormwater or leachate that runs off the pad or through the channels containing the aeration pipes. The drainage channel is sloped to direct any run off toward the centre of the pad, where a 300mm PVC pipe will be connected to the drainage channel to direct any stormwater through the pipe to a stormwater retention pond.

Runoff calculations (Table 1 below) to determine the appropriate sizing of the stormwater detention pond have been undertaken in accordance with standard methodology, with reference to Auckland Regional Council runoff guidelines and NIWA HIRDS calculator, the latter accounting for 2 degrees of climate change. Note that the required depth column of Table uses a 300m^2 flat area and calculates the required depth to accommodate the different storm events in the first column. A 50 year storm event requires a volume of 300x 0.30 which equates to 90m^3. Additional capacity beyond the 1:50 year storm event is provided by sizing the detention pond at 100m^3.

Table 1. Stormwater Management Estimate (1,000 m^2 (25 x 40 m) Compost Aeration Pad, Varying Storm Events)

Storm Event	Depth of rainfall[1], (mm)	Runoff after rainfall losses[2], (mm)	Volume of stormwater after rainfall losses[2], (m^3)	Required depth of 300 m^2 flat collection area adjacent to aeration pad (m)
10-year, 24 hour	95.5	48.7	48.7	0.16
20-year, 24 hr	113.9	64.4	64.4	0.21
50-year, 24 hr	142.2	89.4	89.4	0.30

Notes:

[1] NIWA HIRDS calculator, accounts for 2 degrees of climate change

[2] Runoff (mm) calculated assuming an Initial Abstraction Depth (AI) of 5 mm and Curve Number (CN) of 81 (Group B Soil, Alluvial – Crops, straight rows, minimal vegetative cover), Auckland Regional Council Guidelines for stormwater runoff modelling in the Auckland Region, TP 108, April 1999.

[3] Assumes pad with is 40 m wide and 25 m long, and the slope is parallel with the long side of the pad.

The dimensions of the stormwater retention pond will be 4 metres wide x 25 metres long x 1 metre deep. Equalling 100 cubic metres (m^3), or 100'000 litres of water storage. The pond would be constructed by excavating the required area, and placing a base of AP40 compacted aggregate 100mm deep, with a 25mm layer of sand placed on top of the aggregate. The retention pond would be lined by using an impermeable HDPE geomembrane pond liner, which will prevent leachate from entering into the soil.

Stormwater runoff captured in the retention pond will be recycled into the ASP composting process by pumping the stormwater back to the ASP pad, via a water pump, to irrigate the compost rows. Additional water is required within the ASP process due to the constant supply of air having a significant drying effect on the compost material. Maintaining the correct moisture level range throughout the initial composting phase assists with achieving optimum decomposition rates.

Composting using a forced aeration system, which is applying air through the compost from the base of pile and upward, has a constant drying effect on the material. The generation of leachate within the pile is greatly reduced due to this drying effect, as there is very little moisture that would make its way through the static piles. Rainfall falling onto the outside of the compost piles is the largest source of moisture that comes into contact with the piles. Rain that lands onto the compost rows does not simply become leachate, as even in heavy rain events, the rain does not penetrate throughout the whole compost pile. The majority of rainfall contacts only the outside of the compost pile; any leachate in rain events is heavily diluted due to the intensity of the rainfall. The rain that contacts the compost will run off the ASP pad and through the drainage channels to the Stormwater Retention pond to be recycled through the ASP process, and avoid any standing water around the compost piles.

2. Aerated Static Pile (ASP) System Description

2.1 Aerated Static Pile Method

The Aerated Static Pile (ASP) composting method uses forced and static aeration systems to convert a mixture of high nitrogen by-products, blended with high organic carbon sources, into compost. Fans supply air via pipes to the base of the compost pile, aerating the material; which achieves rapid decomposition, while providing aerobic conditions within the pile and reducing odour generation. The ASP system follows the practices as outlined in the New Zealand Standard for Composts, Soil Conditioners and Mulches (NZS4454:2005), Appendix K3; and it is used successfully worldwide as an effective form of composting while reducing environmental effects. In New Zealand, companies including Silver Fern Farms (Belfast site) and Timaru District Council (Redruth facility) have used ASP composting systems with a high degree of success in transforming waste materials into compost, without causing any negative environmental effects to air or ground water quality.

2.2 Receiving of Material

Waste material for composting is received onto site into a concrete bin, constructed of a concrete pad and interlocking concrete blocks which have been sealed to contain any liquid. The concrete pad extends out beyond the concrete block walls, and is sloped to direct any liquid from the bin to a concrete catchment area, which is filled with an absorbent carbon material (e.g. sawdust). Any liquid is absorbed by the sawdust, and the catchment area is cleaned out by a wheel loader; the wet material recycled into the concrete bin to undergo the composting process.

Any waste materials received onto site must be either de-watered or blended with an absorbent carbon source (e.g. sawdust or wood shavings) at the point of supply. For example, paunch grass is de-watered through a belt press or screw press; other materials are blended with sawdust or wood shavings before collection. Receiving the waste materials as dry as possible reduces the potential of excess liquid in the receiving concrete bin and reduces the potential odour effects.

Raw material product is either mixed or covered with a carbon source, such as bark; immediately upon receipt. The carbon source both acts as a biofilter to reduce any potential odour and as additional absorbency for any remaining moisture. Whether the material is mixed or covered is determined by the current wind conditions in accordance with the site's Air Quality Management Plan.

2.3 Blending

The Nitrogen containing waste material is blended with an organic carbon material (bark or sawdust) to achieve a Carbon to Nitrogen (C:N) ratio between 25:1-35:1; and a moisture content of 55-60%, due to the aeration process having a higher drying effect on the material than other compost systems. As stated in NZS4454:2005 K3: *"Higher nutrient contents (C:N ratios of 25:1-35:1) than with turned pile composting are possible because aeration lessens the chance of oxygen deficiency"; "Odours are minimised because large areas within the composting mass are processed at optimal temperatures. Also, NH3 losses are minimised."*

The materials are mixed together in equal parts (1:1 ratio) to provide the required C:N ratio. The choice of Carbon source assists with providing suitable texture and porosity for aeration and the biological activity of the mix; some coarse material is needed in the mix for ensuring air pathways are available for the oxygen to move through the material and achieve decomposition.

Mixing of the materials is undertaken by a machine operator in either a wheel loader or excavator. The products are mixed thoroughly to provide a consistent mix, and even out any areas where there could be product clumping, which could lead to small pockets of material that may generate odour.

The initial mixing of the material is unlikely to generate any adverse odour effects off-site given the characteristics associated with the raw feedstock.

2.4 Preparation of ASP pad

Before the blended compost material is placed on a concrete aeration pad to begin the composting process; a 300 mm layer of coarse bark is laid on top of the pad. The blended material is placed on top of the coarse bark layer to begin the ASP process. The coarse bark layer serves two purposes; firstly it provides a coarse material for the air from the aeration pipes to move through and into the compost heap; and secondly it raises the base of the compost above the ASP pad to avoid any water saturation of the base of the pile which could restrict oxygen entering the pile, potentially reducing the effectiveness of the decomposition process and causing unwanted anaerobic conditions (odourous) to occur.

2.5 Product Integration and Volume Shrinkage

As different raw materials are mixed together (raw materials blended with carbon sources), smaller particles fill the voids between larger particles; commonly known as product integration. The volume of the resulting mixed materials can be 20% less than the combined volume of the original materials. When assessing the volume of material to be placed from the mixing area to an ASP bed, we need to consider the integration of the materials; by adding the volume of the raw material with the volume of the carbon source and deducting 20% of the volume.

During the ASP composting phase the compost material will experience volume shrinkage. The volume of material decreases through the decomposition process due to the loss of Carbon Dioxide (CO^2) and water to the atmosphere; and as the material decomposes from bulky raw material to a finer, crumbly texture. Overall shrinkage through the ASP phase is expected to be approximately 25% of total volume.

2.6 Placement and Covering of material

Once the aeration bed is prepared with a base of coarse bark, the mixed material is placed onto the ASP Pad to begin composting. The material is placed using a wheel loader and a compost row is constructed on one of the 8 aeration beds. Each row is 5 metres wide x 25 metres long x 3 metres high; the piles can be higher than using other systems, such as the turned pile system, as the forced aeration minimises the extent of anaerobic zones, so that odour production is reduced. The ASP system provides a good diffusion pathway for oxygen to enter the rows for the beginning of the Mesophilic stage of composting; the material will increase to 55^{0}C or higher within 24-48 hours of making the pile.

A 100 mm covering layer of finished compost is added as a thermal blanket. The layer of finished compost is placed over the pile by front end loader; and is used to insulate the piles and further minimise the potential for odour. This thermal blanket ensures that pasteurising temperatures are achieved throughout the whole pile, including the outer zones; and assists with any potential odour suppression, protects the surface from drying, discourages flies, filters ammonia, and contains all microbial activity within the pile, minimising any potential for discharge for any airborne microbial activity. NZS4454:2005 K3 (g) mentions *"Insulation with mesh cloth or finished compost can overcome this problem (pasteurisation temperatures to the outer zones), and with this approach the static pile may replicate conditions of an enclosed system."*

2.7 Monitoring

Temperature, Oxygen and Moisture levels are monitored throughout the ASP process to ensure that optimal conditions for decomposition are maintained.

Temperature monitoring is conducted continuously through the use of 2 temperature probes in each pile of compost undergoing aeration. The temperatures are constantly recorded, and the information is data logged for electronic recording of the information. The temperature sensors are linked to a temperature feedback system to control the aeration fans, and maintain compost temperatures within a predetermined range (i.e ensuring that once the compost temperature reached 65 degrees the fans can introduce oxygen and cool the compost to 50-55 degrees). This way any fire risk within the pile is controlled by ensuring that the pile cannot become too hot, but the temperature is always maintained around the level where pasteurisation and sterilisation occurs to ensure any weed seed and pathogens are eliminated (55-65^{0}C).

Monitoring the temperature is also important to maintain the correct microbial activity. The beneficial microbes that we require in the process operate ideally around 55-60^{0}C. Material will continue to compost at temperatures higher than 65^{0}C, though microbial diversity becomes limited, and restricts the production of microbes that provide the more positive smell to composting.

Oxygen levels are monitored via a handheld probe, and are conducted weekly through the ASP process. Oxygen levels of 15% or greater indicate good aeration and aerobic conditions within the compost pile; the weekly readings are recorded on the batch sheet, as displayed in the Compost Production Manual.

Moisture levels are monitored twice through the ASP process, firstly after the initial mixing of the material and placement on the ASP bed; and secondly after 3 weeks on the ASP bed (halfway through the ASP process). Measuring moisture levels in the pile can be difficult as preferential pathways can develop. It is important to understand that with an aeration system the pile will dry from the bottom upwards, due to air being forced up from beneath the pile. Squeeze testing the material when placing the product on the ASP bed, and then repeating the test when turning the material after 3 weeks is the best indication of the moisture content of the material; and whether moisture needs to be reintroduced midway through the ASP process. A moisture level of 55-60% is ideal (but not lower), though a higher moisture content can be suitable given the drying effect of aeration. A second moisture test can be conducted to verify the results of the squeeze moisture test. Testing the moisture

level of the material using the oven method provides more objective data for moisture testing. The oven method involves taking a sample of the material and drying it in an oven at 105^{0}C for 24 hours. The method is based on removing moisture by oven drying a sample until the weight remains constant. The moisture content percentage is calculated from the sample weight before and after drying.

Maintaining a consistent and controlled oxygen content and temperature throughout the full volume of the pile optimises the compost process and minimises the risk of anaerobic conditions developing and the generation of unpleasant odours. It is most important to monitor temperature through the ASP process; temperature is more likely to be consistent throughout the pile than oxygen or moisture.

2.8 Aeration and Turning

Pressure fans connected to the temperature probes via a feedback loop aerate the piles. These keep the piles aerated by blowing oxygen into the pile at a measured length of time and at a minimum velocity of 13m/s, without introducing too much air and cooling the pile. The material is held on the aeration bed for a period of 6 weeks, or until temperature sampling indicates the completion of the active composting phase. Over this time the temperature within the piles initially rises to 60^{0}C+, and gradually cools after the Thermophillic phase of decomposition to about 35^{0}C. Pasteurising temperatures of 55 degrees+ must be reached for at least 3 days.

During the initial 3 weeks on the ASP bed, the compost material undergoes rapid Thermophilic decomposition. At this point in the process, the material will be turned. Under the New Zealand Standard (NZ5454:2005) turning of the material is not a requirement; though it is practiced by successful operators within New Zealand (including Timaru District Council at the Redruth facility) and it is recommended as industry best practice.

Turning the material through the ASP process remixes the compost and provides a number of benefits including:

- Reducing any preferential pathways in the compost (pathways for air or water to move through the pile). Higher moisture content materials can develop more preferential pathways, which can mean that some of the composting material gets too much oxygen and dries; while other parts of the material stays wet and short of oxygen. Turning and remixing the material removes any preferential pathways and provides more even composting throughout the pile.

- Achieving full pasteurisation throughout the whole pile of compost. The process of turning the material allows all of the compost to be exposed to the high pasteurising temperatures in the centre of the pile. This ensures that all of the material experiences exposure to temperatures of 60^{0}C or greater, destroys any potential weed seed and pathogens within the pile.
- Providing the ability to add water and re-wet the compost pile. The nature of the ASP process to dry the material as it undergoes the composting phase means that the requirement to re-introduce water is high. Turning the material halfway through the ASP process allows the moisture content of the pile to be assessed, and additional water added, if required.

The material is turned with a front end loader, and it is turned from one ASP bed onto the next. With the adequate oxygen levels provided by aeration (15% or greater), odour is likely to be minimal. Some discharge of odour can be expected during this process, and accordingly must be carried out in line with the site Air Quality Management Plan i.e. when wind conditions are favourable and within specified times of the day.

2.9 Removal from the ASP Pad and Maturation

After 6 weeks on the ASP beds pasteurising conditions have been achieved and decomposition is complete (as indicated by a temperature decline due to reduced microbial activity). The compost material will be removed from the concrete ASP pad by wheel loader, and stored in large static maturation rows on an impermeable maturation pad.

With the compost pile being adequately aerated, containing good porosity and having undergone a turn through the ASP process, odour from the removal of the pile is expected to be negligible. The material within the piles will be moved and disturbed, thus exposing the material to the atmosphere. No pockets of anaerobic material will be present within the piles. As a further measure, movement of the piles from the active composting area to the maturation piles can also be timed to coincide with the most favourable meteorological conditions for the site. This will be in accordance with the site's Air Quality Management Plan.

The compost material undergoes a maturation period of a minimum of 2 months, with the material turned monthly by front end loader or excavator; as specified in NZS4454:2005.

3.0 Maturation Pad

The Maturation pad will be constructed to store the compost in the maturation/curing stage after decomposition is complete. The compost material will be placed on the Maturation pad after the 6 week ASP process is complete, and will remain on the pad for a minimum of 2 months while undergoing the maturation phase. The pad is constructed to be impermeable to ensure that any leachate or storm water will not come into contact with the ground. The maturation pad is sloped towards a lined collection pond for the collection of storm water runoff. The compost rows will be placed to run vertical to the collection pond, to allow storm water to run between the compost rows towards the collection pond.

The Maturation pad will be constructed above the existing ground level and consist of a base layer, an impermeable liner and a compacted aggregate top layer for heavy machinery to operate on without impacting the integrity of the permeability of the pad. The base layer is constructed with compacted soil and clay, it will be 300mm deep and sloped to fall 2:100 North to South. The impermeable layer is placed on top of the base material, and consists of a welded 1.5mm double texture HDPE liner (such as IS Dam Liner, or similar), which is laid to provide an impermeable surface. The compacted aggregate top layer is constructed of a 300mm layer of compacted aggregate (SAP65 or similar), which is placed on top of the HDPE liner. A 300mm layer depth is used to provide a solid base for heavy machinery to operate on while not impacting the liner below the top layer.

The collection pond is situated on the North side of the maturation pad. It will be 60 metres long x 10.3 metres wide x 0.2 metres deep; equalling 123.6 cubic metres (m^3), or 123'600 litres of water storage. The pond would be constructed by excavating the required area, and placing a base of AP40 compacted aggregate 100mm deep, with a 25mm layer of sand placed on top of the aggregate. The retention pond would be lined by using an impermeable HDPE geomembrane pond liner, which will prevent leachate from entering into the soil.

