civil tech

Your reference: APP-20171088
8 November 2017

PAID $1500
09 NOV 2017
ENVIRONMENT SOUTHLAND

The General Manager
Environment Southland
Private Bag 90116
INVERCARGILL

Attention: Ms A King

Dear Alex

RE: Application for Discharge Permit and Land Use Consent for Storage Pond – Kerr Inverurie Trust

Attached is an application for a discharge permit for the storm water and solids from a composting operation and a land use consent for a storage pond for the storm water run-off with any contaminants from the composting.

We have responded to all points in your letter of 3 March 2017 and included it within the text but mainly at the start and responded to your letter of 11 April 2017 and included in the letter from e3 Scientific which also includes an assessment of environmental effect.

The application fee of $1500.00 was paid with the last application. This may need to be topped up.

Please contact me if you have any questions.

Yours faithfully
Civil Tech Ltd

Murray Gardyne
Director

PO Box 1558, Invercargill 9840, New Zealand
T (03) 216 9745 M 027 435 7957 E murray@civiltech.co.nz

Application

to

Environment Southland

for

Discharge and Land Use Consent

for

Kerr Inverurie Trust

November 2017

Prepared by

Civil Tech Ltd
P O Box 1558
INVERCARGILL 9840
T: (03) 216 9745
M: 027 435 7957
E: murray@civiltech.co.nz

CONTENTS

Application for Resource Consent (PART A)

environment SOUTHLAND

This application is made under Section 88 of the Resource Management Act 1991

The purpose of this Part A form and the relevant Part B form(s) is to provide applications with guidance on information that is required under the Resource Management Act 1991. Please note that these forms are to act as a guide only, and Environment Southland reserves the right to request additional information.

To: Environment Southland
Private Bag 90116
Invercargill 9840

Full name, address and contact details of applicant *(in whose name consent is to be issued)*

Name: Kerr Inverurie Trust c/- C Kerr

Address: 966 Athol Five Rivers Highway
R D 3, Lumsden 9793

Email:

Phone: 027 437 5173 *Preferred* _____ *Additional* Fax: _____

Consultant contact details *(if different from above)*

Contact name/agent: Civil Tech Ltd c/- Murray Gardyne

Address: P O Box 1558
Invercargill 8940

Email: murray@civiltech.co.nz

Phone: (03) 216 9745 *Preferred* 027 435 7957 *Additional* Fax: _____

Please tick the box for the consent(s) you are applying for and complete the relevant Part B form(s) where available:

Land Use

- [ ] Bore/well
- [ ] New or expanded dairy farming
- [x] Effluent storage
- [ ] Cultivation
- [ ] Tree planting
- [ ] Gravel extraction
- [ ] Hill country burning
- [ ] Riverbed activity (incl. streams/creeks and stopbanks)
- [ ] Bridges and culvert

Discharge

- [ ] To air
- [ ] To water
- [x] To land

Water

- [ ] Take and use surface water
- [ ] Take and use groundwater
- [ ] Dam water
- [ ] Divert water

Coastal

- [ ] Whitebait stand
- [ ] Structures/occupation of space
- [ ] Removal of natural materials
- [ ] Disturb foreshore/seabed
- [ ] Discharge/deposit substances
- [ ] Commercial surface water activity
- [ ] Reclaim/drain foreshore/seabed
- [ ] Marine farming
- [ ] Other coastal activities

1 Are there any **current** or **expired** consents relating to this proposal? ☐ Yes ☑ No

If yes, please provide consent number(s) and description:

2 Are any other consents required from Environment Southland or **other authorities**? ☐ Yes ☑ No

If yes, please state the relevant authority and the type of consent(s) required:

Discharge Permit ES
Land Use Consent ES

3 For what **purpose** is this consent(s) required: (e.g. discharge of effluent, gravel extraction etc.)

Land Use Consent to construct effluent storage. Discharge of waste water

4 **Location of proposed activity**

Address: 966 Athol Five River Highway SH 6

Parawa

Legal Description: Pt Sec 25 and Sec 139 IX Eyre SD and Lot 2 DP 302884

Map Reference (NZTM 2000): 1247424 E 4944485 N

5 The name and address of the **owner /occupier:** (if other than the applicant)

Name: Phone:

Address:

6 **Please attach a map or a coloured aerial photograph, showing at a minimum, the location of the proposed activities.**

Checklist: Have you included the following?

- [x] Payment of the required deposit *(see attached fee schedule)*
- [x] Written approval from all potentially affected parties *(forms available from the Environment Southland website)*
- [x] Site plan/location map/sketch of the proposed activity
- [ ] A copy of the Certificate of Incorporation (*where applicant is a company*)
- [x] Part B form(s) specific to your activity and/or a separate assessment of environmental effects (AEE)

Notes:

(a) If your application does not contain the necessary information and the appropriate fee, Environment Southland must return the application.

(b) Council cannot accept electronic lodgement of applications at this time.

Signature of applicant

I hereby certify that to the best of my knowledge and belief, the information given in this application is true and correct.

I undertake to pay all actual and reasonable application processing costs incurred by Environment Southland.

Name (block capitals) MURRAY GARDYNE

Signed M Gardyne **Date** 9/11/2017

(*Signature of applicant or person authorised to sign on behalf of applicant)*

Application to Discharge to Land (PART B) (non-dairy activity)

environment SOUTHLAND
Te Taiao Tonga

This application is made under Section 88 of the Resource Management Act 1991

A complete Part A form needs to be provided with this Part B form. The purpose of this Part B form is to provide applicants with guidance on information that is required under the Resource Management Act 1991. These forms are to act as a guide only and Environment Southland reserves the right to request additional information. Please also refer to Appendix A of the Regional Water Plan for Southland, 2010.

To: Environment Southland
Private Bag 90116
Invercargill 9840

1 What is this application for?

- [ ] The discharge of contaminants to land where it may enter water
- [x] The discharge of contaminants to land

2 What duration of resource consent is sought? 10 years

3 Please describe the proposed activity:

IRRIGATING STORMWATER ARE RUNNING THRU COMPOSTING MATERIAL AFTER BEING IN STORAGE. SPREADING COMPOST FROM THE PROCESS

4 Please describe the following elements of the proposed discharge to land:

(a) The chemical content (including heavy metals or toxic substances, nitrates, ammonia and dissolved reactive phosphorous)

SEE ANALYSIS IN APPLICATION

(b) Number of discharge points SPREAD OVER LAND

(c) Location/ area of each discharge point SEE AERIAL PHOTO

(d) Maximum rate/ thickness of application 10mm LIQUID LESS THAN 1mm

(e) If the proposed discharge is continuous or intermittent MAX. EVERY 2 MONTHS

10 **Has percolation or soil infiltration testing been carried out and is the test report attached?**

- [x] No
- [ ] Yes, please specify method

AFTER FDE

K value: SPREAD WHEN THERE IS A MOISTURE DEFICIT

11 **What is the discharge site soil category (based on the dominant soil type in the first 1 m depth)?**

Soil Category	Description	Tick
1	Gravels and sands	
2	Sandy loams	
3	Loams	✓
4	Clay loams	✓
5	Light clays	
6	Medium to heavy clays	

Existing Environment

12 **Are any of the following features found within the existing environment of the proposed activity? Describe these features in the space below, along with details of the assessment undertaken to determine the presence of these features.**

	Yes	No
(a) Signs of instream life (e.g. fish, eels, bullies, crayfish, native birds, frogs)?	✓	
(b) Areas where food is gathered from watercourses (e.g. watercress, eels, wildfowl)?		✓
(c) Wetlands, wildlife habitats or bird nesting habitats (e.g. swamp areas)?		✓
(d) Other activities occurring in the area (e.g. commercial activity, fishing, swimming, boating)?		✓
(e) Areas of particular aesthetic, cultural or scientific value (e.g. archaeological sites)?		✓
(f) Other waste discharges, any water takes and/or monitoring sites?		✓

THERE MAY BE EELS BUT FLOW RATES ARE LOW & INTERMITENT.

Please also include a map or site plan (and photographs if necessary) showing the location of roads and property boundaries, water bodies, wetlands and other wildlife habitats, buildings and residential properties, location of discharge points, any registered drinking water takes, and the location of any sensitive sites (e.g. historic places, sites of importance to iwi, public gathering areas etc.) in proximity to the site.

Assessment of Effects

13 **Please describe any possible long term or short term effects the discharge may have on the quality of the receiving environment and including effects on water bodies, biota (plant and animal life), soil quality, and odour and dust effects.**

THE COMPOSTED MATERIAL HAS LOW CHEMICAL ANALYSIS WITH N BEING 2-3%. THE BALANCE IS TRACE ELEMENTS + HIGH CARBON 22%. THE MATERIAL WILL HAVE A LIMING EFFECT. SEE ANALYSIS.

14 **Pursuant to Schedule 4 of the Resource Management Act, 1991, there are a number of matters that must be addressed by an assessment of environmental effects. Please discuss what effects the proposed activity will have on the following:**

(a) any effect on those in the neighbourhood and, where relevant, the wider community, including any social, economic, or cultural effects

THE OPERATION WILL USE FARM WASTE MATERIALS THAT WHEN COMPOSTED WITH THE ORGANIC WASTE PROVIDE NUTRIENTS AT LOW LEVELS & SOIL CONDITIONING AS WELL AS ADDING CARBON TO THE SOILS.

(b) any physical effect on the locality, including any landscape and visual effects

THE COMPOSTING SITE IS 1.7 km FROM THE ROAD.

(c) any effect on ecosystems, including effects on plants or animals and any physical disturbance of habitats in the vicinity

THE COMPOSTING SITE WILL BE CONSTRUCTED IN A CULTIVATED PADDOCK & NO FUTHER HABITATS WILL BE DISTURBED.

(d) any effect on natural and physical resources having aesthetic, recreational, scientific, historical, spiritual, or cultural value, or other special value, for present or future generations

THE NATURAL & PHYSICAL RESOURCES ARE ALREADY ALTERED BY FARMING. THE STORAGE POND WILL BE BUILT WITHIN THE GROUND & TOPSOIL SPREAD & SOWN.

(e) any discharge of contaminants into the environment, including any unreasonable emission of noise, and options for the treatment and disposal of contaminants

THE DISCHARGE WILL ENHANCE AGRICULTURAL PRODUCTION. MACHINERY USED WILL BE TYPICAL OF FARM EQUIPMENT.

(f) any risk to the neighbourhood, the wider community, or the environment through natural hazards or the use of hazardous substances or hazardous installations

NONE

15 **Please include a description of the monitoring or mitigation measures (including safeguards and contingency plans where relevant) to be undertaken to help avoid, reduce, remedy or mitigate the actual or potential effects on environmental features and values. For example, if relevant, please include the following:**

(a) treatment of the contaminants prior to discharge;
(b) buffer distances from water bodies, sloping land, site boundaries;
(c) details of any storage to be provided to enable deferred irrigation;
(d) a description of the monitoring system to be used for checking and recording the quality and quantity of the discharge. Please include how and when the monitoring will occur, and by whom; and
(e) contingency planning – describe how the equipment controlling the discharge will be operated and maintained to prevent equipment failure, and what measures will be implemented to ensure that the effects of any malfunction are remedied.

- MATERIALS ARE TO BE COMPOSTED.
- STORAGE IS 70M FROM WATER & WILL HOLD 150 DAYS OF RAINFALL.
- ALL LIQUID SPREAD ON LAND LESS THAN 10°
- COMPOST & LIQUID WILL BE ANALYSED TO CONFIRM COMPOSTION. BEFORE SPREADING
- ALL LIQUID FALLS BY GRAVITY TO STORAGE.

16 Please justify the term of consent sought with regard to any effects on the environment.

TIME 10 YEAR TERM WILL ALLOW FOR THE CONSTRUCTION COST + TIME TO FULLY ANALYSIS THE PROCESS.

17 Please include a description of any possible alternative locations or methods for undertaking the activity and why these alternatives have not been selected.

THIS ACTIVITY COULD BE CARRIED OUT ON LAND ANYWHERE. THE OWNER WANT TO SEE THE TIMBER PRODUCTS (SAWDUST, CHIPS + SHAVINGS) USED IN CALF + CATTLE FACILITIES USED + SPREAD FOR A USEFUL PURPOSE + NOT JUST DUMPED

18 Please include evidence of any consultation undertaken for this application. This may include (but not be limited to) consultation with adjoining landowners, other consent holders in the immediate area, iwi (e.g. Te Rūnanga O Ngāi Tahu, Te Ao Marama Inc), government departments/ministries (e.g. DOC), territorial authorities and recreational associations.

Please note that in accordance with Schedule 4 of the RMA, you may also be required to provide an assessment of whether or not the proposed activity is contrary to any of the relevant provisions of the following documents.

(a) Regional Policy Statement for Southland, 1997 (and any proposed/ subsequent versions)
(b) Regional Water Plan for Southland, 2010 (and any proposed/ subsequent versions)
(c) National Policy Statement for Freshwater Management, 2014
(d) National Environmental Standard for Sources of Human Drinking Water, 2007

Staff are able to advise whether this is required, as it is dependant on the location, scale and complexity of your proposal. We invite you to come in for a pre-application meeting with Environment Southland consents staff to discuss this.

END OF FORM

Application to Construct Effluent Storage (PART B)

This application is made under Section 88 of the Resource Management Act 1991

A complete Part A form needs to be provided with this Part B form. The purpose of this Part B form is to provide applicants with guidance on information that is required under the Resource Management Act 1991. These forms are to act as a guide only and Environment Southland reserves the right to request additional information. **This form must be used when applying for consent to construct effluent storage, including waste-water, sludge or effluent from an industrial or trade processes or agricultural effluent (including treatment facilities, such as weeping walls and sludge beds).**

To: Environment Southland
Private Bag 90116
Invercargill 9840

1 Location of the storage:

Address: 966 Athol Five Rivers Highway

Legal Description(s): Pt sec 25 and Sec 139 IX Eyre SD and Lot 2 DP 302884

Map Reference (NZTM 2000): 1247424E, 4944485N

2 Proposed method of lining the pond.

☐ Compacted clay ☑ Synthetic liner ☐ Concrete
☐ Other:

4 Construction Details:

Name of designer: Civil Tech Ltd

Name of builder: McDowall Transport Ltd

Name of construction supervisor: Murray Gardyne

Proposed timing of construction: As soon as the land use is confirmed

For agricultural effluent storage and sludge design, is the storage to be constructed in accordance with IPENZ Practice Note 21: Farm Dairy Effluent Pond Design and Construction (2013)? If not, please advise what departure from the standards is proposed and why.

Yes

6 **Please provide details of the proximity of the storage to:**

Nearest surface watercourse:	70	metres
Nearest artificial watercourse:	70	metres
Registered drinking water supplies:	nil	metres
Nearest underground drain:	More than 100m	metres
Property boundary:	450	metres
Dwellings on neighbouring properties:	1800	metres
Coastal marine area:	91,000	metres
Historic heritage	(Archaeological E445) 7,100	metres
Urban areas	(Lumsden) 20,000	metres

7 **What is the total volume of the pond and the the storage and purpose?** 1,600 cubic metres

8 **Please provide a description of all of the sources of waste-water, sludge or effluent to be treated and/or stored in the storage, including the storage capacity of the effluent storage in relation to the volume and nature of the liquid that will enter. For agricultural effluent, you must also attach a Massey Pond Calculator assessment of storage requirements.**

The waste water will originate rainfall that will fall on the composting material and run-off to the storage pond. The volume is based on providing 150 days of rainfall storage on the composting area and the pond surface.

9 **Please provide a description the quality of the waste-water, sludge or effluent. Please include all operational procedures, emergency response and proposed monitoring devices to match the scale and quality of the waste-water, sludge or effluent being stored and sensitivity of surrounding environment.**

The quality of the waste water is unknown but the analysis of raw product is lower than the Water New Zealand Good Practise Guide – Beneficial Use of Organic Waste products on Land (draft).

Please include engineering drawings for the proposed structure(s). This will include, but not be limited to the height of the embankments and placement and orientation of the effluent storage relative to flood flows and stormwater run-off.

Please also include a map or aerial photograph showing the following:

- ☐ the location of the proposed storage;
- ☐ the total property area boundary;
- ☐ surface water bodies, artificial watercourses, installed subsurface drains and wetlands nearby;
- ☐ water supplies - bores, registered drinking etc.;
- ☐ the coastal marine area and the distance to it (if relevant);
- ☐ the location of any dairy sheds and residential dwellings; and
  any additional points of interest – historic heritage, places of assembly etc.

Please note that upon completion of the storage and prior to discharge, you will be required to provide certification of the design and build by a Chartered Professional Engineer.

END OF FORM

COMPUTER FREEHOLD REGISTER
UNDER LAND TRANSFER ACT 1952

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**11103**
Land Registration District	**Southland**
Date Issued	27 September 2001

Prior References
SL10D/272

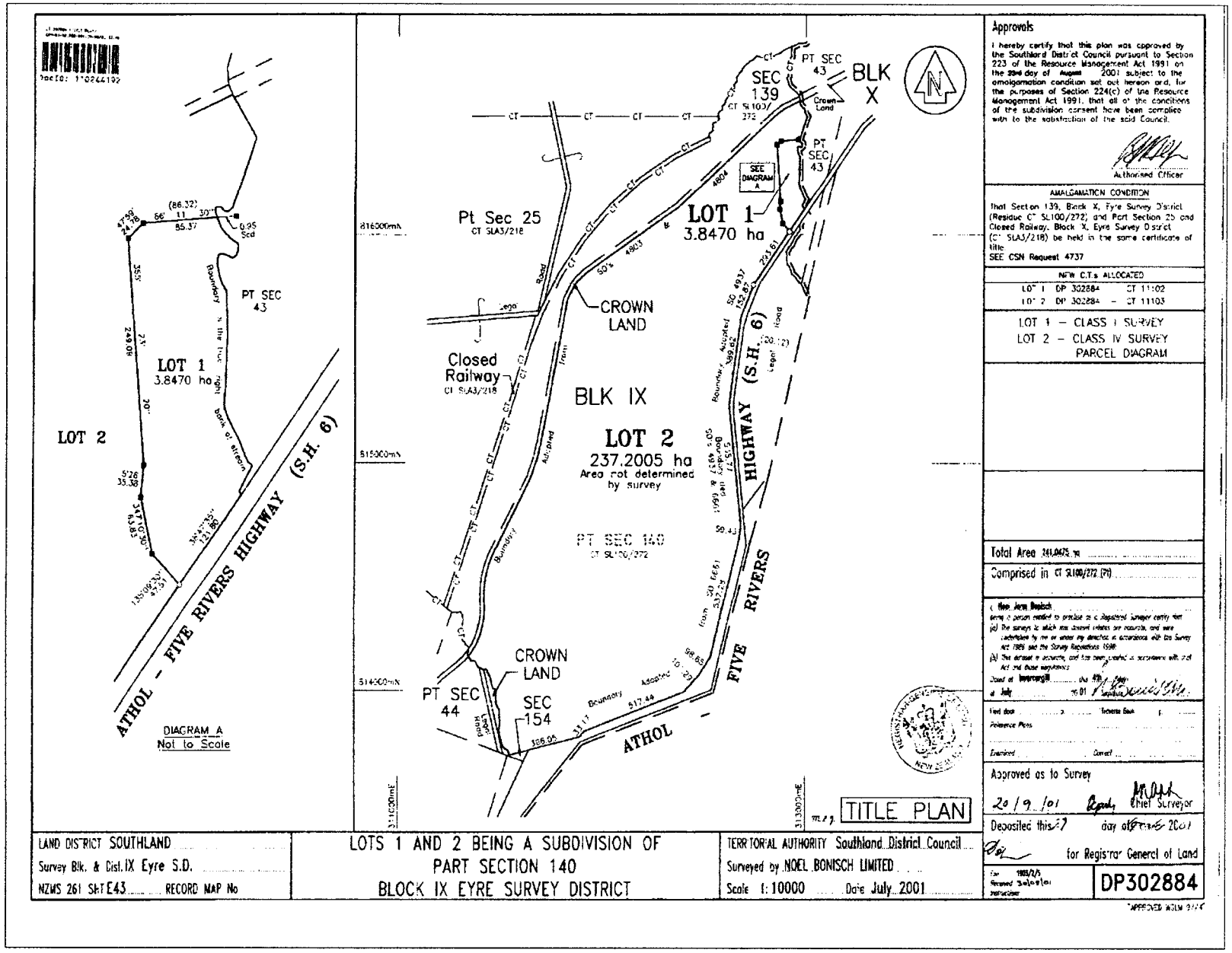
Estate	Fee Simple
Area	237.2005 hectares more or less
Legal Description	Lot 2 Deposited Plan 302884

Proprietors
Cameron Gregor Kerr and Gerard Peter Oudhoff

Interests

Subject to Section 59 Land Act 1948

5712396.3 Mortgage to Rabobank New Zealand Limited - 1.9.2003 at 9:00 am



TITLE PLAN

LAND DISTRICT SOUTHLAND
Survey Blk. & Dist. IX Eyre S.D.
NZMS 261 SHT E43 RECORD MAP No

LOTS 1 AND 2 BEING A SUBDIVISION OF PART SECTION 140 BLOCK IX EYRE SURVEY DISTRICT

TERRITORIAL AUTHORITY Southland District Council
Surveyed by NOEL BONISCH LIMITED
Scale 1:10000 Date July 2001

Approvals

I hereby certify that this plan was approved by the Southland District Council pursuant to Section 223 of the Resource Management Act 1991 on the 29th day of August 2001 subject to the amalgamation condition set out hereon and, for the purposes of Section 224(c) of the Resource Management Act 1991, that all of the conditions of the subdivision consent have been complied with to the satisfaction of the said Council.