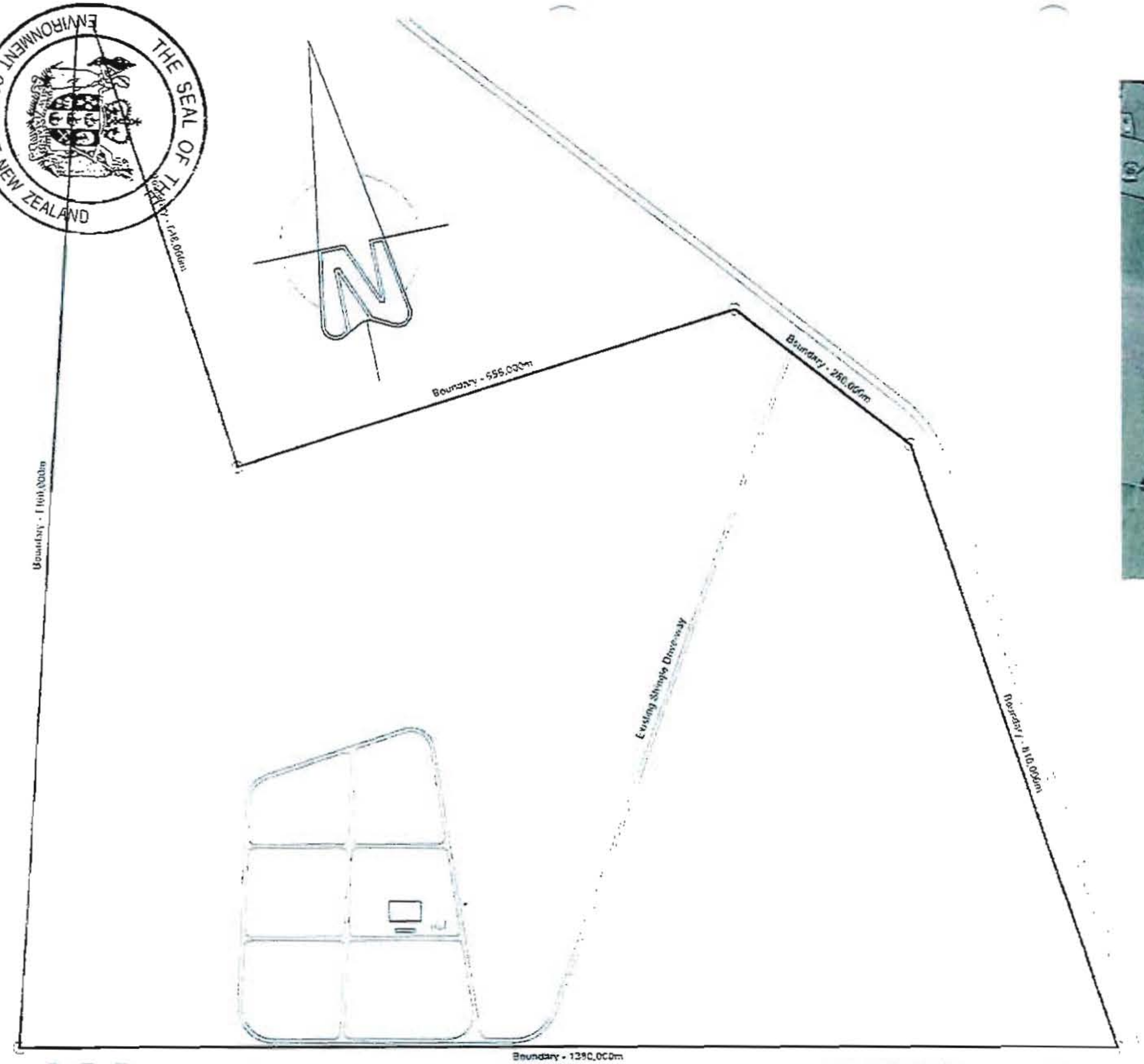
Stormwater runoff captured in the retention pond will be recycled either into the ASP composting process or over the maturing compost rows by pumping the stormwater, via a water pump, to irrigate the compost rows.

The design of the Maturation Pad is included as Appendix B.

3.1 Testing

After the compost completes the maturation phase, a sample is taken for a compost analysis test via Hills Laboratories; to ensure the finished material complies with the requirements of NZS4454:2005. If the compost test results showed that the material had not met the specific requirements, the row is moved back to the beginning of the maturation pad and undergoes another regime of monthly turning and maturation; before being retested for compliance with the New Zealand Standard.

Once the material meets the required specifications in NZS4454:2005, it is removed from the maturation pad, screened to remove any oversize material remaining in the pile, and then sold as a soil conditioner, either to the urban market (landscape yards, landscaper contractors, garden centres, home gardeners); or to the rural market (vegetable growers, dairy farms, vineyards, forestry blocks).



THE SEAL OF THE ENVIRONMENT COURT OF NEW ZEALAND

CLIENT INFO:
CANTERBURY LANDSCAPE SUPPLIES
949 South Eyre Road, Mcleans Island
Swannanoa

SITE INFO

LEGAL DESCRIPTION

PLANNING INFO:

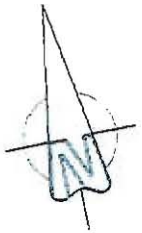
CANTERBURY LANDSCAPE SUPPLIES
949 South Eyre Road, Mcleans Island
Swannanoa

SITE PLAN

REVISION

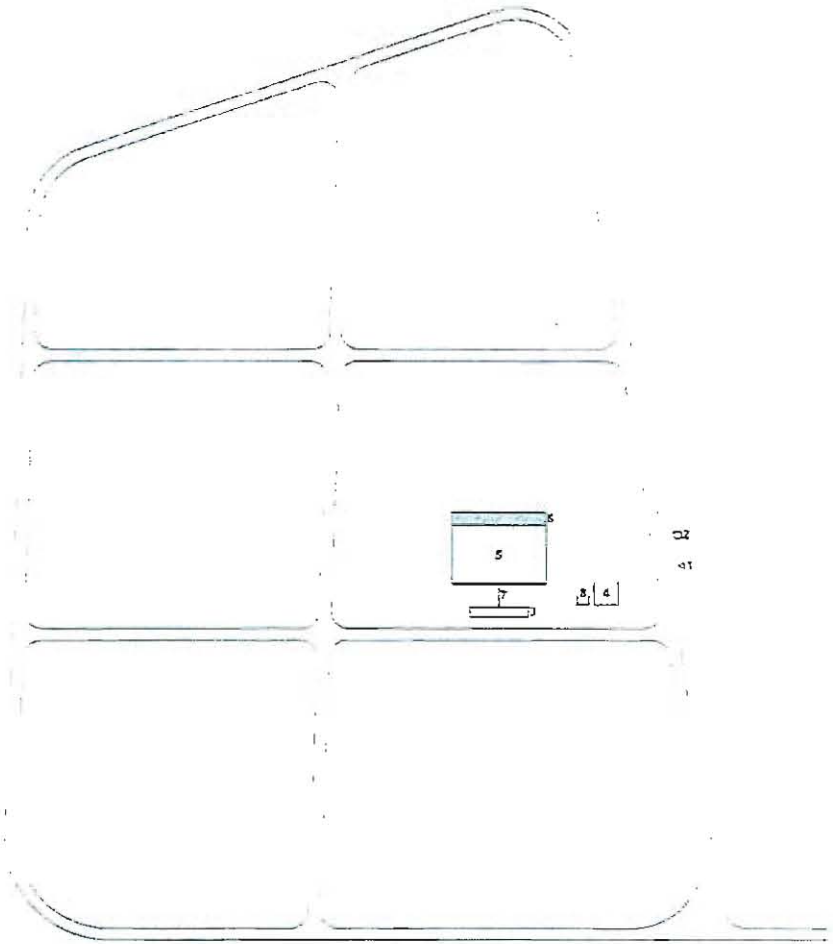
A01
of 04

ENVIRONMENT COURT OF NEW ZEALAND
THE SEAL OF THE



LEGEND

1 - Existing Water Storage Tank
2 - Existing Utility Shed
3 - Stormwater Retention Pond
4 - Existing Receiving Areas
5 - Aeration Pad
6 - Compacted Aggregate Pad
7 - Water Drain
8 - Existing Water Collection Sump



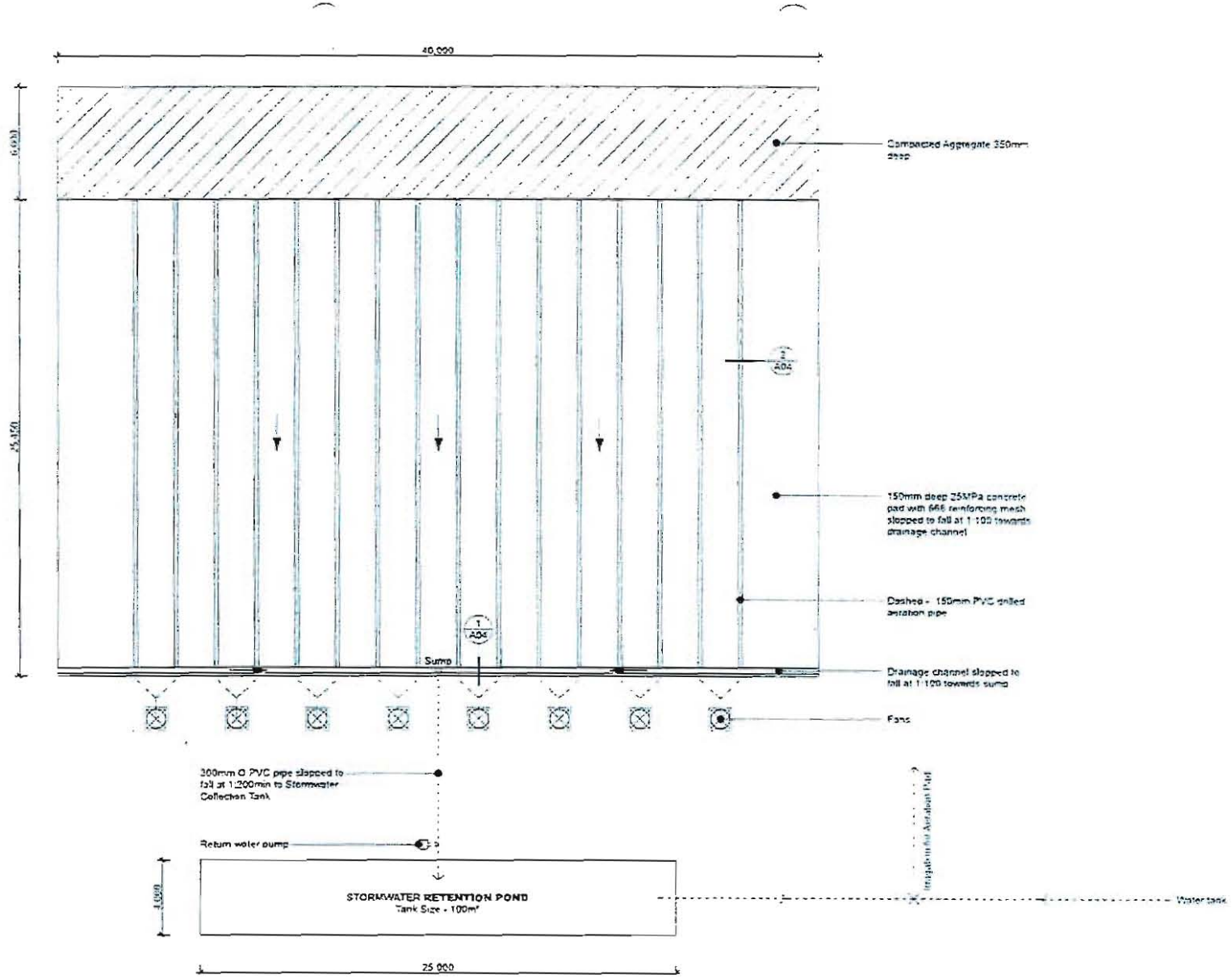
CANTERBURY LANDSCAPE SUPPLIES AERATION PAD LOCATION

949 South Eyre Road, Mcleans Island
Swannanoa

REVISION

SHEET NO

A02
of 04



CANTERBURY LANDSCAPE SUPPLIES
945 South Eyre Road, Mid Loam Island
Swannanoa

AERATION PAD

REVISION

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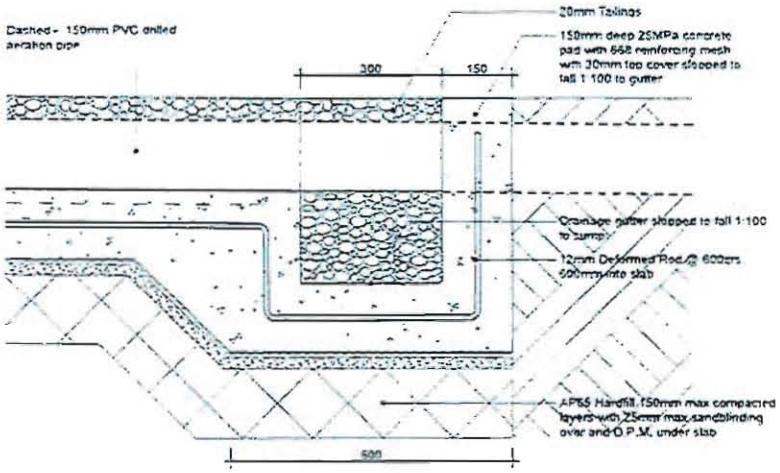
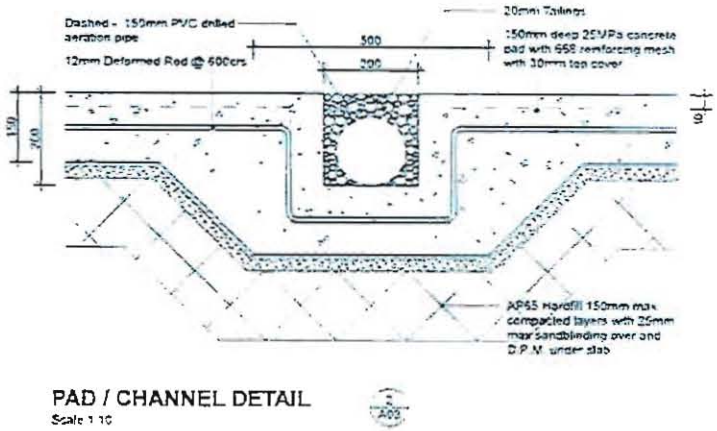
of 04



DRAINAGE CHANNEL DETAIL
Scale 1:10



PAD / CHANNEL DETAIL
Scale 1:10

CANTERBURY LANDSCAPE SUPPLIES
949 South Eyre Road, Mcleans Island
Swannanoa

AERATION PAD DETAILS

REVISION

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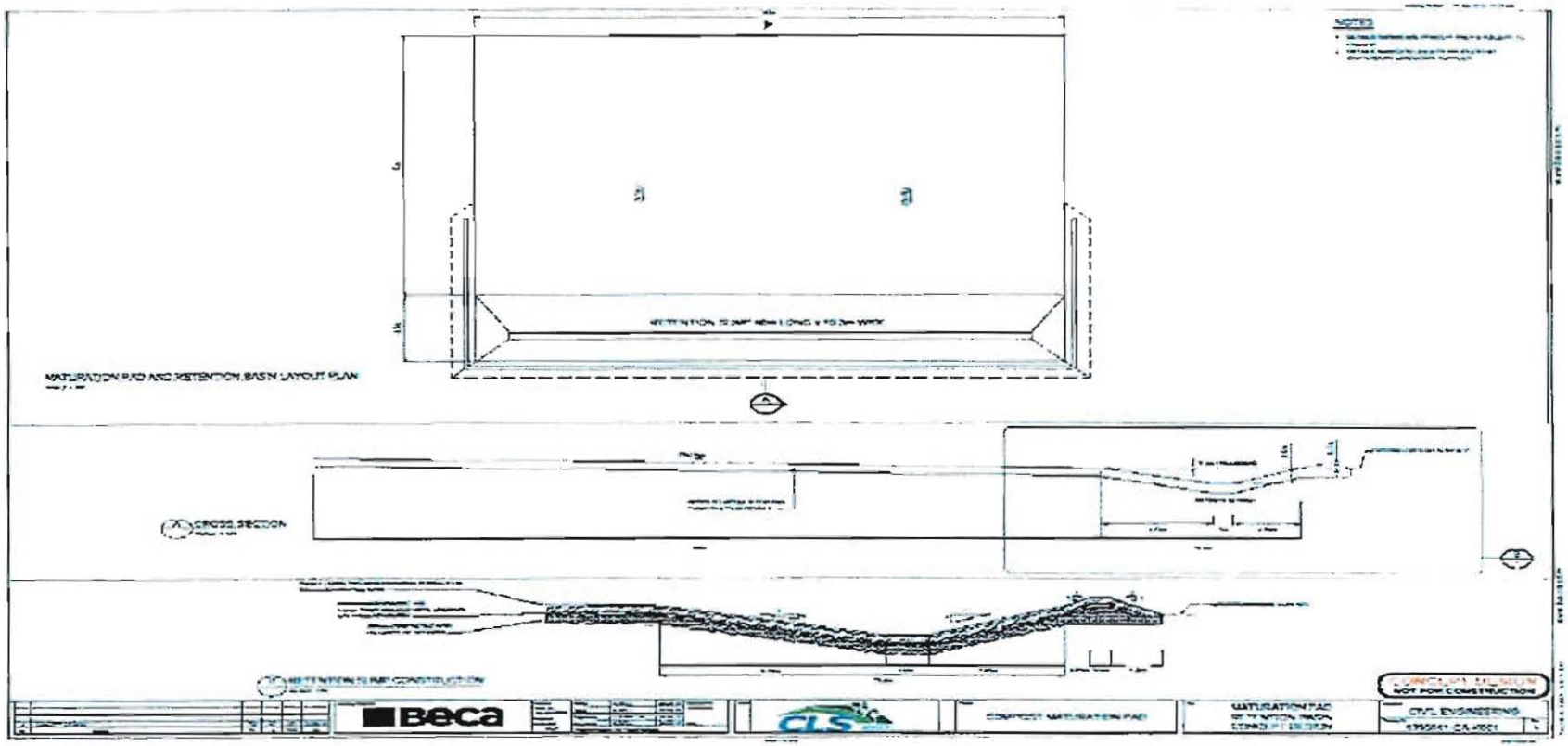
of 04

Appendix A – Woods Architecture Drawings ASP Pad

Appendix B – Beca Engineer Drawings Compost Maturation Pad



ASP COMPOST

PRODUCTION MANUAL

Issue:
Dated:

Authorised by:

AMENDMENT TABLE

Number	Date	Amendments

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1. OVERVIEW

Composting is a controlled, aerobic process resulting in a partial decomposition and stabilisation of organic materials by the action of microbes. Aerobic decomposition controls odours and generates high temperatures which kills pathogenic bacteria and produces a humus-like product.

Canterbury Landscape Supplies produces a composted soil conditioner from organic waste materials, sawdust and bark through controlled aerated thermophillc composting.

The organic waste has an indigenous population of microorganisms which break down the raw materials during composting. Carbon sources such as bark, sawdust or green waste are added to the organic waste to provide porosity, structure and additional carbon for microorganisms.

Aeration

During aeration, aerobic thermophilic bacteria convert the compost mixture from an ammonia based product to a nitrate based product.