Authorised Officer

AMALGAMATION CONDITION

That Section 139, Block X, Eyre Survey District (Residue CT SL100/272) and Part Section 25 and Closed Railway, Block X, Eyre Survey District (CT SLA3/218) be held in the same certificate of title
SEE CSN Request 4737

NEW C.T.s ALLOCATED

LOT 1 DP 302884 CT 11102
LOT 2 DP 302884 CT 11103

LOT 1 – CLASS I SURVEY
LOT 2 – CLASS IV SURVEY
PARCEL DIAGRAM

Total Area 241.0475 ha
Comprised in CT SL100/272 (Pt)

I Noel John Bonisch
being a person entitled to practise as a Registered Surveyor certify that
(a) The surveys to which this dataset relates are accurate, and were undertaken by me or under my direction in accordance with the Survey Act 1986 and the Survey Regulations 1998
(b) This dataset is accurate, and has been created in accordance with the Act and those regulations
Dated at Invercargill this 4th day of July 2001

Field book Traverse Sheet
Reference Plans
Examined Correct

Approved as to Survey
20/9/01
Chief Surveyor

Deposited this 27 day of September 2001
for Registrar General of Land

DP302884

COMPUTER FREEHOLD REGISTER
UNDER LAND TRANSFER ACT 1952

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **15072**
Land Registration District **Southland**
Date Issued 27 September 2001

Prior References
SL10D/272 SLA3/218

Estate	Fee Simple
Area	265.9518 hectares more or less
Legal Description	Section 139 Block IX and Part Section 25 Block IX and Part Railway Reserve Block IX Eyre Survey District

Proprietors
Cameron Gregor Kerr and Gerard Peter Oudhoff

Interests

Subject to Section 59 Land Act 1948 (affects Section 139)

136758.1 Open Space Covenant pursuant to Section 22 QE II National Trusts Act 1977 - 23.12.1986 at 2.59 pm (affects part)

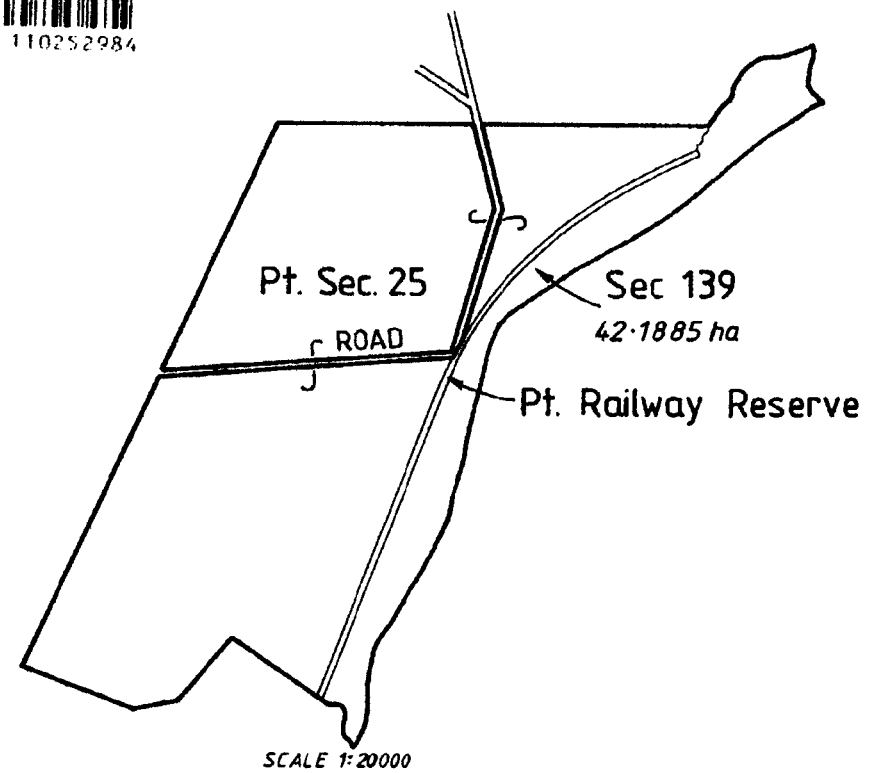
Subject to Section 241(2) Resource Management Act 1991 (affects DP 302884)

5712396.3 Mortgage to Rabobank New Zealand Limited - 1.9.2003 at 9:00 am

9648713.1 Compensation Certificate pursuant to Section 19 Public Works Act 1981 by the Southland District Council - 20.2.2014 at 7:00 am

Identifier **15072**

Doc ID: 11025298 4



SCALE 1:20000
TOTAL AREA : 265·9518 ha

The proposed activities

Applicant:	Kerr Inverurie Trust c/ - Cameron Kerr
Application:	To provide storage of processed animal product to provide time for the processing of the discharge permit.
Location;	966 Athol Five Rivers Highway, Parawa.
Legal description:	Pt Sec 25 Eyre SD
Map Reference:	NZTM 2000 1247424E, 4944485N

(supplied in a letter on 31 March 2017 in response to a letter from Environment Southland on 3 march 2017)
Information about what will be discharged to land

The meat industry byproduct is sourced from GelitaNZ and is residual extracted from cow hide head pieces(skin) only. It does not contain any offal or bone products. Processing of the cow hide removes collagen which is dried and made into gelatin. The waste from the process is residual extracted cow hide (hide with some collagen and fat removed, also called skutch or waste protein. GelitaNZ is the only land animal gelatin manufacturer in New Zealand and is located in Christchurch. The cow hide used to manufacture gelatin is face pieces that are sourced from head and neck areas of the animal. These parts of the hide are not able to be used by other value adding hide processing facilities and would otherwise go to landfill as waste. GelitaNZ sources raw material from approximately 43 abottoirs/meat processors from through the North and South Islands. The only material that will not break down are ear tags. Currently the ear tags are not removed by GelitaNZ but an upgraded plant in 2018 may remove them. After composting the material will be screened to remove ear tags and they will not be spread on the land.

GelitaNZ does not process offal. The only product processed is cow hide (skin). The process, including chemical treatments is summarised below:

- Hide is received as fresh (no treatment), salted (hide +30% salt preservation), or dehaired (treated with sodium sulphide to remove hair).
- Hair is removed by soaking the hide in sodium sulphide (Na^2S) solution pH >11 for approximately 24 hours.
- Hide is conditioned for 15 to 30 days by soaking in a solution of primary hydrated lime ($Ca(OH)^2$), pH>11. Occasionally caustic is also added to the solution (NaOH).
- The hide is washed with water to rinse alkaline chemicals and salt solution from the product.
- The hide is conditioned with sulphuric acid and hydrogen peroxide (H^2SO^4 and H^2O^2) for 4 days with pH<3.
- The hide is washed with water to remove acid chemicals from the product.
- The pH of the conditioned hide is approximately pH3. It is transferred to the food processing part of the plant where the collagen is extracted using steam in stainless steel vats.
- Once the collagen is removed the spent hide (skutch) is discharge to the waste stream and stockpiled for removal from the site for composting or disposal to landfill.

No chemicals are added to the raw material for transport. No there chemicals are added to the spent hide. The material is dough like with no excess liquid coming from it.

Lime, sulphuric acid, hydrogen peroxide and sodium sulphide are all classed as *approved hazardous substances with controls* under the HSNO Act. These substances are required to be transported, stored and handled according to regulations.

GelitaNZ has not undertaken any analysis of our spent hide (skutch) since it was not required for disposal in land fill. However Gelita Australia, which operates a very successful composting operation on their Beaudesert, Queensland, and uses the same raw materials and process as GelitaNZ, has undertaken analysis for their operation.

GeletiaNZ uses only New Zealand hides but there is also the processing they undergo to consider. We use what is known as the "Classic" alkaline / acid process and this has been found to be robust enough to deactivate the TSE prion - the causative agent of BSE.

Skutch Analysis

Moisture	%	67.1
pH (water)		4.01
Conductivity	mS/cm	2.77
Organic carbon (LOI)	% DM	53.9
Nitrogen	% DM	10.0
Nitrate-N	mg/L	< 45
Ammonia-N	mg/L	180
Phosphorus	% DM	0.31
Phosphate	mg/L	750
Potassium	% DM	0.01
Sulphur	% DM	2.20
Sodium	% DM	0.03
Chloride	mg/L	310
C/N Ratio		5.4

Analysis 2009

There have been additional test results and these are included in the attached details from e3 Scientific.

The skutch will be mixed with equal parts of wood chip, wood shavings, sawdust, straw and hay and balage. The initial material sourced will be clean of any animal waste to allow the process to developed. This material will be sourced from saw millers and tree felling where they are chipped and some bark from Haul sites where the bark is stripped prior to log transport. This will all be untreated wood and also straw from cereal crops around the area and on this farm. In the initial trials no material that has animal effluent on it will be included. This material provides carbon structure, porosity for air exchange and a barrier to the surrounding environment. The composting consists the mixing and turning the compost heap to add air to help the micro bacterial breakdown and allow the carbon and nitrogen to interact. The rain water that collects from the composting pad will be stored in the pond and used to spray the compost heaps to keep them moist to stop dust.

The volumes will be up to 1,000m3 of skutch and 1,000m3 of wood and straw product will be used each year. The batches of compost will be built up along the composting pad in a mound. The process will handle 2,000m3 per year but this will compost down to a lesser volume. It will take a full year to get to the 2,000m3 volume which may be as low as 1,000m at the end of the process and that will be spread as new material is added. The site should able to handle 3,000m3 of compost.

The skutch has a doughy feel but still retaining the skin shape. It does not have leachate that comes from it. If rain falls on it, the run-off will be held in the storage pond.

Once composting is complete the material will be screened and spread on the discharge area. The farm area will provide time for the process to be tried and the material tested to confirm the chemical and heavy metal component. Where this material is composted in Australia there are 3 metals in the mix and the Copper and Zinc have a soil – plant barrier that stops it being transferred to animals. The Cadmium levels are very low.

Composted test results – Biosolids limits (Please note this material is not biosolids but shows what the limits are)

Parameter	Existing limits*	Proposed limits**		Australian test results – 2 samples	
Cadmium	1	10	mg/kg dry weight	<0.001	<0.001
Copper	100	1250	mg/kg	75	64

Zinc	300	1500	mg/kg	206	180

*from Guidelines for the Safe Application of Biosolids to Land in New Zealand
**from draft for public comment – Beneficial Use of Organic Waste Products on Land
This is the composted material with a 50% volume of compostable material. The test results for the natural product may be double these readings.

Information about where the material will be discharge

The storage pond is located at 1247424E 4944485N.

The farm has a mix of 60% cattle and 40% sheep. It will have up to 50ha of winter fodder crop. There will be up to 20 hectares of cereal for whole crop balage which may be sown on the winter crop paddocks to soak up the nitrogen after wintering. They will also have 20 hectares of other cereal to be headed for grain and the straw used for the composting. There will be pasture renewal from grass to grass of up to 30 hectares. They make 80 hectare into silage/balage. Their hill country is fallowed through summer and then mod stocked with sheep and cattle over winter to compost the summer growth.

The neighbours, Bairds and Parawa Farmlands Ltd, have reasonably extensive land areas and have sheep and beef. The McNamees are all sheep. They have signed written approval forms which were attached in the original application.

The state highway is 1.5km from the site. The Round the Mountain cycle trail is 300m to the east and downhill of the site and the site may only be visible from further south of the site but at that point the rail line runs through a cutting and that may limit the view.

The prevailing wind on the farm is from the south west. The farm is well sheltered from the north west but there is a wind that comes south off Lake Wakatipu which travel south down the valley.

The aerial photograph shows the areas that the run-off from the liquid will be spread. This will be on slopes less than 10 degrees. Effluent will be spread at less than 5mm and can be pulsed at 2mm per half an hour. The solids will either be in cultivated paddocks and incorporated or onto paddock shut up for fallowing for at least six months. The spreader will only spread at slopes of up to 10 degrees.

The aerial photograph shows the location of waterways. These were located by Environment Southland staff and critical as well as critical source area.

The western side of the farm is on bedrock with deep clays with some stone on the slopes with rock close to the surface on steeper areas where no material is spread. There is no aquifer under the farm as they have tried to drill for water and been unsuccessful. The incorporation of the compost and low rates of application of run-off liquids will ensure an effect less than minor.

The farm is soil testing each year and this will continue. We the farm was purchased there was some very detailed soil testing carried and results of these are attached. The aim will be to optimise the use of any make up solid fertilizer but the compost has a pH of 7.5 to 7.8 and this will tend to have a liming effect. There are no unusual concentrations of any material.

The farm has groundwater nitrate levels of 0.1 – 0.4 mg/l – Pristine, pre-European. There is no aquifer that hold water under the property and water will either run off or seep to the base rock and flow north to the upper Mataura aquifer at Parawa. The gleyed physiographic has some ability for denitrification and the low rates of application and soil incorporation on the crop paddocks will assist in the keeping loss to water low.

Information about how the material will be discharged

The skutch and wood and straw material will be placed and mixed on a shaped and compacted clay base with a rock wearing surface to allow a loader or excavator to turn the compost. A lane will be constructed on the north upslope side of the area to allow truck and trailers to access the site to drop off the material to be used.

Full plans are attached for the composting area and storage pond.

All compost will pass through a rotary screen to remove the ear tags and any other larger material. The ear tags will be disposed of to landfill.

All liquid will be disposed of to pasture or well established crop. Solids will be spread on cultivated land and then incorporated or on established pasture which is to be fallowed from October to June.

The compost will be turned to allow air into it to help the aerobic process. It may be turned up to once a month depending on the time of year and temperature. The material will always be kept moist to help the process as well as ensuring there is no dust.

Testing will be carried out by Hills Laboratory to check the basic make up and initially for cadmium, copper and zinc. Initially it would be carried on each batch over the first year and after getting consistent results scaling monitoring to 2 times per year.

The "leachate" is only rain water as the skutch is doughy hide and does not leach without the rain water. The intake for the pump will have a filter but a stone trap and filter maybe placed at the entry to the storage pond.

The preferred method will be the pods for irrigation but a slurry tanker will be used if required. The 1,600m3 of storage will allow 6 months to test the system.

For compost to process properly will need moisture and dry sawdust will not compost. It will be kept damp and when mixed with straw and wood chips will not become windborne. Cameron Kerr lives on site and the site can be viewed from the farm access track 200m from the house. If dust is occurring the composting is not operating properly.

An assessment of the effects of discharge

The response to this is included in the information included in the letter from e3Scientific on 25 September and is additional information and a response to a letter from Environment Southland on 11 April 2017.

The consent is required for:

Discharge
Discharge of composted organic waste product from the processing of beef hide from faces of cattle which has had Collagen extracted and then steamed and dried. This is mixed with equal parts of wood chip, wood shavings, sawdust, straw and recycled compost. This provides carbon structure, porosity for air exchange and a barrier to the surrounding environment. The composting consists the mixing and turning the compost heap to add air to help the micro bacterial breakdown and allow the carbon and nitrogen to interact. Once composting is complete the material will be screened and spread on the discharge area. The farm area will provide time for the process to be tried and the material tested to confirm the chemical and heavy metal component. Where this material is composted in Australia there are 3 metals in the mix and the Copper and Zinc have a soil – plant barrier that stops it being transferred to animals.

Composted test results – Biosolids limits (although this material is not included as a biosolid)

Parameter	Existing limits*	Proposed limits**		Australian test results – 2 samples	
Cadmium	1	10	mg/kg dry weight	<0.001	<0.001
Copper	100	1250	mg/kg	75	64
Zinc	300	1500	mg/kg	206	180

*from Guidelines for the Safe Application of Biosolids to Land in New Zealand
**from draft for public comment – Beneficial Use of Organic Waste Products on Land
This is the composted material with a 50% volume of compostable material. The test results for the natural product may be double these readings.

Land Use
Construct a storage pond for the rainfall run-off from the processing area.

Property details:

Catchment	Upper Mataura
Total farm area (ha)	503.2
Replacement consents	No, land use and discharge
Physiographic	Oxidizing. bedrock and gleyed
Freshwater Management Unit	Mataura

Discharge Permits Details:

Current permit	No
Proposed volumes (m3)	1,000 of hide and up to 1,000 of wood and straw products combined
Processing area (m2)	3,000m2 (please note this is surface area)
Covered	No
Other sources of effluent	None
Effluent disposal area (ha)	300 This is all land that is cultivated. There are large buffer areas to gullies and intermittent storm water flow

Liquid

Application rate and depth	Category A and C in discharge area by slurry tanker or low application pods

It will also be used to irrigate the composting material as required to keep moist. This may mean that the pond will only be used during winter and spring and spread on the compost heaps and water will be lost to evaporation.

Pod Irrigators	2 - 10mm depth	4mm rate
Slurry tanker	5mm depth	5mm rate

Solids

Application depth	Composted material will be spread by a bulky fertilizer spreader. It can also be worked into the soil with cultivation. It will be spread by a fertilizer spreader (bulky)
Storage proposed (m3)	1,600
Effluent collection/storage liner	1.5mm HDPE
Number of days storage	150 days
Storage requirement m3	1,600
Monitoring proposed	Inspection of inspection chamber

winter. The soils are generally fine textured, prone to water logging, and have extensive artificial drainage. On this farm there several tile drains with mole drains as well. Some nitrogen is removed from water infiltrating through the soil zone via denitrification but by using split nitrogen applications and not applying it during late autumn and winter N loss will be reduced. Loss of nutrients, sediment and microbes via artificial drains following heavy or prolonged rainfall are a key feature of this zone. Water in this zone is not directly linked to any of the major rivers and therefore does not experience dilution from alpine or pristine Bedrock/Hill Country zones. The aim is to protect the soil so that phosphorus loss is reduced by having riparian zones and critical source areas with increased cover and plantings.

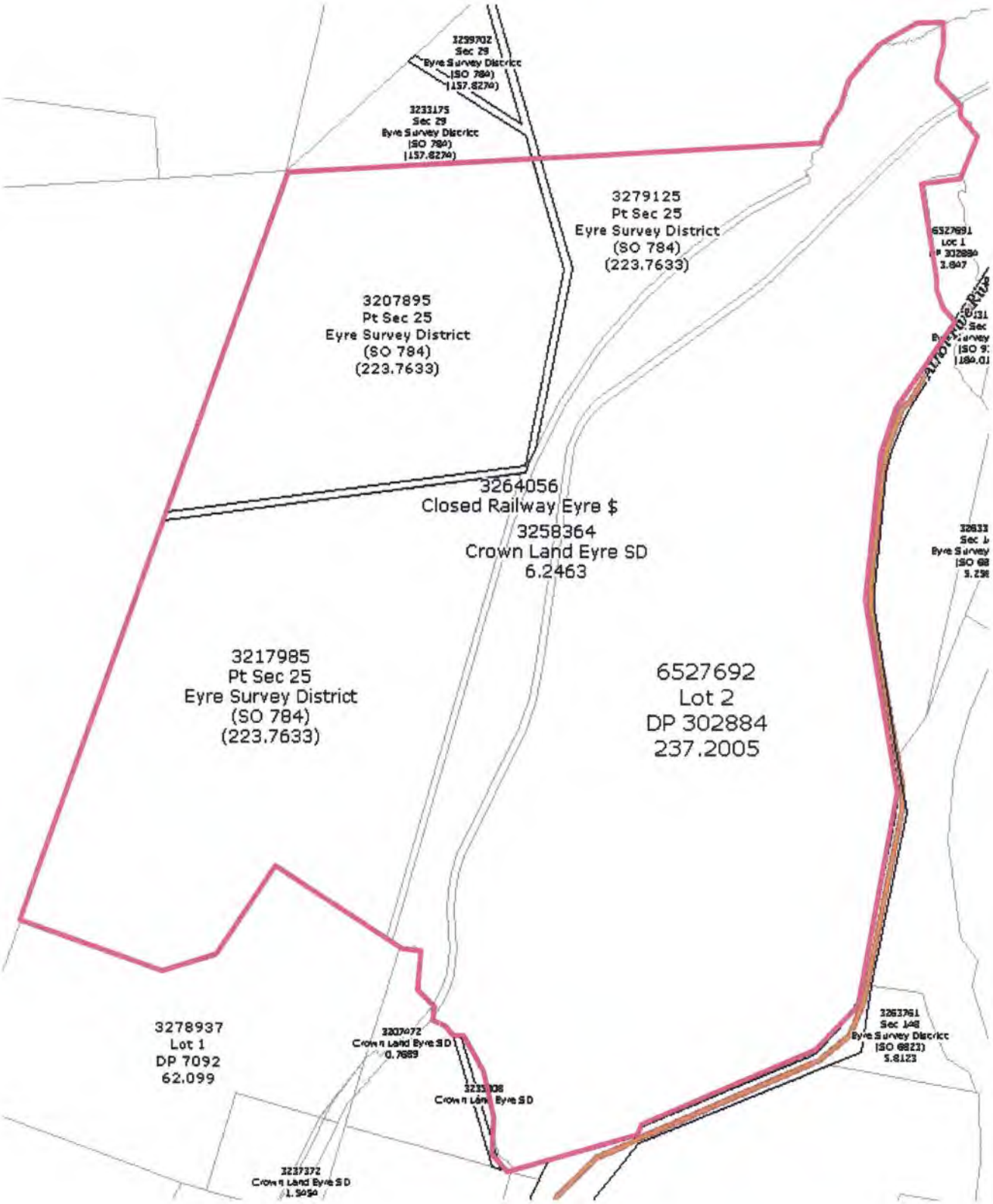
Material Composition

Organic waste product prior to composting

Skutch Analysis

Moisture	%	67.1
pH (water)		4.01
Conductivity	mS/cm	2.77
Organic carbon (LOI)	% DM	53.9
Nitrogen	% DM	10.0
Nitrate-N	mg/L	< 45
Ammonia-N	mg/L	180
Phosphorus	% DM	0.31
Phosphate	mg/L	750
Potassium	% DM	0.01
Sulphur	% DM	2.20
Sodium	% DM	0.03
Chloride	mg/L	310
C/N Ratio		5.4