Aerated static pile composting requires a fan to be connected by PVC piping, drilled with ventilation holes and placed beneath the compost pile which blows air upward through the composting mass. An effective aeration system needs to be in place with the capacity to supply appropriate volume of air to the pile. The aeration rates control various important aspects of the composting process including:

- Temperature levels within the pile
- oxygen levels within the pile
- moisture content within the pile

Temperature

High temperatures of around 55- 65°C; destroy the viability of seeds, inhibit the growth of pathogenic bacteria; and stimulate growth of thermophilic bacteria necessary for composting. Temperatures greater than 85°C will reduce the growth rate of thermophilic bacteria, slowing down the composting process. Therefore the aeration rate should be maintained to provide sufficient oxygen for maximum thermophilic bacteria activity, and temperatures in the range of 55 - 65°C without drying out the pile too much. The internal temperature of the piles should reach 50°C in 3 days, with a maximum delay of 7 days. The material is held on the aeration bed for a minimum of 6 weeks. Over this time the temperature is monitored, with it initially rising to 60°C+, and gradually cooling after the thermophillic phase of decomposition to about 35 °C. As stated in NZS4454:2005 *"Pasteurising temperatures of 55 degrees+ must be reached for at least 3 days."*

Bacteria

The bacteria within the composting pile are those which are naturally occurring in the raw materials. As the compost matures the predominant populations change; dependent on the temperature and age of the pile. The initial predominant population are mesophillc bacteria. As the temperature rises as a result of the bacterial metabolism; the predominant population are the thermophilic bacteria.

Moisture

The optimum moisture content for bacterial growth of a pile at time of establishment is 55-60% w/w. The compost can be dried by increasing fan run times. The initial moisture content can be higher than other composting systems, due to the ASP process naturally having a drying effect on the material; though moisture content of 50% or lower is too dry and water will need to be introduced to the mix.

Carbon Nitrogen Ratio

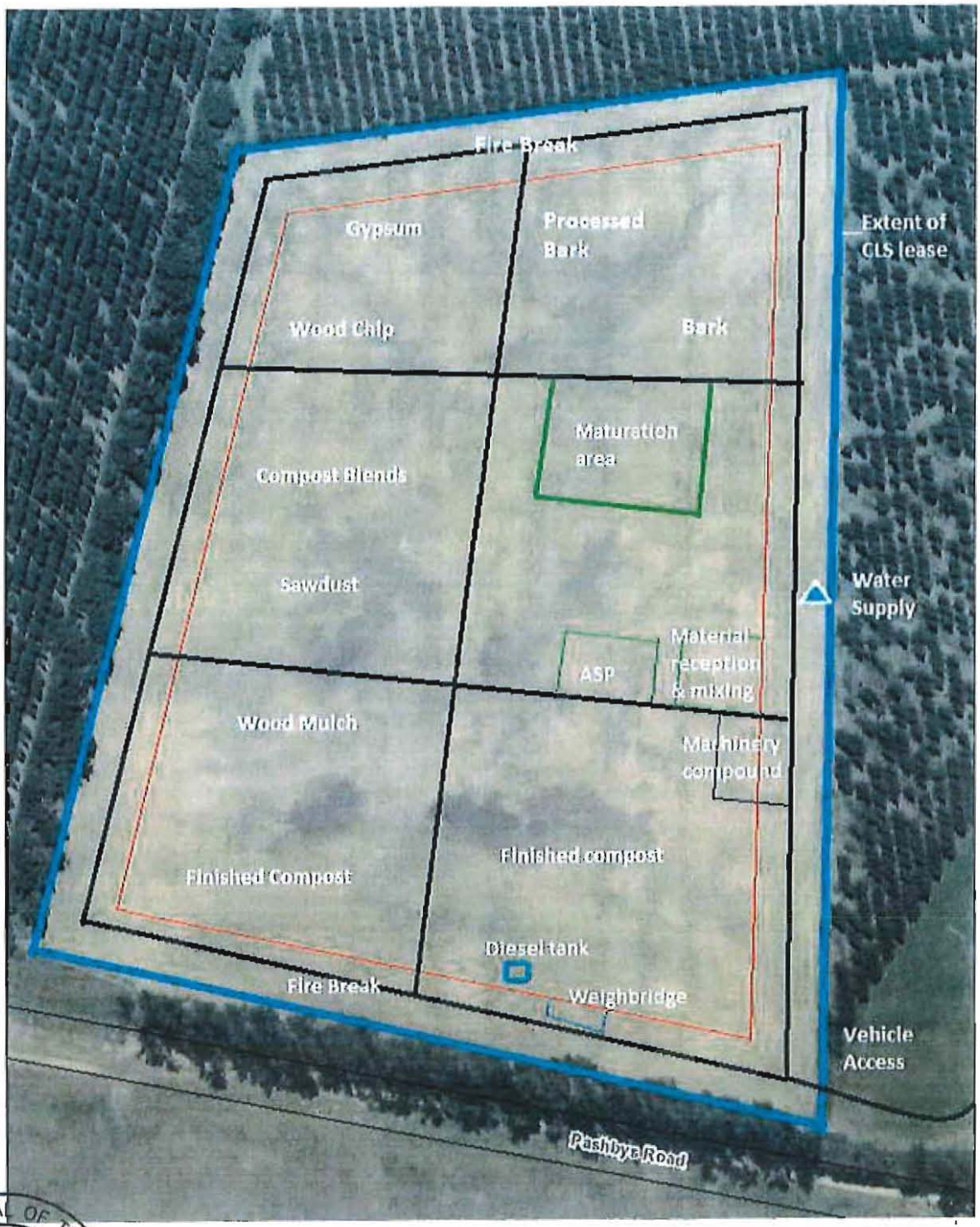
The optimum Carbon Nitrogen ratio is approximately 30:1. The predominant Carbon sources are bark, sawdust and green waste. The main Nitrogen sources are broken down proteins; from bi-products such as paunch grass and biosolids. As outlined in the New Zealand Standard for Composts, Soil Conditioners and Mulches (NZS4454:2005) Appendix K3; *"Higher nutrient contents (C:N ratios of 25:1-35:1) than with turned pile composting are possible because aeration lessens the chance of oxygen deficiency"; "Odours are minimised because large areas within the composting mass are processed at optimal temperatures. Also, NH3 losses are minimised."*

Curing

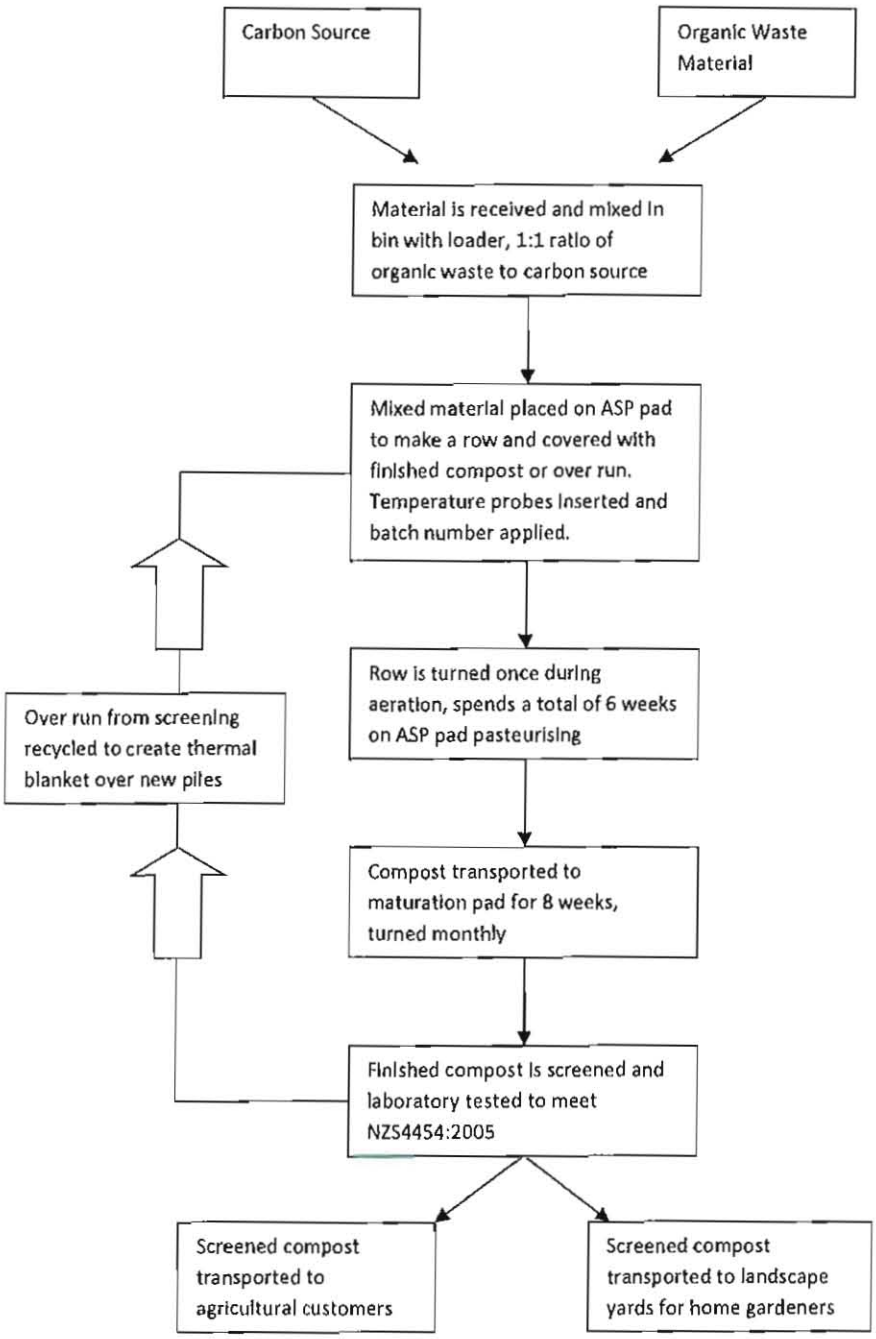
In the curing pile different microorganisms, such as the antiomocetes complete the composting process by breaking down the carbonaceous organic matter largely derived from the bark, sawdust and green waste, over the 2 month maturity period. The sequential turning every month allows these microorganisms to have a plentiful supply of oxygen and redistribute and break up any large lumps of remaining organic matter for easier breaking down by the microorganisms. The pile pH changes during the different stages of breakdown by the bacteria. Initially the pH is slightly alkaline due to the composition of the waste during the aeration phase. pH changes to a more neutral pH of at least 7.0 over time when the bacteria break the proteins down into ammonia and then nitrate. At this stage the compost will undergo a compost analysis test via Hills Laboratories to ensure the finished material complies with the requirements of NZS4454:2005 *Composts, Soil Conditioners and Mulches*.

2. SITE DESCRIPTION

2.1 Layout



2.2 Process Flow Diagram



3. RAW MATERIALS

3.1 Description and quantity of raw material by source

The following table outlines the origins of the sources of organic waste and the quantities received:

Source	Description of product	Average m^3/week (year)	Peak quantity/week
Silver Fern Farms	De-watered Paunch grass/biosolids	67.18 m^3 (2017)	114.58 m^3
Anzco	De-watered Paunch grass	41.70 m^3 (2017)	66.06 m^3
South Pacific Meats	De-watered Paunch grass	44.69 m^3 (2017)	69.43 m^3
Canterbury Woolscour	Wool Clippings	10.83 m^3 (2017)	14.54m^3
Tegal Chickens	Broken eggs, yolk & feathers	6.04 m^3 (2017)	9.92m^3
Intergroup	Grease trap removal blended with sawdust	5.74 m^3 (2017)	11.54m^3

Raw materials received to the site must be as fresh as possible when being delivered to the site, as this assists with minimising any odours from the organic waste products.

All raw materials are inspected on arrival to confirm the suitability for receipt. The product is inspected for any contamination of other materials than specified, and that the physical condition of the product meets the required specification (i.e. that material is de-watered or blended with an absorbent material to provide suitable moisture content).

3.2 Storage time of raw materials

Raw materials are delivered to the site daily, during normal hours of operation. Storage significantly reduces the level of biological activity and can result in odour. Materials are covered with a carbon source, such as bark or sawdust immediately after they arrive. This carbon layer acts as a biofilter to minimise any potential odour from the raw materials.

The materials should be mixed with the carbon source and placed on the aeration bed on the day they arrive, to begin the composting process as soon as possible. As a further precautionary step, when the wind is blowing towards sensitive receptors the raw material is thoroughly covered until wind conditions are suitable for mixing.

If the moisture level of the mixed material is suitable on the mixing pad, then the moisture level on the aeration bed should also be suitable. A moisture content of 55-60% is ideal for the ASP composting process, due to the drying effect of the forced aeration.

4. PROCESS DESCRIPTION

4.1 Delivery of raw materials

Raw material is delivered to the site daily, during normal hours of operation. No delivery of raw materials is permitted outside of normal hours of operation, including Sundays or Public Holidays.

Raw materials are inspected visually on arrival, before being tipped into the receiving bin. Once the material has passed the visual inspection by a CLS operator, it is tipped into the receiving bin while a CLS staff member observes. If any contamination is observed in the material while tipping, the driver is notified that the load is unacceptable and the CLS operator will load the material back onto the truck using a front end loader and it is taken off site. A photograph of the contamination is taken and forwarded to CLS management to pass on to the supplier of the material. CLS then contacts the supplier of the contaminated material to explain why the material was unacceptable, and requests that the supplier investigates the reason for the contamination, and report back to CLS about how they can ensure that future material will meet the required specification and the risk for contamination has been resolved. The material from the supplier is not received back on to the CLS site until CLS have been assured that the risk of contamination has been removed.

4.2 Dewatering

Dewatering is an important process as it reduces the moisture levels to a preferred level. This helps with aeration and moisture control. All materials received on site have undergone a dewatering process at their point of origin, prior to being delivered.

Materials such as paunch grass are pressed through a belt press or screw press to remove excess water. Other materials with a moisture content should be pressed or pre-blended with material to assist with soaking up excess liquid; but is still suitable for composting (such as adding sawdust).

4.3 Mixing

The proper mixing of the waste material with the bark is essential to the proper function of the composting process.

Mixing controls the solids content of the mixture and create a mass that is porous enough to allow air to flow through it uniformly. Inadequate mixing can cause failure of aeration piles. Sections may contain large clumps or balls of organic waste causing anaerobic conditions from which a number of operational problems may occur, such as poor aeration, odour generation and incomplete destruction of pathogens.

Carbon such as bark, sawdust or green waste is mixed with the organic waste in the mixing bin at a ratio of 1:1. The material is mixed using machinery such as a front end loader or excavator, and it is mixed in the receiving bin. Consistency of the mix is controlled by the machine operator. The carbon material absorbs moisture from the organic waste and provides organic carbon which is essential in composting.

If the mixture is too wet, lacks adequate porosity, or lacks the proper Carbon to Nitrogen (C:N) ratio; then poor composting with low temperatures could result. If the mixture is too dry (<45%) then biological activity is severely reduced. Biological activity ceases at 12% moisture content. The moisture content of the mixture should be a minimum of 55% before placement on the aeration beds.

During the mixing stage it is important that the organic waste and the carbon source are thoroughly and uniformly mixed to ensure good pore distribution and adequate movement of air throughout the aeration pile. This then allows for maximum exposure of the surface area of the organic waste particles to the microorganisms (thermophilic bacteria) responsible for decomposing the organic waste. The mixture should also possess sufficient consistency to maintain porosity when placed into the aeration pile.

4.4 Aeration

The method of aeration used is the Rutgers aerated static pile method. The compost operation has 8 aeration beds. The aeration beds are located on a concrete pad with 16 channels (2 per aeration bed) in them containing drilled PVC pipes and overlaid by shingle for the aeration of the compost. The channels contain drainage pipes to drain any liquid from the channels to a sump collection area.

Aeration of the pads is controlled by digital temperature controllers via temperature probes and timers. The timers turn the fans on for a specific amount of time, when the temperature probes indicate the temperature of the pile is <60°C.

4.4.1 Building aeration pile

Before placing any mix material on the aeration pad the aeration channels should be given a visual inspection for any compaction of shingle and restriction of airflow from the fans. Once

inspection is completed a base of coarse bark is used to cover the aeration pad and channels to a depth of approximately 300mm deep uniformly over the whole aeration pad. This layer of coarse bark helps in dispersing the air through the aerating compost material. The compost material then can be placed on top of the bark base, ensuring the compost material does not flow off.

The operator should minimise the amount of time the loader is on the bark base and/or running over the channels for the aeration pipes. The weight of the loader can cause compaction of the bark base, especially on the aeration channels, which restricts the volume of air available to the microorganisms within the aeration pile.

The size of the pile on the aeration beds is important to the composting process. Each of the 8 ASP beds has the same dimension:

25m long x 5m wide x 3m high = 375 cubic metres

375m3 x 2/3 (to calculate volume in a windrow) = 250 cubic metres per aeration bed

After the pile has been built to the optimum height, in accordance with Appendix K 3 of NZS44S4:2005, a cover of either screened oversize or unscreened mature compost is placed over the pile to a depth approximately 100mm deep. This cover of mature compost acts as insulation as well as an active biofilter for any potential odours produced from the pile.

Temperature probes and a batch indicator marker are then inserted into the pile. The temperature probes are connected to a controller which controls the running fan. The temperature probe is positioned half way along the side of the pile and half way up the side of the pile and inserted horizontally to a depth of 1 metre. The controller and fans are switched on and the temperature of the aeration pile recorded electronically.

4.4.2 Recording of Information

An operational check sheet listing date pad built, pad number, indicator lot number and initial temperature of aeration pile is filled in. This check sheet records the production of compost of one pile from mixing through to screening.

The temperature of the aeration piles is recorded constantly and linked to a temperature feedback system to maintain compost temperatures within a predetermined range (between 50-65^{0}C). Temperatures are recorded electronically so data is accessible for constant monitoring and future reference.

A handheld oxygen probe is used to monitor oxygen levels in the pile and ensure aerobic conditions are maintained. Oxygen in each row is measured weekly, by inserting the probe

one metre into the top of the pile, and manually recorded on the check sheet. Oxygen levels must be maintained above 15% to ensure aerobic conditions within the pile.

Maintaining a consistent and controlled oxygen content and temperature throughout the full volume of the pile optimises the compost process and minimises the risk of anaerobic conditions developing and the generation of unpleasant odours.

The temperature within the pile must reach >50°C within 3 days. If it does not, corrective action and an investigation into the pile failure is carried out.

4.4.3 Aeration period and Turning

The aeration of a pile is complete when the temperature stops increasing naturally, and gradually drops below 55°C. When the temperature drops below 55°C the pile can be removed from the aeration pad and the pad prepared for another aeration pile.

This process should occur over a 6 week period, and the material should be turned once during the aeration process. The material should be turned by front end loader after an initial 3 weeks on the ASP pad, with turning conducted in accordance with the site Air Quality Management Plan.

If the pile is adequately aerated (greater than 15% oxygen, as measured with oxygen probe), minimal odours can be expected after 3 weeks. The constant supply of oxygen into the pile, coupled with a mix providing good porosity for oxygen to travel throughout the whole mass; aerobic (good) conditions are maintained within the pile and the rate of decomposition is optimised, greatly minimising the potential of offensive odours. Turning a pile with a front end loader should take no longer than 2 ½ hours. Turning the pile once while undergoing the ASP process assists in ensuring that the whole pile is thoroughly mixed and there are no pockets of anaerobic material, preferential oxygen pathways are minimised - meaning even oxygen and temperature dispersion through the pile and you have the ability to assess the moisture content of the pile and add water (if necessary) through the process.

4.5 Curing

Curing provides additional time so that the compost material can mature and stabilise before distribution and use. The lot number given to the aeration pile is carried through to the curing and screening piles.

Following successful aeration the compost is removed from the bed and placed on the maturation bed in a curing pile for the maturity phase. All curing piles are turned in sequential order each month for a 2 month period. The final turn of the curing pile locates the compost next to the screen.

The turning of the curing piles is carried out in a way which allows the maximum volume of air to disperse throughout the pile. This is achieved by turning the curing piles inside out. In other words, the outside of the pile is used to form the core of the pile whilst the inside of the pile is tipped from the bucket of the loader or excavator over the new core of the pile. Regular turning of the piles maintains an aerobic environment within the piles for containing microbial breakdown and prevents odour generation.

The rotational system of the maturing phase allows the operators to have control on the conditions of the piles. They can modify the rotation sequence and turning frequency to improve the maturity of the compost depending on testing done by the laboratory and performance of the pile.

Temperature monitoring of curing piles is undertaken in accordance with the Air Quality Management Plan.

4.6 Screening

On completion of the maturity phase the compost is removed from the curing pile and processed through a screen. Screening removes any oversized mature compost, stones or other unwanted material from the screened saleable product. This oversized mature compost material is commonly known as over run, and is used for covering the aeration piles where it is used as a biofilter.

Testing

At the end of the maturation period, each batch of compost is sampled and sent to Hills Laboratory for a Compost Analysis to ensure each batch meets the requirements of NZS4454:2005. The results are sent to the General Manager and the Site Foreman; the Site Foreman is notified if any parameters are found to be outside specified limits.

4.7 Sale

Compost is sold in bulk or in bags by CLS throughout the South Island. It is transported to CLS's Belfast site to be either: bagged and distributed, sold through the CLS retail landscape yard; or distributed by CLS to other landscape supply yards, garden centres, landscapers or landscape contractors. Bulk loads are also delivered from the Diversion Road site to local rural customers including vegetable growers, dairy farms, forestry growers and vineyards.

4.8 Operational Constraints

4.8.1 Wind direction restrictions

The operation of the compost plant must comply at all times with the site's Air Quality Management Plan, and operators onsite must be mindful of neighbouring sites, in terms of dust and odour.

When light winds from the West, Southwest or South are being experienced, the following operations should not be conducted:

- Mixing raw material in bin
- Placing mixed material into ASP beds
- Turning the material after 3 weeks on the ASP pad

Other operations should be monitored carefully and stopped if there is strong odour. These operations could include:

- Moving of compost off beds to maturation area once decomposition is complete
- Turning curing piles

4.8.2 Restrictions on hours of operation

In general the hours of plant operations are limited to:

Monday to Friday	6.30am – 4.30pm
Saturday	6.30am – 4.30pm

Operations that have a higher odour potential, such as:

- Mixing raw material in bin
- Placing mixed material into beds
- Turning the material after 3 weeks on the ASP pad

Are limited to the following hours of operation:

Monday to Friday	10.00am – 4.00pm

5. PROCESS CONTROLS

5.1 Position Responsibilities

Site Foreman

- Responsible for Machine Operators and execution of the ASP Compost operation.
- Monitors site performance through the operational control system.
- Responsible for corrective action.

Machine Operators

- Report to Site Foreman.
- Production of compost in compliance with documented system.
- General maintenance of site.
- Daily monitoring of aeration bed temperatures and weekly recording of aeration bed oxygen levels.
- Monitoring of aeration equipment and site drainage

Operations Manager (Belfast site)

- Responsible for the provision of maintenance and engineering requirements for the site

General Manager (Belfast site)

- Provides technical assistance and support to Operations Manager and Site Foreman
- Audits the site on a regular basis
- Assists with data analysis and monitoring of results

5.2 Monitoring and Audit

Monitoring systems are an integral part of the Process Control system used on the site. Monitoring involves a check of actual conditions against written standards for production and safety. Monitoring is necessary to ensure that documented procedures are being followed and that abnormal conditions and consequent actions are recorded. The records built up over time demonstrate the degree of control being exercised over the operation and allow data to be analysed statistically as part of a constant improvement programme.

In addition to auditing of compliance with any conditions of consent by the Canterbury Regional Council, the Diversion Road compost operation will be audited internally at least annually by the CLS General Manager. Audits will cover all aspects of the ASP compost operation, in particular records and corrective action. Where necessary, the General Manager draws on others to assist with audits.

The Site Foreman monitors the operation of the ASP compost system and is responsible for allocation of tasks, process monitoring, and corrective action.

5.3 Corrective Action

The Site Foreman should investigate, if necessary with the aid of either the Operations Manager and/ or the General Manager, any operational or technical problems, out of specification product and complaints from neighbours.

This investigation could include a review of historical data, for example – temperature profile, raw material input or laboratory results. All findings and conclusions should be documented.

Table 5.3/1 outlines corrective action guidelines for a number of issues that may arise during the composting operation.

	Issue	Corrective Action
Aeration Pad	Aeration pad does not reach minimum temperature of 50°C within 3 days.	• Site Foreman is to be notified immediately. • Take aeration pile off pad. Remix product back into mixing bins • Check on the mixing of the waste product. Monitor any changes in recipe used for mixed material. • Check aeration pad for any indication of compaction. Renew shingle if necessary. Depending on the condition of the shingle, it may be necessary to lift the PVC pipes, remove all the shingle and clean out the channels, drains and PVC pipes before re-laying with fresh shingle. • Check that the fan is running and is controlled by the digital temperature controller. Notify an engineer if fan not functioning properly or digital temperature controller is not functioning. • Ensure that digital temperature controller is set to 60°C. Reset as necessary. • Check velocity of fan. Fan velocity must be >13m/s. If <13m/s notify an engineer for immediate maintenance check. • Check when temperature probe was last calibrated. Confirm recorded temperature on probe with a calibrated digital temperature probe. Notify an engineer immediately for servicing if temperature is out by more than 2°C
	Air velocity after 48 hrs<13m/s.	• Site Foreman to be notified immediately. • Check pile temperature. If pile temperature is significantly <50°C carry out corrective actions for aeration pad, if the pile does not reach 50°C within the specified 3 days • Notify an engineer for immediate maintenance check of fans.
Mixing bins	Mixed material in mixing bins for more than 72 hours.	• Mixed material must be remixed with fresh raw product and carbon source before placement on aeration pads as soon as weather conditions allow

	Issue	Corrective action
Sumps	Sump becomes blocked and/or pad unable to drain off leachate to sump.	• Machine operators are to attempt to clear any blockages in the sumps if they can. If unable to then the site supervisor is to be notified immediately. Site supervisor is to inform and contact external contractor to unblock the sumps and/or extract any liquid from the sump for offsite disposal.
Maturation piles	Maturation pile does not look fully matured before screening.	• Place maturation pile to one side of the turning system. • Request a chemical analysis for ammonia and nitrate nitrogen content. • If pile is found to be not mature enough for screening, place it several turns back in the turning cycle. Monitor its progress. • If the chemical analysis results are good, place the pile back into turning cycle and continue
Chemical analysis	Chemical analysis of mature compost outside specified limits.	• Site foreman is to be notified immediately by management staff • If pile is still being screened, all screening must stop immediately until a decision has been made on rectifying the outlying parameter. All sales are to cease on that pile as well. • Site foreman after consultation with management staff will decide on what will happen with affected pile.
Sales	Complaint received by customer of condition of compost received	• Complaint will be reported to Sales Manager immediately, and noted down along with the date the compost was sold to the customer. • If the complaint is related to a pile currently being screened, all screening and sales of product from that pile will cease until the complaint has been examined and any possible problems rectified. • Site foreman in consultation with management staff will check all records concerning the compost pile and assess whether there was a problem with the pile and discuss any likely courses of action. • Site foreman/management staff will write a report listing the complaint and any action taken.

5.3 Documentation

Documentation is made up of independent Laboratory reports, records, audit reports and this manual, which includes task instructions, checklists and standard forms.

Temperature records are recorded and stored electronically using a computer software program. They are stored on the computer program to provide long term, historical data.

Oxygen records are recorded on the operational control check sheets weekly, and on to computer monthly.

The Operations Manager is responsible for the maintenance of the ASP Compost documentation. The manual is formally updated each year. Interim updates are made by signed and dated handwritten amendments.

Each standard form and task instruction has a current version date. Master copies of these forms are stored electronically in an on-line program for printing as required. Completed records are filed on site, and then transferred onto computer to be stored electronically; a copy of this manual is also stored onsite for operator reference and training. Annual reports and audit reports are stored at the CLS main office at Belfast.

APPENDIX 1 - Task Instructions

Introduction

This appendix contains the task instructions applicable to the processing of compost at the CLS Diversion Road site. Tasks are allocated to individuals at the discretion of the Site Foreman.

Each task may be performed by one employee or there may be more than one operator performing specific tasks.

The task instructions cover the following:

- General Requirements
- Daily Pre-Operational
- Daily Operational Tasks
- Routine Tasks (not daily)
- Non-Routine Tasks
- Other Tasks

The task instructions are intended for both training and audit purposes. In both situations, the emphasis should be on the outcome of the task. Auditors need to distinguish between the advisory and mandatory content of task instructions, and the outcome required.

LOADER OPERATION

Subtask	Steps	Notes
Daily Checks	• Inspect fluid levels, including engine, transmission, hydraulic and radiator. • Drain water from fuel tank/separator as required. • Check brakes, indicators, gauges and alarms fitted.	• Time periods for loader inspection are only a guide and are subject to seasonal changes. • See CLS Pre-start Inspection Schedule
Weekly Checks	• Remove and clean air filters. • Grease all joints. • Inspect pins and bushes for excess wear, cracks etc. • Check tyre pressure. • Report faults to Site Foreman.	• Time periods for loader inspection are only a guide and are subject to seasonal changes. • See CLS Pre-start Inspection Schedule
Repairs	• Arrange repair of all breakdowns with Site Foreman.	• All repairs are usually with an external mechanical contractor • Different contractors are used depending on the repair issue (i.e. mechanical, hydraulic, electrical, engineering, tyres)

USE OF BINS AND MIXING PAD

Subtask	Steps	Notes
Mixing bin preparation	• Layer carbon source along the base of the mixing bin receiving waste material. • Build an end wall out of the carbon source or mixed raw material to contain the waste.	• Any water drains to the sump
Preliminary inspection, mixing and covering	• When the waste material arrives, staff inspect the material to ensure that it meets required specification (i.e no contamination and correct moisture level) • When the waste material arrives at the mixing bins, cover immediately with fresh carbon source	• If material does not meet specification, a photograph is taken of the material and sent to CLS management. The material is loaded back onto the truck and removed from site. • The carbon helps soak up moisture from the waste and the mixing keeps material in the aerobic state.
Final mixing	• Add carbon and mix in the bins until the mixture is at the correct moisture level and consistency. • Place the mixed material in the intermediate storage pile on the mixing slab. • Keep the intermediate pile height below 3m to ensure oxygen can diffuse into the pile	• Avoid mixing when the wind is blowing from the South or West. • Moisture content of mixed raw material needs to be in the range of 55-60% • If mixture is inconsistent this will affect the performance of the mixture on the aeration pad. • Mixed raw material stored in the mixing bin should not be stored there for more than three days

SCREENING

Subtask	Steps	Notes
Screening	• Mature compost is screened • Each different grade is kept separate.	• Screening removes large stones, pieces of bark, wood etc and releases any trace of ammonia left in the product. • The Overrun is used to cover new aeration bed.
Maintenance	• All daily and weekly checks are to be carried out.	• All repairs are done with suitable contractors.

CHECKSHEET COMPLETION TASKS

Subtask	Steps	Notes
Compost operator	• Records temperature and status of each pile daily. • Fills out initial pile information sheet. • Fills out incoming product sheet • Fills out individual pile record sheet weekly	• Pile record sheets are held in the weigh bridge office and on the computers
Supervisor	• Complete record sheet weekly • Completes carbon source records monthly	

AERATION BED OPERATION

Subtask	Steps	Notes
Preparation	• Lay a 300mm carbonaceous layer on concrete before adding mixed waste material	• There are eight beds • Note the wind direction and hours of work restrictions for this activity.
Loading the bed	• Place the blended waste and carbon material on the bed of the carbonaceous layer. • Cover mixed waste on aeration bed with a layer of mature compost to a depth of 100mm. • Activate windrow fans.	• Fans circulate air through the product, drying it out as well as supply oxygen to the aerobic microorganisms present. • The fans operate on sensors. By reducing the fan running time the bed temperature can be increased. • The mature compost acts as a bio filter for odours produced by the mixed waste material. • Compost currently sits on the beds for six – eight weeks
Unloading the bed	• Turn off the fans when not in use. • Unload the bed with a loader onto the maturation area. • Ensure the marker peg is moved and placed in the piles new position.	• Note wind direction and hours of work restrictions for this activity
Turning	• Turn the material from one bed to the next with loader.	• Turning of each row undertaken after a minimum of 3 weeks pasteurization • Note wind direction and hours of work restrictions for this activity

MATURATION

Subtask	Steps	Notes
Turning	• Switch fans off on windrow from which compost is removed. • Remove compost from windrow and place either at the start of the maturing compost piles, or in the area for stockpiling compost. • Turn the maturing piles monthly until the pile reaches the position for screening • The stockpiled compost should be turned once every four – six months	• Maturation allows the remaining organisms to break down the compost completely and convert any ammonia to nitrates. • Turning ensures all material goes through the medium temperature breakdown in the piles interior. It also physically breaks up any large lumps.

COMPOST LABORATORY ANALYSIS

Subtask	Steps	Notes
Initial testing	• A sample of mixed material is taken by the site supervisor before each bed is put down. This is tested for correct moisture content.	• The moisture level should be 55-60%
Final product testing	• Mature and screened compost is sampled and tested by Hills laboratory	• The sample is tested for compliance to NZS4454:2005

PUBLIC SALE

Subtask	Steps	Notes
Sales		• All sales are made through the Belfast site. • Bulk trucks are loaded from both the Diversion road site and the Belfast site
Complaints	• Complaints are to be directed to the Management staff and Site supervisor. • From the recorded date of supply of the compost the pile it came from will be determined. • The site supervisor In consultation with the Management staff will check all records concerning the compost pile and assess whether there was a problem with the pile and discuss any likely courses of action. • The site supervisor/Management staff will write a report listing the complaint and any action taken.	