LOCALITY PLAN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Crown Land Eyre SD
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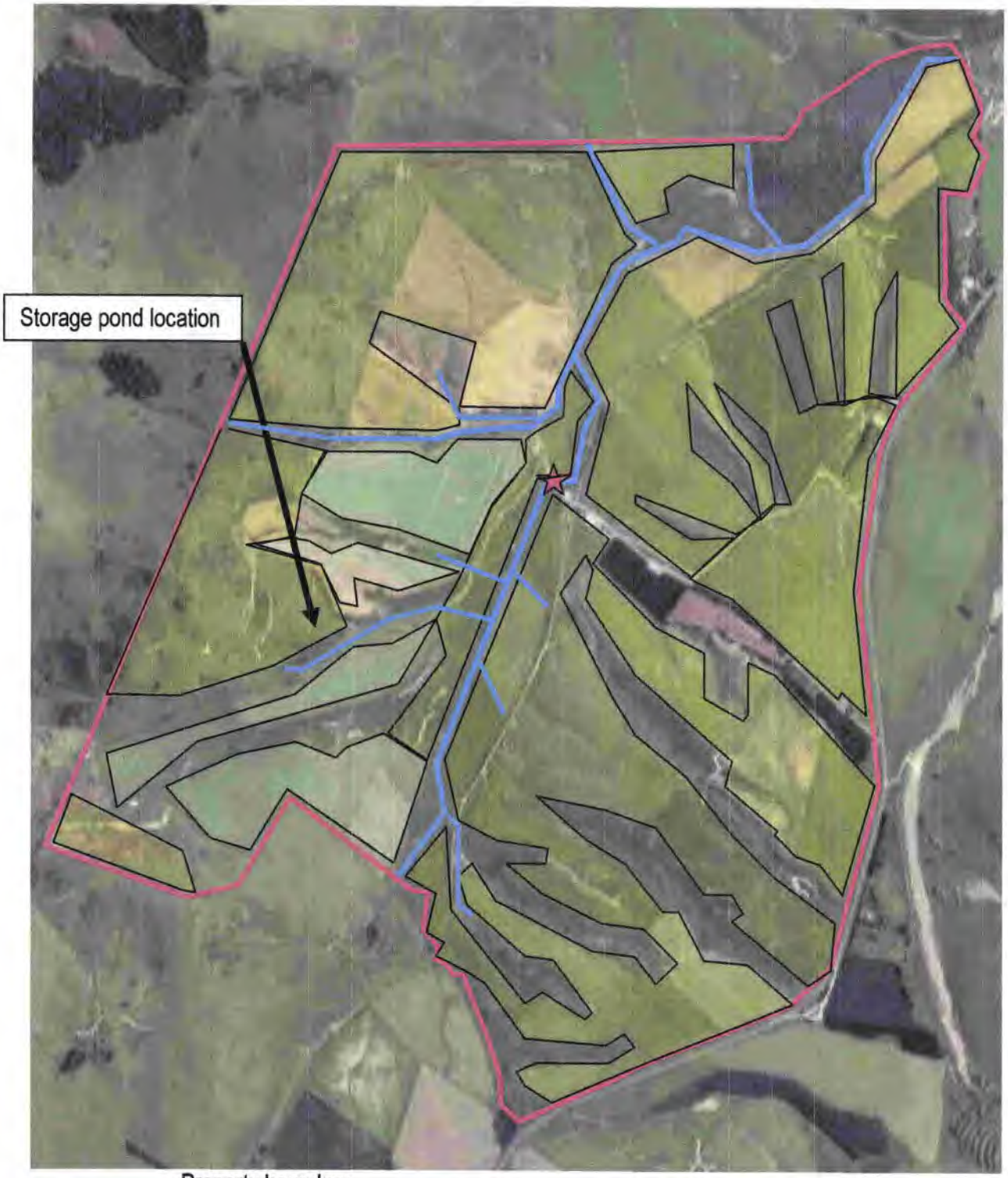
LEGAL PLAN



Property boundary

Discharge of storm water and compost

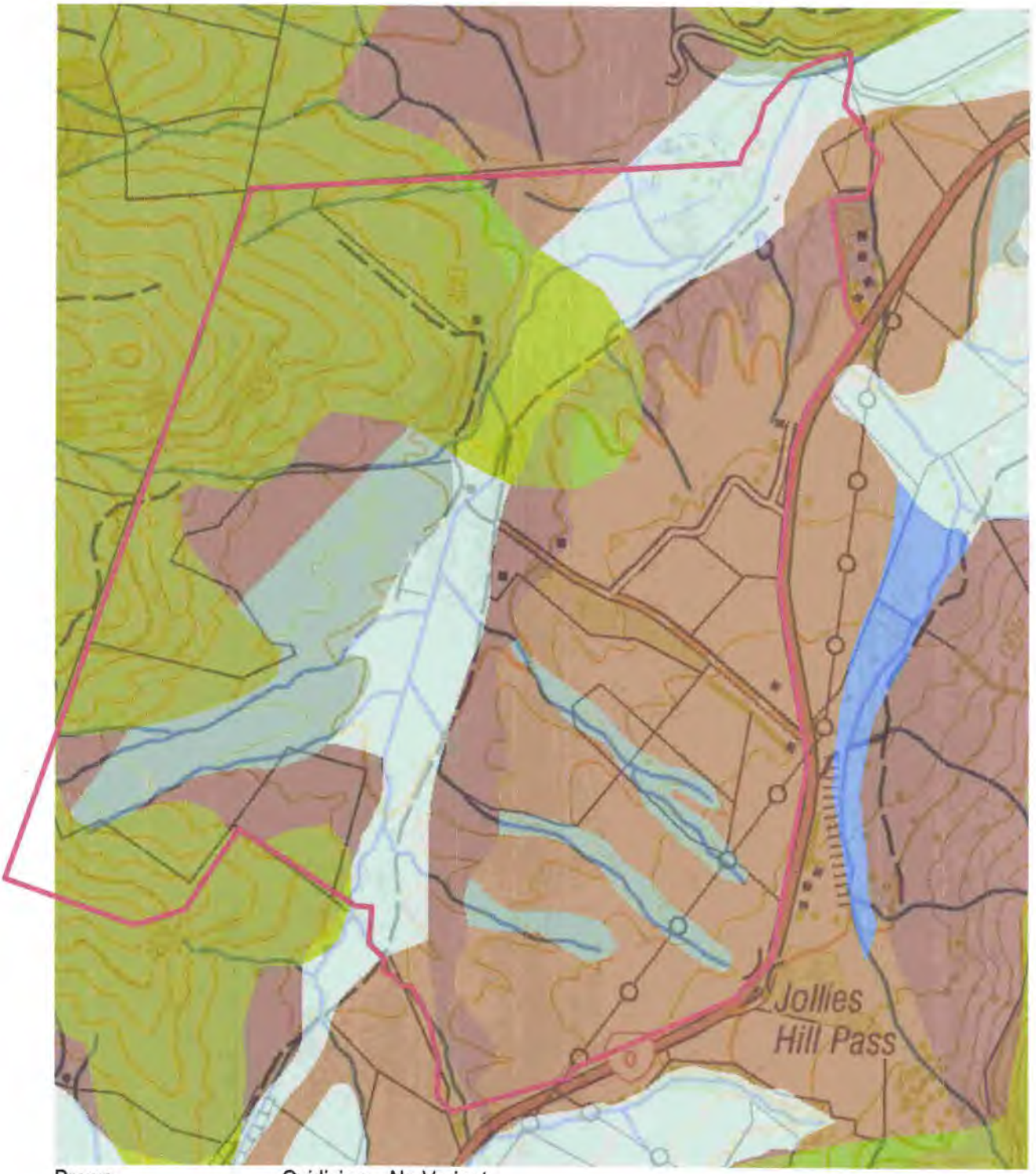
The compost discharge area. This material will be incorporated during cultivation or on fallowed land

Open drains running

Intermittent drain most of the small gullies will have water running in heavy rain