MAINTENANCE OF AERATION BEDS AND PLANT

Subtask	Steps	Notes
Cleaning drain channels and renewing shingle	• The aeration pipes are to be kept clear of debris. Remove the covering shingle after two new beds have been laid and check the holes in the pipes for blockages. • Clean out the aeration channels every six months and replace the shingle with fresh 20/40mm river stones both above and below the 150mm diameter aeration pipes. • Occasionally pipes may need to be completely replaced	• Good and even airflow is critical to effective composting • Pipes are 150mm PVC pipes, with 8 x 12mm holes per metre drilled in the top side of the pipe. One x 12mm hole per metre is drilled on the bottom of the pipe for drainage.
Fan maintenance	• A maintenance inspection on the fans is to be conducted every three months by an engineer. • This includes checking the belt, bearing motor and lubrication condition, as well as the general condition of the fan and above ground ducting. • In the case of fan failure, an engineer should be contacted to arrange repairs. • The fan belts are to be replaced annually	
Fan controllers	• All temperature probes shall be checked annually against a standardized hand held probe, by an electrician. • The results are to be included with their calibration records. • In case of controller failure, the Electrical engineer should be contacted to arrange repairs.	• The probes should be within 2°C of the standardized probes

APPENDIX 2 - Checklists

Checks on the composting operation are divided into two groups:

- Operational Parameters
- Audit Parameters

OPERATIONAL PARAMETERS

Item	AERATION PAD TEMPERATURE
Issue	Odour generation, incomplete destruction of pathogens, pad failure
Standard	50^{0}C within 3 days of being made
Action	Notify Site Foreman Check fan is running and thermostat operational Check temperature probe operation Check air velocity in PVC pipes Remove material from bed Check aeration channels for compaction, renew shingle if necessary Remix pile adding fresh material, monitoring recipe changes

Item	FAN VELOCITY
Issue	Poor aeration of pile
Standard	Fan velocity >13 m/s
Action	Check channel has been cleared in the last 6 months Renew shingle Check pipes Check drain for waterlogging

Item	AERATION PAD SHINGLE
Issue	Compaction resulting in poor aeration
Standard	Not compacted The shingle used in the aeration channels is 20/40mm river stones. The diameter of the hole drilled into the 150mm PVC pipe in the aeration bed is 12mm, of which there are 8 holes per metre on the top of the pipe. This will ensure an inlet area of 861mm^2/m. Along the base of the 150mm pipe there is a 12mm drainage hole every metre.
Action	Lift PVC pipes Remove all shingle Clean out channels, drains and PVC pipes Replace with fresh shingle

Item	MIXING BIN
Issue	Odour generation
Standard	Inspection of raw material on arrival. All material adjudged as having unacceptable odour or not meeting specification rejected. Raw material mixed on day of arrival If mixing is prevented due to wind conditions, raw material to be covered with a layer of carbon (such as bark), to act as a biofilter and suppress odour
Action	Assess wind condition and if suitable, mix raw material on day of arrival If wind condition unsuitable, cover raw material with carbon source immediately on arrival

Item	MIXING BIN CATCHMENT
Issue	Catchment is full of liquid
Standard	Mixing pad sump to contain absorbent carbon material (such as sawdust) Sawdust soaks any liquid collected from the mixing bin Once sawdust is saturated, it is emptied from the bin by front end loader and mixed with raw material in the mixing bin
Action	Remove saturated carbon (sawdust etc) from the catchment with front end loader Mix the saturated material into the raw material in mixing bin Record when this has occurred on daily operational check sheet Put fresh carbon material back into mixing bin catchment

Item	CURING PILE
Issue	Not mature enough for screening
Standard	Mature by the end of the turning system
Action	Place pile to one side of the turning system Request a chemical analysis from independent laboratory for ammonia and nitrate nitrogen content If results show pile is not mature: - Place pile back to beginning of turning process on maturation pad - Record on operational check sheet and monitor progress

AUDIT PARAMETERS

Item	OUTSTANDING ISSUES
Issue	Previously noted defects not corrected
Standard	Records should be kept of outstanding issues, noting where possible agreed solutions and timetables. When corrective action is taken, the date is to be recorded.
Action	Where commitments have not been met or issues not adequately recorded, discuss with Site Foreman and ensure appropriate action is taken

Item	DOCUMENTATION
Issue	Incomplete or substandard documentation threatens the validity of quality system and is evidence of declining standards of commitment.
Standard	Documentation should be present and filed correctly Documentation should be current version All required check sheets should be completed correctly Where defects were identified, there should be evidence of appropriate action taken to prevent re-occurrence
Action	Investigate substandard documentation, discuss with Site Foreman

Item	LABORATORY TESTS
Issue	Tests not carried out/ Substandard Results
Standard	All scheduled testing carried out against the New Zealand standard, namely NZS4454:2005 *Compost, Soil Conditioners and Mulches* Where substandard results received, evidence of action by way of investigation, repeat tests, remedial action on mixing, processing etc All reports filed correctly
Action	Investigate substandard aspect, discuss with Site Foreman, Operations Manager and General Manager

Item	OPERATIONAL COMPLIANCE
Issue	If tasks are not being carried out as per instructions, possible threat to product or health & safety
Standard	Mandatory tasks should be carried out as per Instructions Non-mandatory tasks should be carried as per instructions or by alternative means giving equivalent result
Action	Discuss discrepancies between Task Instruction and task being observed with Site Foreman. Ensure action taken to have task performed correctly or amend and sign Task Instruction.

Item	HAZARD SURVEYS, HAZARD ASSESSMENTS
Issue	Injury risk by inadequate controls on hazards
Standard	Hazard surveys are to be carried out on all major hazards on site, with annual reviews to ensure adequate coverage. Hazard surveys include all requirements in the site Health & Safety, Fire and Rodent plans. All significant identified hazards are to have a hazard assessment carried out with approved controls put into practice. Hazard assessments are held by the Site Foreman.
Action	Where hazard surveys and/or hazard assessments are not completed or inadequate, discuss with Site Foreman and Operations Manager to set a timetable for rectifying defects.

APPENDIX 3 Standard Forms

- ASP Compost Control Check Sheet
- Weekly Oxygen levels of Aeration Pads

ASP Compost Control Check Sheet

Compost Ingredients	Material eg bark, paunch grass etc	Cubic metres mixed (Ratio 1:1)	Date mixed	notes
Carbon Source				
Waste Material				

Date placed on aeration pad: _____ **Marker Peg:** _____ **Pad #** _____

Temperature	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Monday						
Tuesday						
Wednesday						
Thursday						
Friday						
Saturday						

Date turned on aeration pad: _____

Date removed from aeration pad: _____

Dates turned:

Screened: From: _____ To: _____

Comments:

Supervisor signature _____ Management signature _____

THE SEAL OF THE ENVIRONMENT COURT OF NEW ZEALAND

Weekly Oxygen Levels of Aeration Pads

Weekending:

Week	Pad 1	Pad 2	Pad 3	Pad 4	Pad 5	Pad 6	Pad 7	Pad 8	Weather
Week 1									
Week 2									
Week 3									
Week 4									
Week 5									
Week 6									

Weekending:

Week	Pad 1	Pad 2	Pad 3	Pad 4	Pad 5	Pad 6	Pad 7	Pad 8	Weather
Week 1									
Week 2									
Week 3									
Week 4									
Week 5									
Week 6									

Supervisor signature _____ Management signature _____

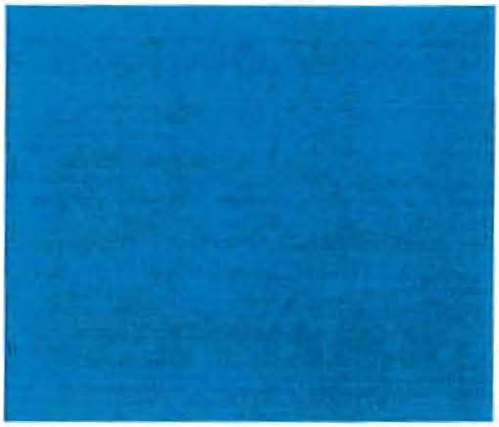
Report

Compost Management Plan

Prepared for Canterbury Landscape Supplies Ltd (Client)

By Beca Limited (Beca)

02 September 2018



Revision History

Revision N°	Prepared By	Description	Date
A	Michele Dyer		

Document Acceptance

Action	Name	Signed	Date
Prepared by	Michele Dyer		
Reviewed by	Prue Harwood		
Approved by	Graeme Jenner		
on behalf of	Beca Limited		

Table of Contents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ENVIRONMENT COURT OF NEW ZEALAND

1 Purpose

1.1 Background

This Compost Management Plan (CMP) has been prepared to manage the discharges to the environment from the activities undertaken at Canterbury Landscape Supplies (CLS), Diversion Road site. The purpose of this CMP is to provide a framework for managing discharges so that potential adverse effects beyond the site boundary are either avoided or minimised to the fullest extent possible. The CMP identifies the following:

- The sources of odour, dust and leachate that may be created on site
- Emission controls and procedures to prevent discharges from each significant source
- Inspection and monitoring programmes
- Describing the necessary record-keeping to verify and document ongoing compliance with the CMP and resource consents
- Establishing the roles and responsibilities of staff throughout the organisation in relation to the CMP

1.2 Objective

The objectives of this CMP are:

- To operate in full compliance with the resource consent requirements and demonstrate this through reporting procedures;
- To provide the methods that may be employed to avoid or mitigate adverse effects on the environment due to the composting activities;
- To liaise with the local community as required.

1.3 Resource consent conditions

A copy of the applicable resource consent conditions are included in **Appendix A**.

2 Site Description

2.1 Site Location

The site is located on Diversion Road in Swannanoa, Waimakariri District as shown on Figure 2-1. The area used by CLS is 9.8 hectares (ha) in area and is located within a 278 ha site. The area used by CLS is flat and is surrounded on the north, east and west by a plantation of pine trees. The land to the south of the site has been returned to pasture since the aerial photograph in Figure 2-1 was taken and is now separated from the CLS site by a row of mature trees along Pashbys Road.

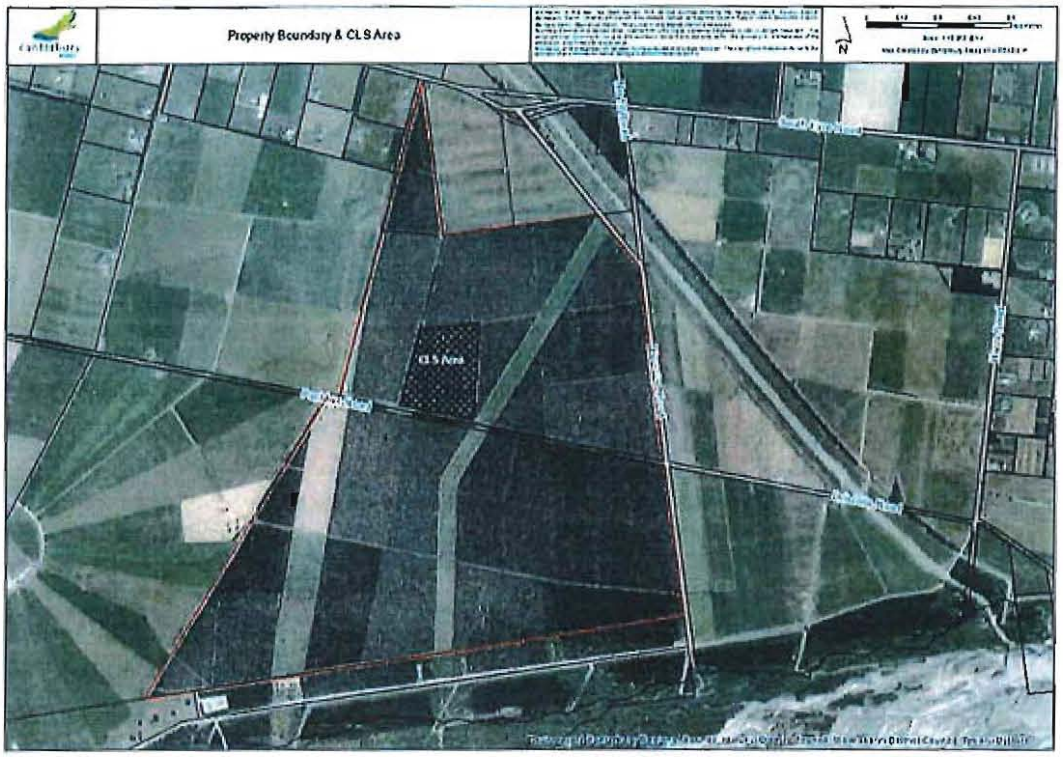


Figure 2-1 Location of CLS site and property boundary (red outline)

2.2 Site Layout

The layout of the activities taking place on site is illustrated in Figure 2-2.

Figure 2-2 Layout of activities on site

2.3 Surrounding Environment

The area which surrounds the property on which CLS operates is rural with the predominant land use being dairy farming. The closest dwelling to the CLS site is 820 m to the northwest with the next closest houses being 1000 m to the west and 1000 m north east of the site. The dwellings are separated from the site by the surrounding plantation and farm land. The locations of the closest dwellings are shown in Figure 2-3. There are no other sensitive locations, such as schools or places of public assembly in the vicinity of the site.

There are Transpower National Grid electricity transmission lines located to the east and west of the site. The line to the west is approximately 280m from the western boundary of the site and runs approximately parallel to it. The line to the east is approximately 45m from the southeastern corner of the site at Pashbys Road and runs in a northeasterly direction towards Diversion Road. In the vicinity of the northeastern corner of the site the transmission line is approximately 250m from the site.

Figure 2-3 Aerial photograph showing the CLS site and neighbouring residences (imagery sourced from Google Earth)

2.4 Meteorology

Weather conditions, particularly wind speed and direction, influence the dispersion of contaminants. The nearest meteorological station to the site, with a long term record of verified results, is at Christchurch Airport, which is located approximately 7.5 km to the south of the property. Wind data taken from the NIWA Clifo database for Christchurch Airport, is likely to be representative of average wind conditions at the site. Figure 2-4 shows a wind rose analysis of the average wind speed and direction measured at the airport for 2008-2011. The windrose shows that winds blow predominantly from the north easterly and south westerly quarters.

Calm conditions (wind speeds of less than 0.5 m/s), occurred for 1.43% of all hours for the four year period and low wind speeds (less than 1.5 m/s) occurred for approximately 16% of time. Peak odour levels downwind of the site are expected to occur during low wind speed conditions when the dispersion of the emission plume is restricted.

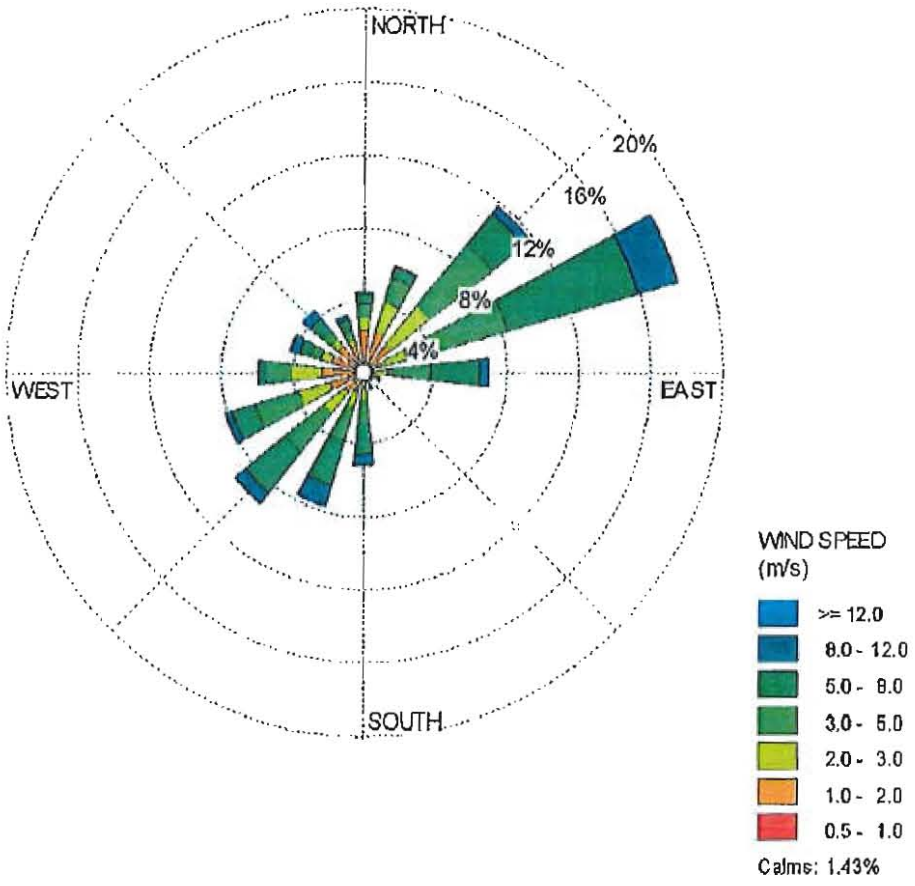


Figure 2-4 Wind Rose analysis of wind speed and direction for Christchurch Airport (1 January 2008 – 31 December 2011) (1-hour averages). Data sourced from NIWA Cliflo database

3 Process Description

The composting process procedures are based upon *Introduction to Composting Science and Management for Industry Training An overview of the scientific principles of the composting process* (CompostNZ 2007) and Appendix K of NZS 4454:2005 *Composts, Soil Conditioners and Mulches.* The design of the proposed ASP system has been peer reviewed and approved by Transform Compost Systems, a global specialist in the design of composting operations. The procedures are best practice guidelines for commercial composting in New Zealand.

The best practice guidelines in NZS4454:2005 are aimed firstly at the compost facility operator, by outlining the requirement to consider factors such as ingredients, type of compost processing, care with mixing, dimensions of the composting mass, composting duration, moisture content, temperature and oxygenation throughout the composting process. Secondly, these guidelines are designed to assist others in monitoring and assessing composting operations.

Odours and leachate generation can be minimised by correct compost processing as described in these best practice guidelines.

3.1 Best Practices for Aerated Static Piles (ASP) Composting of Organic Waste Materials

3.1.1 Ingredients

The materials that are to be used in the compost are as follows:

- Sawdust and bark
- Dewatered paunch grass
- Solids from meat and milk processing wastewater treatment
- Scoured wool fragments
- Egg shell
- Compostable packaging with some residual food waste
- Grease trap waste
- Bio solids that meet Grade A or B of the *Guidelines for the Safe Application of Biosolids to Land in New Zealand 2003* or any replacement
- Paper from glb-board offcuts
- Green waste
- Leaf litter.

Details of all types of feedstock used for composting shall be recorded to ensure traceability from delivery through to release of end-product.

All feedstock is to be blended with carbon sources (sawdust, bark fines) as soon as practicable after it arrives on site. Stockpiling of feedstock is to be avoided.

3.1.2 Nutrients

Carbon and nitrogen are the primary elements that organisms need for food. Bacteria and fungi get their energy from carbon found in carbohydrates, such as the cellulose in bark and sawdust. Nitrogen, a component of protein, is necessary for the population growth of the micro-organisms active in the composting process.

The availability of nutrients in the organic material is a limiting factor in the composting process. Accelerated decomposition requires a proper balance of these macronutrients. If the carbon to nitrogen ratio is too far out of balance, the microbial system will suffer.

The optimum carbon-nitrogen ratio for active aerobic composting is between 25-35:1.

Mixing the organic waste material with sawdust or bark fines in a ratio of about 1 part organic waste material to 1 part sawdust or bark fines will create the C:N in the optimum range.

The more the carbon-nitrogen ratio deviates from this range, the slower the decomposition process becomes. With a ratio of greater than 35:1, nitrogen represents a limiting factor and the reaction rate slows. With a carbon-nitrogen ratio lower than 15:1, rapid microbiological activity results, with possible oxygen deficiency and excess nitrogen is driven off as ammonia. While this loss of nitrogen is not detrimental to the process of decomposition, it lowers the nutrient value of the end product and can contribute to odours generating from the compost site. As stated in NZS4454:2005 K3: *"Higher nutrient contents (C:N ratios of 25:1-35:1) than with turned pile composting are possible because aeration lessens the chance of oxygen deficiency";*

The C:N ratio of the finished product should be approximately 20:1.