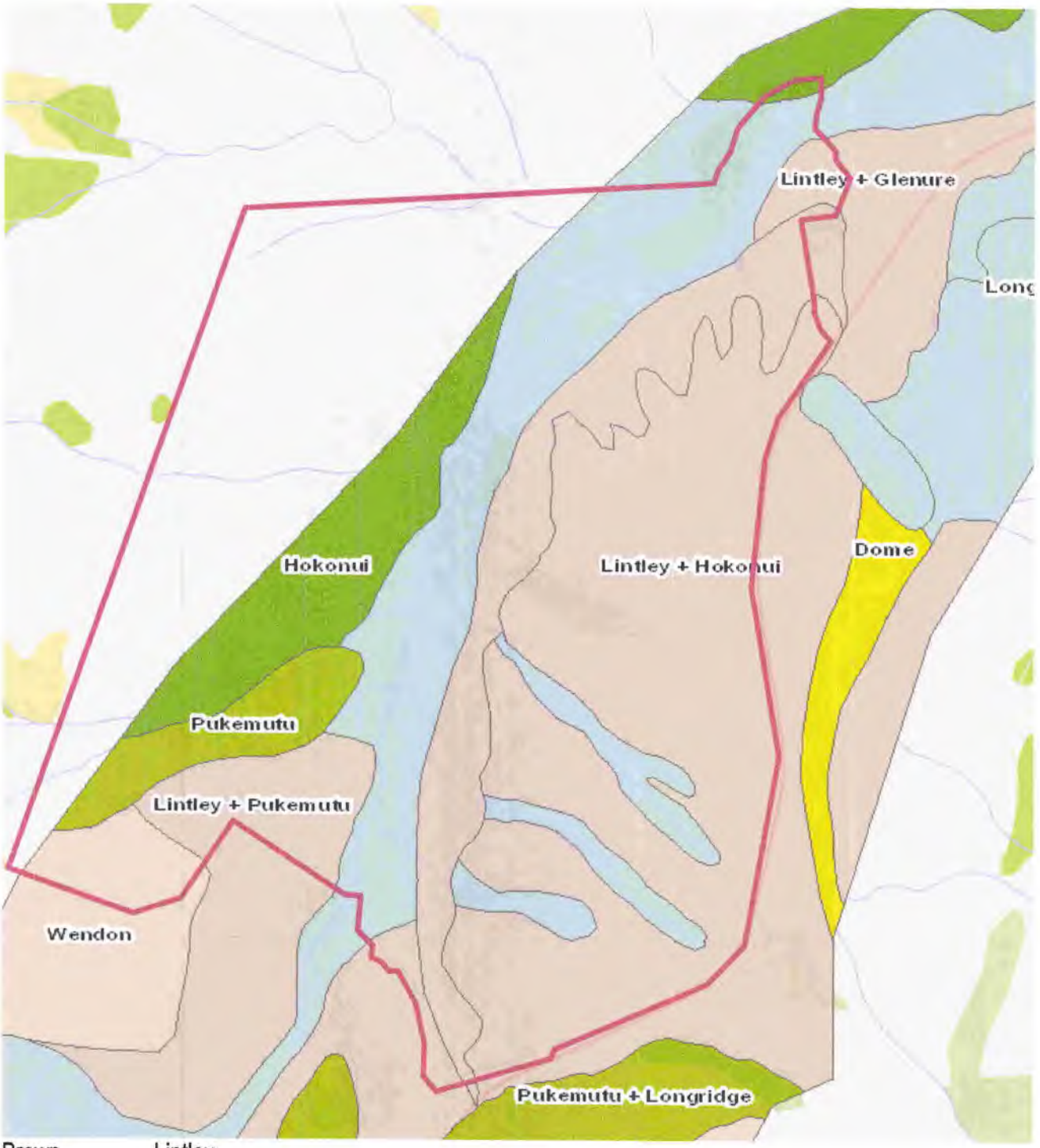
Bridge and culverts

AERIAL PHOTOGRAPH



Brown	Oxidizing – No Variant
Dark brown	Oxidizing – Overland flow
Dark green	Bedrock Hill – Overland flow
Green	Bedrock Hill – No Variant
Dark Grey	Gleyed - Overland flow
Grey	Gleyed – No Variant

PHYSIOGRAPHIC ZONES



Brown	Lintley
Blue	Longridge
Dark green	Hokonui
Light green	Pukemutu
Beige	Wendon

SOIL TYPES

2.0 Consents Required

Resource consents are required under the Regional Effluent land Application Plan (RELAP), operative Regional Water Plan for Southland (RWP) and proposed Southland Water and Land Plan (pSWLP).

Regional Effluent Land Management Plan

- The discharge of industrial and trade processes is a discretionary activity under Rule 5.5.1.

Regional Water Plan for Southland

- Discharge of contaminate originating from industrial or trade waste is a discretionary activity under Rule 16D.

Under the RWP the application is considered to be for a discretionary activity.

Proposed Southland Water and Land Plan

- The discharge of solid animal waste onto land a permitted activity under Rule 38.
- The construction of the effluent storage facility is a restricted discretionary activity under Rule 32 (a).
- Rule 3 – for controlled or restricted discretionary activities

Under the pSWLP the application is considered to be for a restricted discretionary activity.

Overall, the application would be is considered to be a restricted discretionary activity.

A design producer statement PS 1 and a PS 2 - design review from a CPEng is included.

3.0 Statutory Considerations

Section 104 of the Act sets out the matters that must be considered when assessing an application for a resource consent. Section 104(1) of the Resource Management act, 1991, states:
(1) When considering an application for a resource consent and any submission received, the consent authority must, subject to part 2, have regard to:
(a) any actual and potential effect on the environment of allowing the activity : and
(b) any relevant provisions of –
(i) a national environment standards:
(ii) other regulations:
(iii) a national policy statement:
(v) a regional or proposed regional policy statement
(vi) a plan or proposed plan, and
(c) any other matter the consent authority considers relevant and reasonably necessary to determine the application.

Those matters which are relevant for this application are discussed in the following sections.

Part 2 of the Resource Management Act 1991

This application is consistent with the purpose and the principles of the Act, as set out in Section 5. The proposed activities will have no more than minor adverse effects on the ability of the receiving environment to meet the reasonable foreseeable needs of future generations, or on the life – supporting capacity of the land or any ecosystem associated with it. Proposed consent conditions will ensure that any potential adverse effects of the activities will be avoided, remedied or mitigated.

There are no matters of national importance, as outlined in Section 6 of the Act, that may be affected by the proposed activities. The application is also consistent with Section 7 of the Act, with particular regard given to the maintenance and enhancement of the quality of the environment. With regard to Section 8 of the Act, the proposed activities are not inconsistent with the principles of the Treaty of Waitangi.

Actual and potential effects (Section 104(1)(a))

The actual and potential effects of the proposed activities were considered earlier in the application. Conditions of consent will ensure that any adverse effects are avoided, remedied or mitigated.

Relevant provisions of national policy statement (Section 104(1)(b)(iii)

The policies of the National Policy Statement for Freshwater Management that are relevant to this application are:

Policy A2 Specify targets and implement methods in a way that considers the sources of relevant contaminants to assist the improvement of water quality.

Policy C1 Regional council managing freshwater and land use and development in catchments in an integrated and sustainable way, so as to avoid, remedy or mitigate adverse, including cumulative effects.

Policy D1 Involve iwi/hapu in the management of freshwater, identify tangata whenua values and interests in freshwater, and reflect tangata whenua values in the management of, and decision-making regarding freshwater.

With regard to policies A3 and A4, the Council has set objectives and limits for freshwater under the Regional Water Plan. The discharge in this instance is to land, and conditions are imposed to avoid or minimize effects on water.

Policies B5 and B7 seek to protect the life supporting capacity of the fresh water resources. The Council must have regard to the available allocations of such resources and ensure that consent applications do not cause an adverse effect on the natural variability of flow of any fresh water body. This proposal has discharge to land and best practice for solids and liquid management and will have standard conditions set by Council avoid and minimize effects on water quality. To help maintain the quality of fresh water, low rate spreading, sufficient storage to enable deferred irrigation of storm water during adverse soil conditions will minimize groundwater surface water degradation. The farm management practices integrate well with the freshwater requirements.

Consideration of Te Tangi a Tauira and existing agreements with Te Ao Marama Inc address Objective D1 and Policy D1.

Relevant provisions of the Southland Regional Policy Statement (Section 104(i)(b)(v))

The following policies in the Regional Policy Statement are of particular relevance to this application:

Policy 4.5 In considering resource consents, local authorities shall assess the effects of land use and development on the quality and sustainability of water in water bodies and provide for any adverse effects to be avoided, remedied or mitigated.

Policy 5.4 Utilise land treatment of liquid wastes where this can be undertaken in a sustainable manner and without significant adverse environmental effects.

Policy 5.5 In considering resource consents, local authorities shall assess the effects of land use and development on groundwater and surface water, including both point and non-point source discharges, and provide for any adverse effects to be avoided, remedied or mitigated.

Comment
These provisions seek to avoid or to minimize adverse effects on the Region's water resources and encourage the conservation of water and its efficient allocation and use.

In particular, Policy 5.5 refers to non-point source discharges which may affect water quality which is an important consideration when assessing the potential cumulative effects of intensive grazing.

The proposed activities are not contrary to the Southland Regional Policy Statement as these provide for the proposed activity.

Relevant provisions of the Proposed Southland Regional Policy Statement 2012 (Section 104(1)(b)(v))

The following objectives and policies in the proposed Regional Policy Statement are of particular relevance to this application:

Objective TW.2	provision for iwi management plans
Policy TW.3	Take iwi management plans into account
Objective WQUAL.1	Water quality goals
Policy WQUAL.1	Identify values of surface water and groundwater that should be maintained, and manage discharges and land use activities to maintain or enhance water quality.
Objective WQUAL.2	Lowland water bodies
Policy WQUAL.2	Maintain and enhance water quality by managing activities to reduce the levels of nitrogen and phosphorus, sediment, and microbiological contaminants.
Policy WQUAL.5	Prefer discharges to land over discharge to water.
Objective RURAL.1	Sustainable land use in rural areas
Policy RURAL.1	Use and development of rural resources enables economic, social and cultural wellbeing

Comment
The proposed activity is consistent with water quality policies in maintaining through management of discharges and land use, the existing surface and groundwater quality in the area [WQUAL.1, WQUAL.2, WQUAL.5]. The proposed works meet the Council's preference for discharge to land [WQUAL.5].

Policy TW. Requires that iwi management plans, such as Te Tangi a Tauira, be taken into account.

The proposed activity is partly consistent with water quality objectives and policies of the Proposed Southland Regional Policy Statement in maintaining, through management of discharges and land use, the existing surface and groundwater quality in the area. Proposed mitigation measures include more than adequate liquid storage for deferred irrigation, and low rate irrigation. The farm also uses the preference for discharge to land. The conditions requiring any water quality monitoring will contribute to data already held regarding the region's water resources. The property is within a rural area and an established sheep, beef and dairy grazing and must be considered with regard for environmental, economic, social and cultural values. The new storage pond that will ensure adverse effects on the environment are avoided, remedied, or mitigated.

Relevant provisions of the relevant regional plan objectives, polices and rules (Section104(1)(b)(v))

The objectives and policies of the Regional Water Plan that are relevant to this application have been grouped according to topic:

- **Water qualtity:**

Policy A4 When considering an application for discharge the consent authority must have regard to:
- The extent to which the discharge would avoid contamination that will have an adverse effect on the life-supporting capacity of freshwater, and on the health of people
- Any more than minor adverse effect resulting from the discharge would be avoided

Policy 3 Allow no discharges to surface water bodies that will result in a reduction in water quality

Policy 13 Avoid the point source discharge of raw sewage, foul water and untreated agricultural effluent to water

Policy 25 Adverse effects arising from point and non-point source discharges

- **Land and soil health**

Policy 31A Match the level of management that is required for discharges of contaminants onto or into land to the level of environment risk posed

Policy 31C Manage discharge of contaminants onto land or into land to avoid, remedy or mitigate adverse effects

- **Cultural considerations**

Policy 1.A Take iwi management plans into account

Comment
Consideration of the term of consent is addressed under Policy 43. Policy 43 matches consent duration to the level of environmental risk associated with the activity. Where it is likely that a resource consent will be reapproved in future, the consent duration represents the period that the Council considers the existing conditions will be effective to manage the adverse effects of the activity.