3.1.3 Receipt of raw materials

Raw materials are delivered to the site daily, during normal hours of operation. No delivery of raw materials is permitted outside of normal hours of operation, including Sundays or Public Holidays. Any raw material received on site must be received within 48 hours from being processed at its point of origin. Material is collected by CLS on a daily basis, and any suppliers who deliver raw material, are instructed of this requirement to minimise odour from the raw material.

All raw materials are inspected on arrival to confirm the suitability for receipt. The product is inspected for any contamination of other materials than specified, and that the physical condition of the product meets the required specification (i.e. that material is de-watered or blended with an absorbent material to provide suitable moisture content). Once the material has passed the visual inspection by a CLS operator, it is tipped into the receiving bin while a CLS staff member observes. If any contamination is observed in the material while tipping, the driver is notified that the load is unacceptable and the CLS operator will load the material back onto the truck using a front end loader and it is taken off site. A photograph of the contamination is taken and forwarded to CLS management to pass on to the supplier of the material. CLS then contacts the supplier of the contaminated material to explain why the material was unacceptable, and requests that the supplier investigates the reason for the contamination, and report back to CLS about how they can ensure that future material will meet the required specification and the risk for contamination has been resolved. The material from the supplier is not received back on to the CLS site until CLS have been assured that the risk of contamination has been removed.

3.1.4 Initial mixing.

Thorough mixing is important, and turning the material once during the ASP process helps to distribute material evenly throughout the pile. Good mixing of ingredients minimises variations in the composting mass and results in consistent processing.

3.1.5 Pile formation

Piles are formed on the concrete aeration pad, and remain on the pad for the 6 week decomposition phase of the compost process.

The concrete aeration pad construction is explained in the document *Design and Description of Aerated Static Pile (ASP) Compost process.*

Piles should initially be placed up to 3 metres high with a bottom width of 5 metres. Piles are to be placed on one of the 8 aeration beds, with every second aeration bed containing freshly mixed material, to allow sufficient room for a front end loader to turn the pile onto the adjoining aeration bed after the initial 3 weeks of composting. Volume reduction of up to 25% will occur during the composting process due to a number of factors including: product integration when mixing, loss of moisture during the aeration process and loss of carbon through microbial activity.

Piles of material aged from 6 to 14 weeks are to be formed on the impermeable maturation pad consisting of an impermeable high density plastic (HDPE) liner with a layer of compacted aggregate 300 mm deep that is a total area of 2'400 square metres and can store more than double the volume contained at any time on the concrete ASP pad.

Piles of mature compost that are more than 14 weeks old can be located on the ground surface.

3.1.6 Pile turning.

The parameters for moisture, temperature and oxygen are all monitored on the ASP system. As referred to in the document *Design and Description of Aerated Static Pile (ASP) Compost process*, turning the windrows while undergoing aeration is not a requirement in NZS4454:2005; though it is practiced by successful operators both in New Zealand and worldwide (as recommended by Transform Compost Systems, Canada, and Timaru District Council owned Redruth Facility). The material will be turned once after 3 weeks of the initial aeration process, and then at monthly intervals during the maturation process until at least 14 weeks.

The turning of the piles on the aeration beds is completed using a front end loader. With the ASP system, only material on one aeration bed needs to be turned each week. Turning one row will take a maximum of 2.5 hours using a wheel loader, turning the material from one aeration bed to the next. Removal of material from the ASP system to the maturation pad will also occur weekly, once the material has completed its decomposition phase. This process will also only take a maximum of 2.5 hours, and as the material has been adequately aerated during the ASP process; odour will be negligible.

To avoid or further minimise any risk to sensitive receptors, turning of windrows should take place during favourable weather conditions, whenever possible. However if unfavourable weather conditions persist for more than a week turning can proceed but must be undertaken at a time that is least likely to cause adverse effects on the neighbouring properties.

The preferred weather conditions for turning windrows are as follows:

Winds greater than 1.7 m/s and blowing away from the closest houses, i.e. when winds are blowing from the east, north, northeast and northwest.

If unfavourable weather conditions persist for more than a week, then turning can take place between the hours of 1000 and 1600 Monday to Friday and not be undertaken on Saturday.

3.1.7 Moisture content.

For ASP systems a moisture content of 55-60% is ideal, due to the aeration process having a higher drying effect on the material than other compost systems.

Water is added as needed during turning to maintain about 55-60% moisture content throughout the composting process.

Moisture content that is too low can minimise evaporative cooling so that the pile overheats, unless it is so dry that microbiological activity is inhibited (e.g. 30 – 35 % at starting).

Monitor moisture at the beginning of the aeration process and when a pile/windrow is being turned

Moisture monitoring using the squeeze test or the oven test:

Squeeze test

(i) Grab a compost sample from at least 30 cm into the pile

(ii) Squeeze a handful of the composting material into a closed fist.

(iii) If any moisture is squeezed from the material it is too wet – turn the pile.

(iv) When the hand is opened, if the material retains the squeezed shape, the moisture content is right, at about 60 – 65%.

(v) If the material falls apart it is too dry – turn the pile, adding water when turning.

(vi) Record the moisture status: (i) too wet (ii) OK (iii) too dry

Oven Test

(i) Take a sample of the compost

(ii) Weigh the compost sample and record weight

(iii) Place the sample in an oven to dry, at 105^{0}C for 24 hours.

(iv) Remove moisture in oven by drying the sample until the weight remains constant.

(v) Weigh the dried compost sample after it is removed from the oven.

(v1) The moisture content percentage is calculated from the sample weight before and after drying

3.1.8 Temperature

The temperature should reach a minimum of 55 °C for at least 15 days, then gradually stabilise around 40 – 50°C

High temperature achievement is a function of pile dimensions, oxygenation, moisture content and available nutrients.

Temperature gradients exist within piles. Cooler temperatures occur both in the outer zones and the inner, anaerobic zones (when present) in non-aerated piles. In an aerated system, where the material is maintained in an aerobic state, there is less chance of cooler or anaerobic zones. NZS4454:2005 states *"Odours are minimised because large areas within the composting mass are processed at optimal temperatures. Also, NH3 losses are minimised"*. To minimise this further, the material is turned once during the aeration process and the pile is covered with 100mm of finished compost as a thermal blanket. The layer of finished compost is used to insulate the piles and further minimise the potential for odour. This thermal blanket ensures that pasteurising temperatures are achieved throughout the whole pile, including the outer zones; and assists with any potential odour suppression, protects the surface from drying, discourages flies, filters ammonia, and contains all microbial activity within the pile, minimising any potential for discharge for any airborne microbial activity. NZS4454:2005 K3 (g) mentions "*Insulation with mesh cloth or finished compost can*

overcome this problem (pasteurisation temperatures to the outer zones), and with this approach the static pile may replicate conditions of an enclosed system."

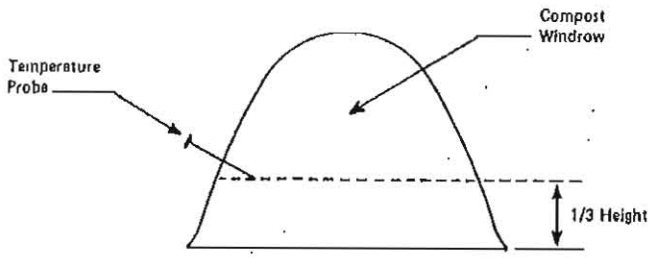
A temperature profile is recorded to ensure that optimal processing is occurring.

Temperature is measured in each pile/windrow with the use of 2 temperature probes per windrow. Temperature information is constantly recorded and data logged for electronic recording.

Temperature sensors are linked to a temperature feedback system which controls the aeration fans.

Temperature information including: pile number, time and date, and operator are also recorded on the batch sheet.

TEMPERATURE MEASUREMENT TECHNIQUE



If the temperature in the pile is less than 40°C, or more than 75°C, the pile must undergo increased aeration.

3.1.9 Aeration and Oxygenation

Aeration is primarily managed through the aeration fans supplying air to the base of the piles. Oxygen depletion can result from: high microbiological activity (because of high nutrient levels), compactness of mass (related to size of particles), the ratio of air-to-water-filled spaces (depending on moisture content), bulking agent size and length of diffusion pathway (related to dimensions of pile). Oxygen concentrations of at least 15% (and never less than 5%) should be maintained throughout the pile. At oxygen levels below 5% anaerobic decomposition commences, producing unpleasant odours.

Conditions leading to anaerobic decomposition are:

- **Piles that do not reach target temperatures;**
- **Piles that are not aerated;**
- **Piles that are too wet.**

Measure and record oxygen concentration weekly with handheld oxygen probe and record on batch sheet.

3.1.10 Curing

When the material appears to have ceased active composting, it can be moved to a maturation pile. The maturation piles should not exceed 4.5 metres high, as the risk of spontaneous combustion increases with large piles. The compost should remain in a maturation pile for a minimum of 8 weeks. This will allow final stabilisation and the maturation period will allow organisms that are compatible with soil environments to re-inoculate the compost.

As composting progresses, the material will begin to resemble humus and soil. The material is moving towards a stable product. The carbon-nitrogen ratio is approaching 20:1 and the volatile nitrogen is being captured in organic compounds.

At 14 weeks begin to monitor the level of stabilisation of the compost. Two simple procedures can be used for this purpose. The first test involves turning the pile and monitoring the internal temperature. If the pile reheats, the product is not yet stable enough for curing. In the second test, a sample of the compost can be placed in a plastic bag and sealed for 24 to 48 hours. If significant odour is given off as the bag is opened, the product is not yet stable.

3.1.11 Screening

The particle size to be screened is determined by the type of end-product to be produced.

3.2 Water Supply

Water for use in the composting operation will be sourced from a well on the property or recycled from rainfall capture on the ASP and maturation pads.

4 Emission Sources and Mitigation

4.1 Overview

The main discharges into air arising from the operation are odour and particulate matter (dust) to air and leachate to land. This section provides a description of the main odour and dust emission sources and associated controls and procedures, along with a description of the methods to be used to minimise the discharges to land.

The controls and procedures will need to be reviewed when there is a new or changed activity, changes to equipment or procedures, or if there is a change to legislative or consent requirements.

4.2 Discharges to Air and Mitigation Methods

The key sources of discharges to air at the site and associated emission controls and procedures are provided in Table 4-1.

Table 4-1 Odour sources and associated management controls and procedures at the site

Source	Contaminant	Control/procedure
All compost windrows	▪ Odour and dust	▪ Maintain aerobic conditions within the windrows by following the procedures in section 3 ▪ Use sprinklers to keep the surface of windrows damp when required
Raw materials	▪ Odour and dust	▪ Organic raw materials accepted on site shall be mixed in composting rows or covered with sawdust, mature compost and/or bark fines on the day of receipt. ▪ The raw material is inspected upon receipt to ensure the material is suitable in terms of age, contamination and moisture content. If the material is not deemed suitable it is loaded back onto the truck and removed from site. ▪ If the weather conditions are deemed unsuitable for processing then the material shall be covered by sawdust, mature compost and/or bark fines. The material shall then be processed as soon as possible when the weather conditions are suitable. ▪ Use sprinklers to keep the surface of raw material stockpiles damp when required
Compost windrow in an anaerobic state (i.e. due to upset conditions)	▪ Odour	▪ Avoid turning under calm conditions or when the wind is blowing from W, SW, S, SE directions ▪ Aerate windrow by increasing aeration from the fans to bring back to aerobic conditions ▪ Avoid turning before 1000 hours and after 1600 hours Monday to Friday and all day Saturday when neighbouring residents are most likely to be at home
Leachate and ponded water	▪ Odour	▪ Prevent the discharge of leachate to land by locating windrows on a concrete ASP pad or impermeable maturation pad as described in section 3. Leachate collected from these surfaces will be collected and discharged into ponds. The ponds will have a connecting pump to circulate the liquid back over the compost piles to maintain pile moisture. The ponds will be monitored regularly for odour. Measures to avoid odour, including removal and disposal of the liquid by commercial sucker truck, or installing an aeration system to the tanks will be implemented where required. The ponds will be regularly

		Inspected and desludged as necessary. ▪ Remove excess ponded water on site using the trash pump and store it in the onsite storage tank and reuse on the windrows when weather conditions permit.
Screening of bark and shredding of wood and gypsum	▪ Dust	▪ Use water sprays on the screens and shredders when required. ▪ Do not shred gypsum when wind speeds measured on site exceed 5 m/s and the wind is blowing towards the closest neighbours i.e. from the west, southwest, south and southeast.
Vehicle movements on access ways and yard areas	▪ Dust	▪ Maintain the main access ways around the site in good condition ▪ Use water sprays on access ways and yard areas when necessary to suppress dust ▪ Limit vehicle speeds on site to no more than 20 km/hr

4.3 Discharges to Land and Mitigation Methods

To prevent discharges to land and water on the site the following mitigation methods shall be used.

Table 4-2 Discharges to Land and Water and Associated Mitigation Methods

Source	Contaminant	Mitigation Methods
Compost windrows	Leachate	▪ Prevent the discharge of leachate to land by locating windrows on a concrete ASP pad or impermeable maturation pad as described in section 3, where any leachate will be captured in water catchment pond.
Ponded water	Leachate	▪ Remove excess ponded water on site using the trash pump and store it in the onsite storage tank and reuse on the windrows when weather conditions permit. ▪ Maintain the surface of the site to facilitate drainage and prevent ponding
Vehicles	Oil and fuel leaks	▪ Maintain all vehicles and machinery on site to prevent oil and fuel leaks

4.4 Contingency Methods

In the event that odour, dust or leachate cannot be adequately controlled within the site and additional measures are required in order for CLS to comply with the provisions of the resource consent, contingency procedures will be implemented.

These procedures may include but are not limited to the following:

- The use of additional water carts and irrigation systems to dampen dusty surfaces;
- The removal of excessively odorous raw materials or compost from the site
- The removal of excess leachate from the site
- Stopping all work on areas of the site that are sources of excessive dust or odour other than dust and odour control activities.

5 Monitoring

Monitoring that is undertaken onsite is broadly divided into process monitoring and environmental monitoring and are shown in Table 5-1 and Table 5-2 respectively.

Table 5-1 Process monitoring

Monitoring activity	Frequency
Temperature monitoring of active and maturing compost piles	Continuously through the active phase with electronic recording, and monthly with handheld probe for maturation piles
Oxygen monitoring of active and maturation compost piles	Weekly in active stage, and monthly in maturation
Moisture monitoring	After initial mixing and after 3 weeks, when the ASP pile is being turned

Table 5-2 Environmental Monitoring

Monitoring activity	Frequency
Meteorological monitoring	▪ Constant monitoring undertaken by onsite meteorological station ▪ Daily and reactive monitoring undertaken using meteorological applications installed onto the operators phones and the onsite wind sock so that current and future meteorological conditions can be checked and current and forward workload can be planned around predicted wind conditions
Odour monitoring	▪ Reactive odour monitoring in response to odour complaints

6 Responsibilities

CLS has the ultimate responsibility to ensure that all statutory requirements and conditions of consent are complied with and composting activities are carried out in accordance with the CMP.

The Site Supervisor will have day-to-day responsibility for the implementation of the CMP and will have the following attributes and experience:

- Be experienced in the management of composting facilities;
- Be experienced in the control of odour, dust and leachate from composting facilities;
- Have a thorough knowledge and understanding of the requirements to manage the composting facility in a manner that minimises any adverse effects on the environment and the nearby residents;
- Have a thorough knowledge and understanding of the requirements to comply with the conditions of resource consents and the implications of non-compliance; and
- Be experienced in the training of personnel in the methods used to control the discharges to air and land from a composting facility.

The Site Supervisor will have the following associated responsibilities:

- To ensure that all contractors and staff are properly trained and understand the requirements of the CMP;
- To ensure that the emission control and mitigation measures and procedures outlined in the CMP are implemented effectively;
- To ensure that resource consent conditions are complied with at all times;
- To ensure that the environmental monitoring programme is carried out as required;
- To ensure that complaints are received and investigated as outlined in the CMP;
- To ensure that discharges to air of offensive or objectionable odour are avoided or mitigated as far as is practicable;
- To ensure there are adequate personnel and equipment on site at all times to enable the emission control and mitigation measures outlined in the CMP to be implemented effectively;
- To ensure that in the Site Supervisor's absence an appropriately qualified deputy is available; and
- To ensure the CMP is current and reviewed at least annually.

All contractors and staff working on site will be required to ensure that their activities comply with the requirements of the CMP.

7 Training and Induction

It is the responsibility of the Site Supervisor to implement an on-going training and induction programme for all contractors and staff. The purpose of this programme is to make all personnel working on site aware of and understand the purpose and requirements of the CMP, the resource consent conditions and the ramifications of a failure to comply with these requirements.

The training programme for all contractors and staff will include at least the following aspects:

- The responsibilities of all staff and contractors for carrying out the work on site in a manner which does not result in adverse effects on the environment and local residents and in accordance with resource consent conditions;
- The potential legal ramifications of adverse environmental effects occurring as a result of the project and non-compliance with resource consent conditions;
- The minimum requirements for control of discharges to air and land for all activities on site;
- The requirements for staff to monitor weather and inspect the site for odour, dust and leachate discharges, assess the adequacy of control methods and implement additional control methods when required;
- The actions to be taken in the event of extreme weather events, malfunctions or breakdowns of equipment; and
- The actions to be taken if a complaint is received from the public or consent authority.

8 Complaints

8.1 Overview

Complaints may be referred by one or more of the regulatory authorities, a member of the public or a member of the CLS team. It is the responsibility of the Site Supervisor to respond to and follow up all complaints regarding discharges from the site. The Site Supervisor is responsible for ensuring suitably qualified personnel are available to respond to complaints at all times.

A Complaints Register will be maintained and made available to the consent authority on request.