Overall, the proposed activities comply with the above policies. The applicant has proposed mitigation measures for potential adverse effects on the environment arising from the proposed activities. Any other potential adverse will be mitigated through consent conditions, providing the applicant adhere to these.

Relevant provisions of the relevant regional plan objectives, polices and rules (Section104(1)(b)(v))

The objectives and policies of the proposed Southland Water and Land Plan that are relevant to this application have been grouped according to topic:

- **Water quality:**

Objective 1 Integrated management of land and water

Objective 2 Water and land recognized as enabler of wellbeing

Objective 3	Inherent health
Objective 4	Tangata Whenua values and interest
Objective 6	No reduction in the quality of freshwater
Objective 8	Water quality to meet Drinking-Water Standards
Objective 9	Quality of freshwater is managed
Objective 18	All activities operate at good management practice.
Policy 4 – 12	Physiographic zones, avoid, remedy or mitigate
Policy 13	Manage land use activities and discharges
Policy 14	Prefer discharge to land
Policy 15	Maintain and improve water quality
Policy 16	Minimising the environmental effects from farming activities
Policy 17	Avoid adverse effects on water quality Manage effluent systems Maintain and operate effluent systems Avoiding surface run-off/overland flow Avoiding discharge of untreated agricultural effluent to water

Comment

Overall, the proposed activities comply with the above objectives and policies. The applicant has proposed mitigation measures for potential adverse effects on the environment arising from the proposed activities. Any other potential adverse will be mitigated through consent conditions, providing the applicant adhere to these.

Any other matters considered relevant and reasonably necessary to determine the application (Section104(1))

The following policies in Te Tangi a Tauria (iwi management plan) are of particular relevance to this application:

Policy 3.5.1(3)	Discharge of FDE must always require a consent (this is not FDE)
Policy 3.5.1(4)	Sustain and safeguard the life-supporting capacity of soils
Policy 3.5.1(5)	Avoid using high-risk soils for irrigation
Policy 3.5.1(6)	Oppose discharge of FDE to Water
Policy 3.5.1(8)	Require best practice for land application for managing FDE
Policy 3.5.1(11)	Avoid surface run-off, ponding or contamination of water resulting from the application of FDE
Policy 3.5.1(13)	Require buffer zones between discharge areas and waterways
Policy 3.5.1(14)	Require buffer zones between discharge areas and bores of at least 100m
Policy 3.5.1(15)	All spray drift as a product of irrigation of effluent must be managed and contained within the boundaries of the consent area
Policy 3.5.8(1)	Accidental Discovery Protocol
Policy 3.5.11(15)	Avoid the use of rivers as a receiving environment for the discharge of contaminates

Policy 3.5.11(17	Ensure activities in upper catchments have no adverse effects on mahinga kai, water quality and water quantity in lower catchments
Policy 3.5.13(4)	Avoid compromising water quality as a result of water abstraction
Policy 3.5.13(5)	Avoid water as a receiving environment for discharge of contaminates
Policy 3.5.13(6)	Avoid impacts on water as a result of inappropriate discharge to land activities
Policy 3.5.13(11)	Require monitoring of discharge permits to detect non-compliance with consent conditions
Policy 3.5.14(17)	Advocate for duration not exceeding 25 years

Provided the applicant adheres to consent conditions, the adverse effects of the proposed activities should be no more than minor, and will comply with the above policies.

Written approvals

The new storage pond will be built to the west side of the farm and 1.5km from State Highway 6. The neighbours have given their written approvals which are attached. They are McNamee on the south, Baird on the west and Parawa Farmlands Ltd on the north side. The nearest neighbours house is 1800m away.

Effects on the Environment

I have assessed the effects on the environment in terms of each of the resource consents applied for. This is expanded by the letter from e3 Scientific dated 25 September 2017.

Land Use Consent

The new storage pond requires consideration of the following:

- Effects on water quality, including potential for contamination of groundwater and other watercourses, and effects on sources of human drinking water:
- Effects on soil stability in relation to the design, construction and stability of the pond; and
- Odour

Effect on water quality
The storage pond was designed by Civil Tech Ltd and a design review from a CPEng and the design and build process will be signed off by a CPEng.

The pond is more than 50m from any surface water body.

We consider the potential effects on sources of human drinking water to be less than minor considering there are no registered drinking water sites downstream of the pond.

Overall, we consider the potential effects on ground and surface water quality from the pond to be less than minor. The pond was located with very good buffers and the construction methodology will be supervised during construction.

Effects from odour
The run-off storage pond has buffer separation distances as specified and consent conditions will ensure that these are met. These distances are considered sufficient to contain any potential odour effects within the property boundary.

Overall the location will ensure that the potential effects from the existing effluent storage pond will be no more than minor.

Assessment of Environmental Effects

Overview

The storage is to be constructed to hold the organic waste product initially and then any storm water run-off until it can be used to irrigate the compost to keep it moist. The solid organic waste and wood product type material used in the compost will be brought in and mixed and placed in windrows. Any rainfall on this site will run off into the storage pond. If any of this liquid is left after irrigating the compost then it will be pumped to the discharge area or taken and spread by a slurry tanker. The composted material will be screened and spread on the 300ha discharge area which is all land that is cultivated on the farm. There are large buffer areas in the gullies between the spreading area and the flowing and intermittent storm water drains.

With the storage it will be possible to hold off irrigating until there is water holding capacity in the soil.

The Nitrate levels are mostly classed as pristine, pre-european (0.1 – 0.4). The application rate can be as low as 2mm with pulsing and the slurry tanker could be used at 1mm if required. With the irrigating of the compost with water to keep it moist irrigation may not be required as there is 150 days storage. Adherence to the consent conditions will be important.

The property owners are using low depth of application of effluent with a large discharge area for the solids there will be no artificial nitrogen required on the farm.

The application area will be soil tested and application rates designed to optimize the nutrient.

There is one stream through the property and is fenced. There is uncultivated buffers along the intermittent drains. The irrigation and solid spreading areas will have a 20m buffer zone to the waterways and boundaries. The key to both minimizing the risk of nitrate leaching and the efficient use of organic waste material is to match application rates as closely as possible to the agronomic nutrient needs of crops. In this case the nitrogen will be applied when the crops require it in early summer. The minimal quantities of metal is minimised by the binding mechanisms of soil. The material will not be close to waterway, 20m buffers, on land with slopes less than 10 degrees nor when there is heavy rainfall as it will not be able to be incorporated if it was wet. The material is spread on cultivated land with limited natural habitat. It is unlikely that contaminants in organic material will impair the fertility of agricultural soils with balanced application rates. After the first 2 batches of compost it will be fully tested and certification to apply to other properties. The material will be applied to soils with sufficient pH >5.5 and to good soils with minimal sand. The levels of Cadmium are very low and below detection levels. The material close to the highway will be incorporated within the soil and any odour would be less than minor.

The receiving environment will not be to frozen soils, water logged or on snow. The slopes will be less than 10 degrees, have at least 20m buffers to any waterbody and have pH greater than 5.5 and usually 7 to 8. This material is a lot more benign than biosolids.

1. Slope

The discharge areas will be less than 10 degrees.

2. Water quality risks

The water quality will be protected by the ability to store run-off until there is sufficient soil moisture deficit to irrigate with low application rates. Many open drains that run through the property are fenced and vegetated but mostly dry except during heavy rain. The composting pad all slopes to the storage pond for rainfall collection. The application rates are low and spread over a large area. Most of the compost will be incorporated into the soil in a crop paddock or spread on an area that will be fallowed for 8 months prior to mob stocking and

paddock composting. This is where the bulk vegetation growth is mobbed stocked and all the vegetation is composted with the animal waste. This method is mostly used on extensive organic farms.

3. Soil risk/vulnerability factors

The farm has a mix of soils with the Lintley and Wendon soil being low risk and large areas of flat to undulating land. There are no unsuitable soils on the farm. The soils were mapped in the Topoclimate series.

4. Nutrient management

The key to on-going success is to carry out soil testing regularly. Sixty percent of the farm will be used to spread the compost. The aim is to spread a small amount over the large area each year to reduce the use of artificial fertilizer. Once the material is tested after the first two batches, it may be used on other farms.

5. Sensitive areas identification

The permanent streams that runs through the property have been mapped by Environment Southland. There are a number of intermittent gullies that run water after rain. The areas by the streams are well vegetated and fencing may be required in the future. The water from the composting pad will be managed by storage and low application rates to land if required. No irrigation water will reach the drains. All the rainfall may evaporate in this drier climate.

6. Riparian management

The drains that are adjacent to grazed areas are fenced and vegetated with two fully planted. The shed, yards and effluent storage pond are well away from any open drain. The vegetation within the open drains will tend to trap any sediment when they flow.

7. Soil disturbance/earthworks

The pond and pad construction are more than 50m to the nearest waterway and the material used in the construction will be clay and stone which will not cause sediment to reach the waterway.

8. Runoff

Low application rates are used and all the drains have vegetation cover.

Good Management Practices

The following good management practises are undertaken.

Nutrient Management	Soil testing carried out and fertiliser levels kept at optimum levels Record all liquid and fertilizer spreading
Riparian Management	All riparian areas are vegetated
Liquid Management	Using low levels of liquid spreading over 60% of the farm Optimse the use of P and K

Oxidising – artificial drainage

Protect soil structure, particularly in gullies	Avoid pugging pastures and repair bare areas keep cultivation at correct distances from riparian areas

Reducing phosphorus use and loss	Keep Olsen P levels at optimum or less Maintain buffer zones
Reduce the accumulation of surplus nitrogen in the soil particularly during autumn and winter	The compost will provide the only nitrogen used Re-sow bare or pugged areas of soil
Avoid preferential flow of liquid through drains	Only irrigate when there is sufficient soil moisture deficit Apply liquid at low rates Have sufficient liquid storage
Capture contaminants at drainage Outflows	Identify critical source areas Review riparian areas and increase if necessary

Physoigraphic Zone – Bedrock/Hill Country

Protect soil structure, particularly in gullies	Avoid pugging pastures and repair bare areas Keep cultivation at correct distances from riparian areas
Reducing phosphorus use and loss	Keep Olsen P levels at optimum or less Maintain buffer zones
Reduce the accumulation of surplus nitrogen in the soil particularly during autumn and winter	The compost will provide the only nitrogen used Re-sow bare or pugged areas of soil
Avoid preferential flow of effluent through drains	Only irrigate when there is sufficient soil moisture deficit Apply liquid at low rates Have sufficient liquid storage
Capture contaminants at drainage Outflows	Identify critical source areas Review riparian areas and increase if necessary
Managing critical source areas	Identifying these areas and fencing or including settlement traps