8.2 Actions to be taken as soon as possible after a complaint

Immediately following receipt of a complaint, the Site Supervisor will:

- Fill out a complaint form;
- Note the following;
  - time, date, identity and contact details of complainant (if provided)
  - wind direction and strength and weather conditions
  - If complaint has been referred from Environment Canterbury;
- Ask the complainant to describe the odour or dust emission; whether it is constant or intermittent, how long it has been going on for, is it worse at any time of day, does it come from an identifiable source;
- As soon as possible after receipt of a complaint undertake a site inspection. Note all odour and dust producing activities taking place, who is responsible for the site and the odour and dust mitigation methods that are being used. Order any remedial action necessary. If the complaint was related to an event in the recent past, note any site activities that were underway at that time, if possible;
- As soon as practical (preferably within two hours), visit the area from where the complaint originated to ascertain if odour and/or dust is still a problem;
- If it becomes apparent that there may be a source of odour or dust other than activities at CLS causing the nuisance, it is important to verify this. Photograph and document the source and emissions if possible;
- As soon as possible after the initial investigations have been completed contact the complainant to explain any problems found and remedial actions taken;
- If necessary update any relevant procedures to prevent any recurrence of problems; and
- Complete complaint form and file on Complaints Register.

Follow up actions

- Advise Environment Canterbury as soon as practicable that a complaint has been received and what the findings of the investigation were and any remedial actions taken; and
- Advise staff and contractors that a complaint has been received and what the findings of the investigation were and the remedial actions taken.

9 Consultation

9.1 Community Liaison Group

CLS will facilitate the formation of a Community Liaison Group. The objective of the group is to facilitate the information flow between CLS and the community and to be an ongoing point of contact between CLS and the community.

The functions of the group may also include acting as a forum for relaying any community concerns about the operation of the composting facility and reviewing the implementation of measures to resolve and manage any community concerns regarding the effects of the facility. In particular CLS will provide and opportunity for the group to receive and discuss the results of all monitoring and reports required by the conditions of the consents.

CLS shall be responsible for the keeping and distribution of the group's minutes to all participants of the group.

As a minimum the following shall be invited to participate in this group:

1. Two representatives of landowners within 1.5 km of the site and who are also submitters to the consent application; and
2. A representative of the Eyre District Environmental Association Incorporated;
3. A representative of Environment Canterbury in an observer capacity.

CLS will convene the meetings of the group and shall offer the opportunity for meeting at least twice annually.

9.2 Community

CLS will consult with the local community in the event that there are any significant issues regarding the environmental effects of the composting operation.

The contact phone numbers and email addresses to be used for registering a complaint are included in **Appendix B**.

The contact phone number of the Site Supervisor shall be displayed on a sign located at the entrance to the site off Diversion Road, notified to submitters to the consent and to members of the Community Liaison Group.

9.3 Environment Canterbury

CLS will provide Environment Canterbury with contact numbers to be used to advise CLS of a complaint from a third party. The contact phone numbers and email addresses to be used for registering a complaint are included in **Appendix B**.

10 Reporting

CLS to contractors/staff

CLS will report the following to contractors and/or staff involved in composting operations:

- Advice of any complaints received and the remedial actions taken.

CLS to Environment Canterbury

CLS will provide:

- Advice of any complaints received as soon as practicable after receipt of the complaint.
- A copy of the CMP within one month of the commencement of consent and if any significant revisions of the CMP are made during the year.
- Copies of the results of all monitoring required by the resource consents if requested

Environment Canterbury to CLS

CLS has requested that Environment Canterbury advise CLS of any complaints they receive regarding the CLS site as soon as practicable after a complaint has been lodged.

11 CMP Review Procedure

The CMP shall be reviewed at least annually or following a significant change to the composting operation and will be provided to Environment Canterbury within 1 month of the completion of the review process

Appendix A – Resource Consents

Appendix B = Site Personnel Contact Phone Numbers

Sephira ENVIRONMENTAL

1 October 2018

101a Mays Road, St Albans, Christchurch 8052
phone: 03 967 9523 mobile: 022 354 0902
email: helen@sephira.nz
www.sephiraenvironmental.co.nz

Canterbury Landscape Supplies Ltd
PO Box 275
Kaiapoi 7644
Attention: Phil Wylie

CLS-A0272-012L-v2

Dear Phil

Re: Stormwater Assessment, Canterbury Landscape Supplies - Diversion Road, Swannanoa

To assist Canterbury Landscape Supplies (CLS) in responding to comments from Environment Canterbury on the most recent proposals for managing compost operations at the Diversion Road site, you have requested Sephira Environmental Limited (Sephira) to do the following:

- Calculate rainfall/run off for relevant storm events for both the 1,000 m^2 concrete-lined aerated static pile (ASP) pad, and the 2,400 m^2 maturation pad (aggregate pad with an HDPE liner beneath). The storm events used will be the same as for the April 2018 assessment by Sephira Environmental (10-year, 20-year and 50-year, 24-hour storms).
- Assess the required volume of catchment ponds for both the ASP and maturation pads to mitigate discharge for the selected range of storm events. Assume 20% excess sump capacity.
- Provide an updated site plan and detailed drawings (similar to those supplied in the April 2018 report) showing the placement of the Receiving/Mixing Bin, ASP pad, maturation pad and their respective catchment ponds/areas, with associated bunding.

Stormwater runoff volumes have been estimated for the 1,000 m^2 ASP pad (Table 1) and the 2,400 m^2 maturation pad (Table 2) using the Auckland Regional Council guidelines for stormwater management (TP108 1999). Supporting calculations are attached. Based on design information provided by CLS, the runoff will be directed to lined retention sumps with the capacity to hold the anticipated runoff from a minimum of a 50-year storm event, plus 20% freeboard. The preliminary retention sump concept design by Beca can hold 386.4 m^3, and would therefore be adequate to hold the expected runoff from a 50-year design storm, plus 20% freeboard (258 m^3). The approximate size and configuration of the pads and their retention sumps are provided on Figures 1 and 2.

Kind regards,

Helen Mongillo
Principal Environmental Engineer and Hydrogeologist
Sephira Environmental Limited

THE SEAL OF THE ENVIRONMENT COURT OF NEW ZEALAND

Attachments:

1. Tables 1 and 2
2. Report limitations
3. Figures 1 and 2
4. Calculation sheets for stormwater assessment
5. HIRDS estimate from NIWA online calculator
6. Beca concept design for maturation pad (June 2018)

Table 1. Stormwater Management Estimate - ASP Pad (25 x 40 m, 1,000 m²)

Storm Event	Size of Pad (m²)	Depth of rainfall[1], (mm)	Runoff after rainfall losses[2], (mm)	Volume of stormwater after rainfall losses[2], (m³)	Volume to contain design storm plus 20% excess capacity, (m³)	Recommended depth of 300 m² flat collection area adjacent to aeration pad, assuming 20% excess capacity (m)
10-year, 24-hr	1,000	95.5	48.7	48.7	58.4	0.19
20-year, 24-hr	1,000	113.9	64.4	64.4	77.3	0.26
50-year, 24 -hr	1,000	142.2	89.4	89.4	107	0.36

Notes:
[1] NIWA HIRDS calculator, accounts for 2 degrees of climate change
[2] Runoff (mm) calculated assuming an Initial Abstraction Depth (AI) of 5 mm and Curve Number (CN) of 81 (Group B Soil, Alluvial – Crops, straight rows, minimal vegetative cover), Auckland Regional Council Guidelines for stormwater runoff modelling in the Auckland Region, TP 108, April 1999.
[3] Assumes pad with is 40 m long and 25 m wide. The slope of the pad does not affect the volume calculation.

Table 2. Stormwater Management Estimate - Maturation Pad (40 x 60 m, 2,400 m²)

Storm Event	Size of Pad (m²)	Depth of rainfall[1], (mm)	Runoff after rainfall losses[2], (mm)	Volume of stormwater after rainfall losses[2], (m³)	Volume to contain design storm plus 20% excess capacity' (m³)
10-year, 24-hr	2,400	95.5	48.7	116.9	140
20-year, 24-hr	2,400	113.9	64.4	154.6	186
50-year, 24-hr	2,400	142.2	89.4	214.6	258

Notes:
[1] NIWA HIRDS calculator, accounts for 2 degrees of climate change
[2] Runoff (mm) calculated assuming an Initial Abstraction Depth (AI) of 5 mm and Curve Number (CN) of 81 (Group B Soil, Alluvial – Crops, straight rows, minimal vegetative cover), Auckland Regional Council Guidelines for stormwater runoff modelling in the Auckland Region, TP 108, April 1999.
[3] Assumes pad with is 60 m long and 40 m wide. The slope of the pad does not affect the volume calculation.

Report Limitations

1. The document was prepared based on a site-specific scope agreed between the client and Sephira Environmental Limited which has a specific purpose and it is not intended to be used for any other purpose. These purposes were outlined in the proposal to the client.
2. The methods used are those described in the report and methods not specified cannot be assumed to have been undertaken.
3. The results are based on published information and data from the site and we provide no warrantee that the conditions will be exactly as represented in the report. Due to the variability of site conditions the document cannot be held to represent a complete understanding of the conditions of a site and we assume no responsibility for unexpected conditions which may be discovered.
4. The document only describes the site conditions at the time the report was prepared. Changes to the site or near the site due to the effects of time or changes in legislation may occur which render the report conclusions as inapplicable.
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6. We accept no responsibility for the information provided to us for use in the document. It is assumed to be accurate as received regardless of the source. We have made no independent verification of the data received, beyond the agreed scope of the work.
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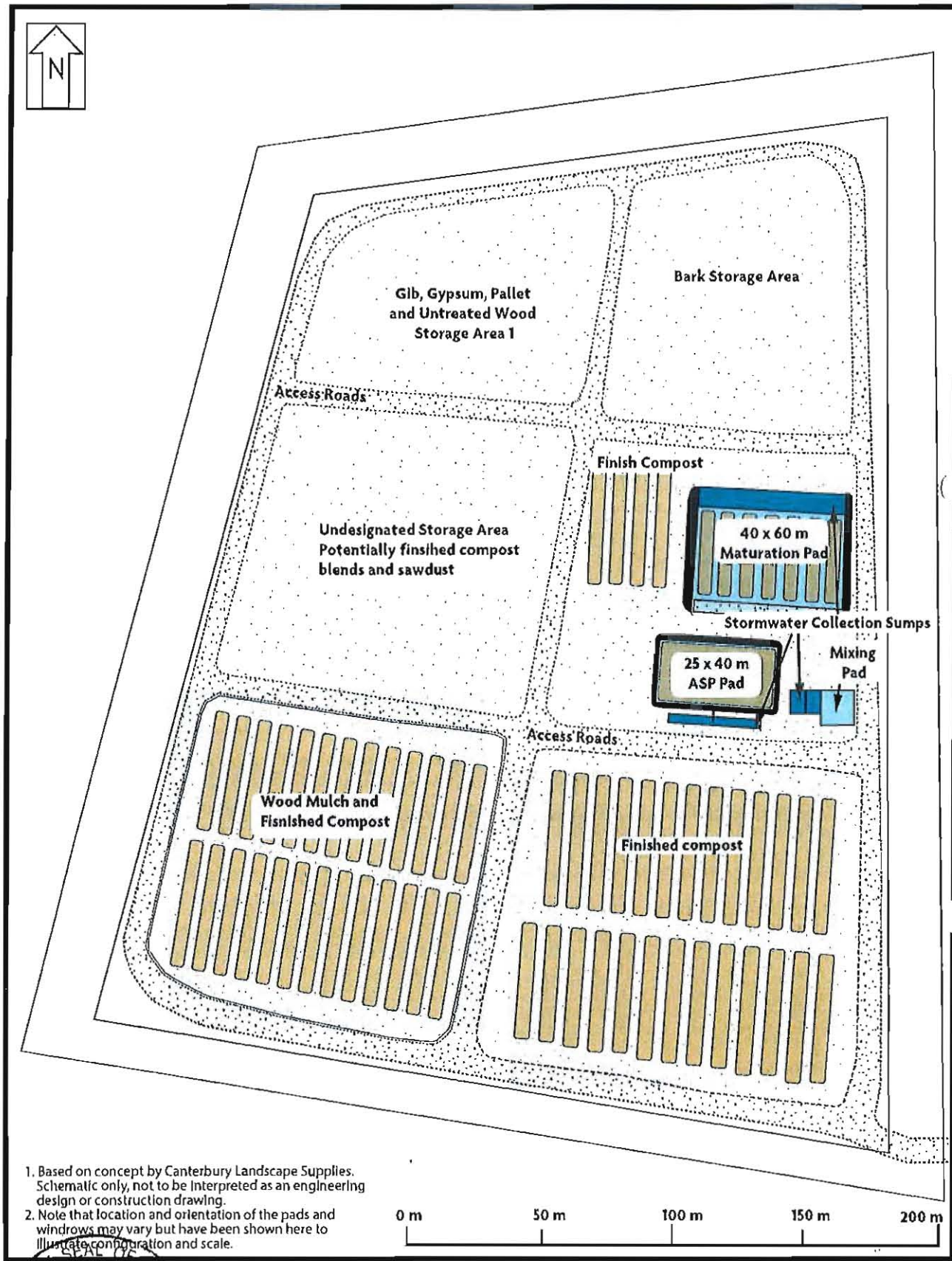
9. This report does not include legal advice which should be gained from professional practitioners.



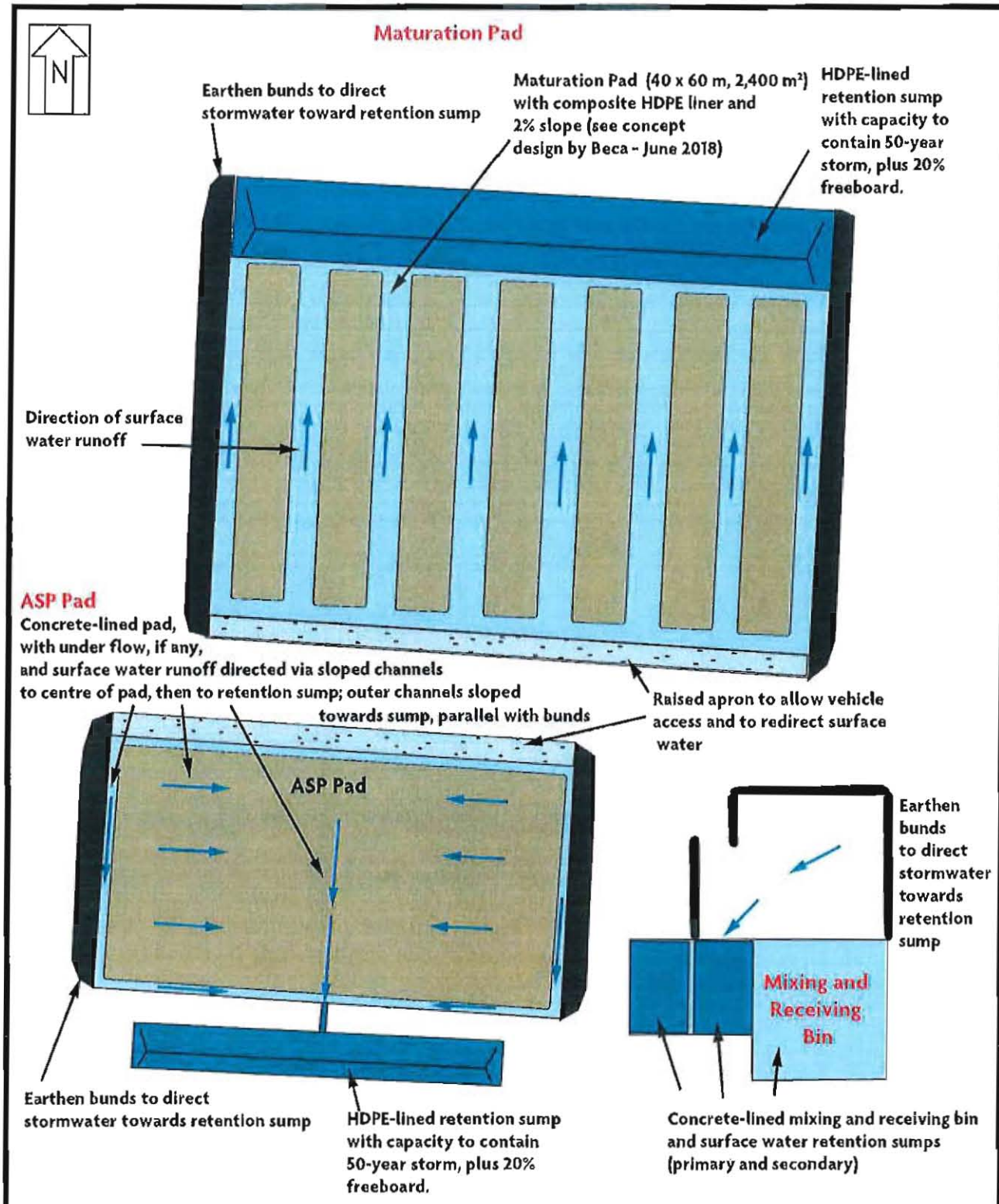
1. Based on concept by Canterbury Landscape Supplies. Schematic only, not to be interpreted as an engineering design or construction drawing.
2. Note that location and orientation of the pads and windrows may vary but have been shown here to illustrate configuration and scale.

Subdivision Road Compost Facility

Composting Layout

Sephira ENVIRONMENTAL

Figure 1



CLS Diversion Road Compost Facility

Stormwater Management

Sephira ENVIRONMENTAL

Figure 2

Client/Project: Canterbury Landscape Supplies (CLS) Diversion Rd		Sephira ENVIRONMENTAL	Page 1 of 2
Project No.: A0272	Calculation Sheet		
Date of Calculation: 26/3/18	Calculations by: Helen Mongillo	Date of Review:	Reviewed by:

Rainfall Runoff Calculation

Based on Auckland Regional Council Technical Pub No. 108, April 1999 Guidelines for Stormwater Runoff modelling

Assumptions:

Location: Diversion Rd, Swannanoa, Compost Windrows

Soil Classification: Group B - Alluvial Soils (Table 3.2)

Curve Number (CN): 81, based on "Crops, straight rows, minimal vegetative cover." (Table 3.3)

$$Q = \frac{(P - I_a)^2}{(P - I_a) + S}$$ Equation 3.1

where

Q = runoff depth (mm)

P = rainfall depth (mm)

S = potential maximum retention after runoff begins (mm)

I_a = initial abstraction (mm)

Equation 3.2

$$S = \left(\frac{1000}{CN} - 10\right) 25.4 \text{ (mm)}$$

$$S = \left(\frac{1000}{81} - 10\right) 25.4$$

$$S = (12.35 - 10)\, 25.4$$

$$S = 59.6 \text{ mm}$$

$$I_a = 0.2 S$$

$$I_a = 0.2 \times 59.6$$

$$I_a = 11.92$$

P varies w/ Storm event. Based on HIRDS estimate (NIWA online Calculator) (see Attached)

24hr Storm	P (mm)
10 yr	95.5 m
20 yr	113.9 m
50 yr	142.2 m

See Next Page for Runoff Estimates

Client/Project: CLS Diversion R&D		Sephira ENVIRONMENTAL	Page 2 of 2
Project No.: A0772	Calculation Sheet		
Date of Calculation: 26/3/18	Calculations by: Helen Mongillo	Date of Review:	Reviewed by:

Rainfall Runoff Calculation

$Q_{10\text{-yr}}$, 24 hr storm

$$Q_{10} = \frac{(95.5 - 11.92)^2}{(95.5 - 11.92) + 59.6}$$

$$= \frac{6,985.6}{83.6 + 59.6}$$

$$= \frac{6,985.6}{143.18}$$

$$= 48.7 \text{ mm}$$

$Q_{20\text{-yr}}$, 24 hr storm

$$Q_{20} = \frac{(113.9 - 11.92)^2}{(113.9 - 11.92) + 59.6}$$

$$= \frac{10,400}{102 + 59.6}$$

$$= \frac{10,400}{161.6}$$

$$= 64.4 \text{ mm}$$

$Q_{50\text{-yr}}$, 24 hr storm

$$Q_{50} = \frac{(142.2 - 11.92)^2}{(142.2 - 11.92) + 59.6}$$

$$= \frac{16,973}{130.28 + 59.6}$$

$$= \frac{16,973}{189.9}$$

$$= 89.4 \text{ mm}$$

High Intensity Rainfall System V3

Results for Canterbury Landscape Supplies

Depth-Duration-Frequency results (produced on Friday 26th of January 2018)
Sitename: Canterbury Landscape Supplies
Coordinate system: NZMG
Easting: 2471187
Northing: 5753564

Rainfall depths (mm)

		Duration									
ARI (y)	aep	10m	20m	30m	60m	2h	6h	12h	24h	48h	72h
1.58	0.633	3.9	5.7	7.2	10.5	14.9	25.7	36.3	51.3	62.5	70.2
2.00	0.500	4.3	6.3	7.9	11.7	16.4	28.2	39.6	55.7	67.9	76.2
5.00	0.200	6.0	8.8	11.0	16.2	22.4	37.6	51.8	71.7	87.4	98.2
10.00	0.100	7.4	10.9	13.6	20.1	27.5	45.2	61.9	84.8	103.4	116.1
20.00	0.050	9.1	13.3	16.7	24.6	33.4	54.2	73.4	99.6	121.4	136.3
30.00	0.033	10.2	15.0	18.8	27.7	37.4	60.1	81.0	109.2	133.2	149.6
40.00	0.025	11.1	16.3	20.5	30.2	40.5	64.6	86.8	116.6	142.2	159.6
50.00	0.020	11.8	17.4	21.8	32.2	43.1	68.4	91.6	122.6	149.5	167.9
60.00	0.017	12.4	18.3	23.0	33.9	45.3	71.6	95.7	127.8	155.8	174.9
80.00	0.012	13.5	19.9	25.0	36.8	49.0	77.0	102.5	136.3	166.2	186.6
100.00	0.010	14.4	21.2	26.7	39.3	52.1	81.5	108.1	143.3	174.7	196.2

Coefficients

c1	c2	c3	d1	d2	d3	e	f
0.0003	-0.0197	-0.0002	0.5678	0.4980	0.2864	0.2860	2.3548

Standard errors (mm)

		Duration									
ARI (y)	aep	10m	20m	30m	60m	2h	6h	12h	24h	48h	72h
1.58	0.633	0.4	0.4	0.4	0.5	0.5	0.7	0.9	1.0	1.1	1.3
2.00	0.500	0.4	0.4	0.4	0.5	0.5	0.8	1.0	1.1	1.3	1.4
5.00	0.200	0.4	0.5	0.5	0.7	0.7	1.1	1.6	1.6	1.9	2.1
10.00	0.100	0.5	0.6	0.7	0.9	1.0	1.7	2.3	2.2	2.7	3.0
20.00	0.050	0.6	0.9	1.1	1.4	1.4	2.5	3.5	3.2	3.9	4.4
30.00	0.033	0.8	1.1	1.3	1.8	1.8	3.2	4.5	4.0	4.9	5.5
40.00	0.025	0.9	1.3	1.6	2.2	2.1	3.6	5.2	4.6	5.6	6.4
50.00	0.020	1.0	1.4	1.8	2.6	2.4	4.3	5.9	5.2	6.3	7.1
60.00	0.017	1.1	1.6	2.0	2.8	2.6	4.7	6.5	5.8	6.8	7.7
80.00	0.012	1.2	1.8	2.3	3.3	3.0	5.4	7.5	6.4	7.8	8.8
100.00	0.010	1.4	2.1	2.6	3.7	3.4	8.0	8.4	7.1	8.6	9.8

Extreme rainfall assessment with climate change

Projected temperature change: 1.0 ° C
Rainfall depths (mm)

		Duration									
ARI (y)	aep	10m	20m	30m	60m	2h	6h	12h	24h	48h	72h
1.58	0.633	4.2	6.1	7.7	11.2	15.8	27.1	38.0	53.5	64.9	72.7
2.00	0.500	4.6	6.8	8.5	12.5	17.4	29.7	41.5	58.1	70.5	78.9
5.00	0.200	6.5	9.5	11.8	17.4	23.9	39.8	54.8	75.6	91.8	102.9
10.00	0.100	8.0	11.8	14.6	21.6	29.5	48.3	65.9	90.1	109.7	122.9
20.00	0.050	9.8	14.4	18.0	26.5	35.9	58.2	78.8	106.6	130.0	145.8
30.00	0.033	11.0	16.2	20.3	29.9	40.4	64.9	87.5	117.9	143.6	161.1
40.00	0.025	12.0	17.6	22.1	32.6	43.7	69.8	93.7	125.9	153.4	172.1
50.00	0.020	12.7	18.8	23.5	34.8	46.5	73.9	98.9	132.4	161.5	181.3
60.00	0.017	13.4	19.8	24.8	36.6	48.9	77.3	103.4	136.0	168.3	188.9
80.00	0.012	14.6	21.5	27.0	39.7	52.9	83.2	110.7	147.2	179.5	201.6
100.00	0.010	15.6	22.9	28.8	42.4	56.3	88.0	116.7	154.8	188.7	211.9

Projected temperature change: 2.0 ° C
Rainfall depths (mm)

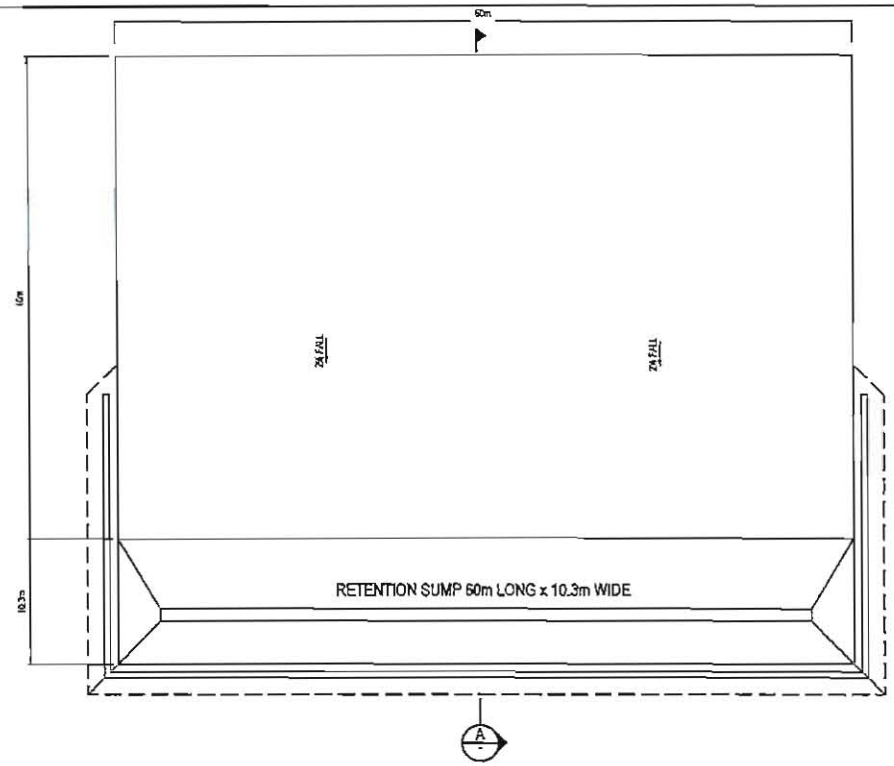
		Duration									
ARI (y)	aep	10m	20m	30m	60m	2h	6h	12h	24h	48h	72h
1.58	0.633	4.5	6.6	8.2	11.9	16.7	28.4	39.8	55.7	67.2	75.1
2.00	0.500	5.0	7.3	9.0	13.3	18.4	31.2	43.4	60.5	73.1	81.5
5.00	0.200	7.0	10.2	12.6	18.5	25.4	42.1	57.8	79.4	96.1	107.6
10.00	0.100	8.6	12.6	15.7	23.1	31.5	51.3	69.9	95.5	116.0	129.8
20.00	0.050	10.6	15.4	19.3	28.4	38.5	62.2	84.1	113.9	138.6	155.4
30.00	0.033	11.8	17.4	21.8	32.1	43.4	69.7	94.0	126.7	154.0	172.6
40.00	0.025	12.9	18.9	23.8	35.0	47.0	74.9	100.7	135.3	164.7	184.7
50.00	0.020	13.7	20.2	25.3	37.4	50.0	79.3	106.3	142.2	173.4	194.8
60.00	0.017	14.4	21.2	26.7	39.3	52.5	83.1	111.0	148.2	180.7	202.9
80.00	0.012	15.7	23.1	29.0	42.7	56.8	89.3	118.9	158.1	192.8	216.5
100.00	0.010	16.7	24.6	31.0	45.6	60.4	94.5	125.4	166.2	202.7	227.6

Projected temperature change: 3.0 ° C
Rainfall depths (mm)

		Duration									
ARI (y)	aep	10m	20m	30m	60m	2h	6h	12h	24h	48h	72h
1.58	0.633	4.8	7.0	8.8	12.6	17.7	29.8	41.5	57.9	69.6	77.6
2.00	0.500	5.3	7.8	9.6	14.1	19.5	32.7	45.3	62.9	75.6	84.2
5.00	0.200	7.4	10.8	13.4	19.7	26.9	44.4	60.8	83.3	100.5	112.3
10.00	0.100	9.2	13.5	16.7	24.6	33.4	54.4	74.0	100.8	122.3	136.6
20.00	0.050	11.3	16.5	20.8	30.3	41.0	66.2	89.5	121.1	147.3	164.9
30.00	0.033	12.6	18.6	23.3	34.3	46.4	74.5	100.4	135.4	164.4	184.2
40.00	0.025	13.8	20.2	25.4	37.4	50.2	80.1	107.6	144.6	175.9	197.2
50.00	0.020	14.8	21.6	27.0	39.9	53.4	84.8	113.6	152.0	185.4	208.2
60.00	0.017	15.4	22.7	28.5	42.0	56.2	88.8	118.7	158.5	193.2	216.9
80.00	0.012	16.7	24.7	31.0	45.6	60.8	95.5	127.1	169.0	205.1	231.4
100.00	0.010	17.9	26.3	33.1	48.7	64.6	101.1	134.0	177.7	216.6	243.3

NOTES

1. DETAILS SHOWN ARE CONCEPT ONLY & SUBJECT TO CHANGE
2. DETAILS BASED ON LAYOUTS PRODUCED BY CANTERBURY LANDSCAPE SUPPLIES



MATURATION PAD AND RETENTION BASIN LAYOUT PLAN
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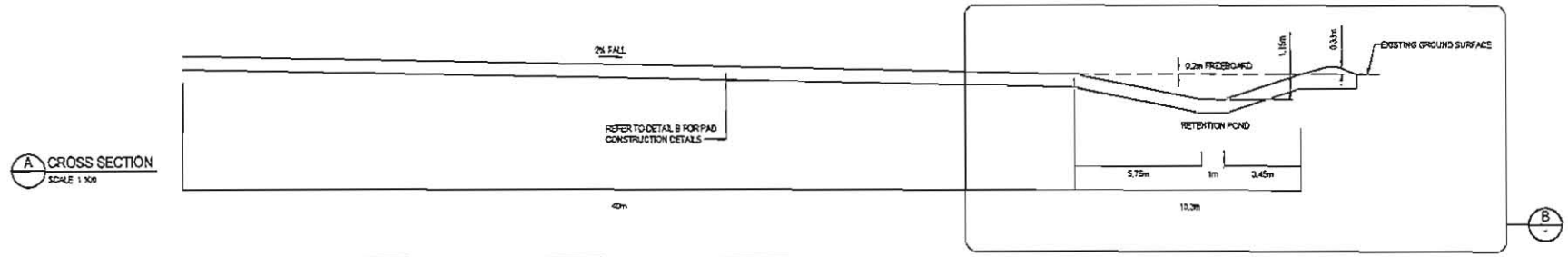

A CROSS SECTION
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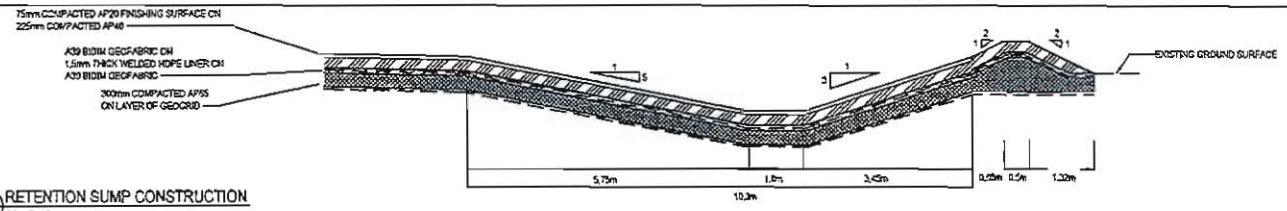


B RETENTION SUMP CONSTRUCTION
SCALE 1:50

CONCEPT DESIGN
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
A	CONCEPT DESIGN	TG	AC	AB	31.08.18

Beca

CLS

MPOST MATURATION PAD

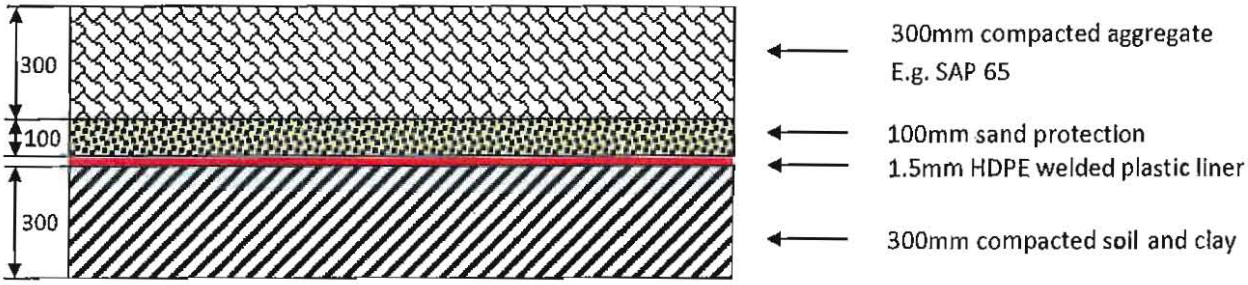
MATURATION PAD
RETENTION BASIN
CONCEPT DESIGN

CIVIL ENGINEERING
4395441-CA-K001 A

Maturation Pad Liner System

The liner system for the Maturation Pad consists of 4 different layers, all of which have different functions. The below Figure 1 shows the Maturation pad Liner system.

Figure 1: Diagrammatic section of the Maturation Pad liner system



It consists of the following layers, each with different functions, as detailed in the table below. Layers are described from top to bottom.

Table 1: Description of the Maturation pad liner system

Layer	Thickness	Function
Compacted Aggregate layer	300mm	Operating surface for machinery and liner protection
Sand Protection Layer	100mm	Protect the HDPE liner from mechanical damage
HDPE Welded Plastic Liner	1.5mm	Impermeable leachate barrier
Compacted Soil & Clay layer	300mm	Foundation for HDPE Plastic liner

The barrier portion of the liner system – the layer that prevents leachate from entering the surrounding environment – is the 1.5mm high density polyethylene (HDPE) plastic liner. The same liner is used in the construction of landfills as a protective barrier to prevent leachate entering groundwater. The HDPE liner has a smooth top surface, allowing material to slip off it and reduce the amount of tension on the liner system.

The HDPE liner material used on site will be sourced from a local supplier, and ensure that it meets the industry standards for geomembranes. The quality of the material used and the manner in which the Maturation Pad is constructed is important to ensure the liner system performs as intended. Mechanical damage during construction is the main way in which the liner can be damaged.

The HDPE liner will be installed by the supplier of the material, who are specialist sub-contractors with proven experience. The HDPE sheets are joined together using a hot-wedge welder. This joins the sheets together in a double seam allowing the seam to be sealed, and tested to confirm there are no leaks.

Placing the sand protection layer, and compacted aggregate operating layer on top of the HDPE liner system is done with care to avoid damaging the liner. Machinery places the sand and aggregate layer while working off a depth of material to ensure that wheel and track loads are not concentrated directly on the HDPE liner.