Physoigraphic Zone – Gleyed – artificial drainage

Protect soil structure, particularly in gullies	Avoid pugging pastures and repair bare areas Keep cultivation at correct distances from riparian areas
Reducing phosphorus use and loss	Keep Olsen P levels at optimum or less Maintain buffer zones
Reduce the accumulation of surplus nitrogen in the soil particularly during autumn and winter	The compost will provide the only nitrogen used Re-sow bare or pugged areas of soil
Avoid preferential flow of effluent through drains	Only irrigate when there is sufficient soil moisture deficit Apply liquid at low rates Have sufficient liquid storage
Capture contaminants at drainage Outflows	Identify critical source areas Review riparian areas and increase if necessary

Managing critical source areas	Identifying these areas and fencing or including settlement traps

Physoigraphic Zone – Lignite/Marine Terraces

Protect soil structure, particularly in gullies	Avoid pugging pastures and repair bare areas Keep cultivation at correct distances from riparian areas
Reducing phosphorus use and loss	Keep Olsen P levels at optimum or less Maintain buffer zones
Reduce the accumulation of surplus nitrogen in the soil particularly during autumn and winter	The compost will provide the only nitrogen used Re-sow bare or pugged areas of soil
Avoid preferential flow of effluent through drains	Only irrigate when there is sufficient soil moisture deficit Apply liquid at low rates Have sufficient liquid storage
Capture contaminants at drainage Outflows Managing critical source areas	Identify critical source areas Review riparian areas and increase if necessary Identifying these areas and fencing or including settlement traps

INFRASTRUCTURE LOCATION

Design and Construction Checklist

Kerr Inverurie Trust
Parawa
Athol Five Rivers Highway SH 6 Pt Sec 25 Eyre SD

Pond Volume

Volume required	1,600m3
Required by Discharge Permit	Volume calculated by Massey pond calculator
Freeboard	500mm
Minimum batter slope	2:1
Liquid depth	2.5m

Composting Pad Infrastructure
Rainfall on the composting pad will be directed to the storage pond by shallow swale drains.

Climate data	963/mm/year Five Rivers
Land application area	300 hectares solids, 40 hectares liquid
Soil types	Pukemutua (high risk)
Catchment areas	217 ha high risk
Water volumes	Rainfall only. Rainfall used to irrigate compost.
Effluent irrigation	Low application pods, rain gun, travelling irrigator, slurry tanker and umbilical system to a maximum depth of 25mm at 10mm/hour
Pond volume	1,600m3

All the organic waste product mixed with equal parts of wood chip, wood shavings, sawdust, straw and recycled compost will be placed on the composting pad. The rainfall will flow down the pad to be captured in the storage pond. The compost will be irrigated to keep it moist. The excess storm water will be pumped to the liquid discharge area and the compost will be spread on the solids discharge area. The storage pond will be built to hold the storm water and initially the organic waste product.

Geotechnical Assessment

There are two small quarries in the pond area. The material, in which the pond will be built after the topsoil is stripped, is yellow clayey silt and broken rock. The site slopes gently to the north east. The pond will be excavated below the surface and the excavated material used to build the walls. The clayey silt and rock is stable with good construction qualities when built in thin layers at optimum moisture content. The construction material is competent clayey silt and rock. The base of the pond will be above the ground water level but a subsoil system is to installed check for leaks in the future.

Hydrological Assessment

The pond is to be built into the rock layer. There is no sign of ground water in the quarries. The pond will be constructed of original material and built above the water table. There will be no hydrostatic pressure on the pond when empty. The pond will have a geotextile and 1.5mm synthetic liner with subsoil drainage in the base of the pond that will drain to the south east corner.

Design

Bank protection	Synthetic liner
Batter slope	2:1
Protection of storage pond at entry from pipe	Synthetic liner – double thickness
Fence requirement included in plans and specification	

Construction
McDowall Transport Ltd
Equipment used
20 tonne excavator
10 tonne roller

Construction sequence	Strip topsoil
	Construct keyways and roll in layers
	Build walls in layers with rolling
	Shape walls and top of wall to outside
	Install subsoil drainage and inspection chamber
	Install synthetic liner
	Place topsoil around outside wall, landscape and sow
	Install pipework and fence

On site testing
On site to set out pond. After topsoil is stripped check site for any previous disturbance of the site materials and probe and take Scala penetrometer reading of existing clay layer if there is not stone present. Check keyway construction and carry out proof rolling during keyway filling to determine optimum number of passes. Take Scala of completed compaction if possible. Take NDMs of layers if required. Visit site every 2 days if one excavator operating, more if another operating. On each visit record: date, time, weather, machinery on site, what was inspected (what they were doing or had completed and location). Any instruction given, if photographs were taken (always), anything to follow up on next visit and any variation required. The last inspection will be on completion of the earthworks component prior to the liner being installed.

The plans and specification including the construction methods and liner material will achieve a leakage rate low enough to avoid environmental contamination. The floor level will be above the height of the water table. Protection and maintenance of the pond and liner will be provided for by the owner. All consent conditions for the pond will be met.

The pond liner will have a 20 year warranty on the liner material and 5 year warranty on workmanship.

Monitoring
Check pond level as required.
Check the liner for any signs of wear or tear.
Check the inspection chamber monthly

The subsoil drainage system under the pond is for leak detection.

I used the Massey pond calculator which gave a 90%ile requirement of 1,503 but consider that the data in 1984 and 1985 is suspect. The water that is irrigated over the compost will evaporate and during summer this may drain the pond. If the site is irrigated with 4 - 5mm of water per day it will use 15m3 of water.

The 1.5mm HDPE liner will be completely suitable as it is for dairy effluent. As in all effluent ponds the liner has a geotextile fabric to protect it from any stone or rock. None of the chemical used in the processing are present and are washed out but the HDPE will cope with those chemicals. It has high resistance to mechanical, chemical and UV radiation and is used under most landfill in New Zealand.

e3 Scientific

25 September 2017
Kerr Inverurie Trust
966 Athol Fiver Rivers Highway
Parawa
Southland

Dear Cameron,

RE: Discharge of skutch and associated leachate to land consent application – 966 Athol Five Rivers Highway, Parawa

1 Introduction

On behalf of the Kerr Inverurie Trust (KIT), Civil Tech Limited (CTL) lodged a resource consent application with the Southland Regional Council (SRC) in February 2017 to support the storage, composting and discharge of 'Skutch' compost onto the KIT farm located at 966 Athol Five Rivers Highway, Parawa. The application also sought the construction of an effluent pond designed to capture leachate from the composting skutch.

In April 2017, SRC returned the consent application to CTL. The SRC correspondence (SRC ref: APP-20171173) considered the application was incomplete and did not contain the necessary information required to satisfy the 4th Schedule of the Resource Management Act (RMA), the Regional Water Plan for Southland and the proposed Southland Water and Land Plan. The correspondence cited four key matters that required further detailed information. These included:

1. A consideration of possible alternatives for the disposal of the 'Skutch'.
2. CPEng sign off for the design and construction sign off of the proposed effluent pond.

3. Detailed characterisation of the 'Skutch' material and the leachate coming off the composted material to better quantify the environment risks associated with the storage, composting and application of the waste material.
4. Based on the characterisation of 'Skutch' material provide further consideration of Part 2 of the RMA and against relevant objectives, policies and rules contained in any relevant National Environment Standard; National Policy Statement; Regional Policy Statement and Regional Plan.

To address the information requested by the SRC, KIT engaged e3Scientific Limited (e3s) to complete further detailed assessment of the Skutch material. The letter report sets out the findings of the assessment and provides all of the information sought by the SRC.

2 Consideration of Possible Alternatives

e3s understands approximately 550 tonnes of skutch compost material is stockpiled in Southland with 400 tonnes stored at the McDowall Rural Services yard located at 1465 Limehill Browns Road and 150 tonnes stockpiled on the KIT farm in Parawa.

As set out in the CTL consent application the raw skutch material was sourced from the Gelita Plant in Rangiora with the specific objective of composting the material for application onto KIT paddocks. Should KIT not obtain consent for the storage and discharge of the material onto the farm the only viable alternative will be disposal to a landfill facility such as the AB Lime Class A landfill facility in Winton. Disposal fees of the compost material to AB Lime could be up to $200 per tonne. Disposal costs alone to AB Lime for 550 tonnes of the skutch compost may be on the order of $100,000.

Given the costs of the disposal of the skutch and the value of the product as a fertiliser and soil conditioner for the KIT farm, the preferred management option of the material is to advance the use of the product as set out in the CTL consent application.

3 CPEng Sign Off

e3s understands CTL has submitted information to the SRC regarding CPEng sign off for the design of the effluent disposal pond. No further information regarding this item is provided herein.

4 Characterisation of the Skutch Raw Product, Compost and Leachate

4.1 Raw Product and Composted Skutch – Total Concentrations

The CTL consent application describes the origin of the skutch product and details the materials used to support the composting process. Gelita has also provided information in a letter dated 20 March 2017 detailing Gelita processes which result in the production of the skutch waste product (see Attachment 1). e3s understands skutch is essentially spent cow hide once the hair and collagen from the cow face has been removed.

The skutch waste product has been analysed a number of times by Gelita in Australia to support a composting operation on their site in Beaudesert, Queensland. Table 1 presents laboratory analysis undertaken by Gelita on the raw product in 2009 along with analysis of two samples collected from the composting plant. Table 1 also presents the analysis from a further three samples collected from the stockpile at the McDowall Rural Services site in Winton. e3s understands the three samples included one sample of the raw skutch waste, one skutch sample composted with sawdust and a third sample consisting of a composted skutch and bark mix. The laboratory certificates for the two Gelita samples collected in 2016 and the three samples collected from McDowall Rural Services in 2017 are provided in Attached 2. Please note we do not have the laboratory certificate for the sample analysed by SGS Laboratories in 2009.

e3s has adopted two reference guidelines for the purpose of this assessment. The reference guidelines are useful to provide some context to the analytical results and are discussed below.

4.1.1 Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health.

The Canadian Soil Quality Guideline (SQG) provides risk based guideline values for agricultural landuse activities. Among other things, the guidelines are designed to protect stock from the ingestion of soil and pasture and people consuming produce. We note New Zealand has not produced risk based guidelines for an agricultural landuse scenario. Given KIT proposes to apply composted skutch to paddocks on the farm it, e3s considers the Canadian SQG for the agricultural landuse scenario is a useful reference for the analytical data.

4.1.2 Background Levels for Southern New Zealand

Background levels for agricultural soils in Southern New Zealand have been provided as reference values for the heavy metals in the skutch compost. The rationale for providing an indication of background levels is to consider if the heavy metals in compost are above background levels and if the application of composted material could result in the accumulations at levels that could present a risk to stock.

4.1.3 Analytical Results

The analytical results for six samples representing the raw skutch product and composted material are presented in Table 1. The laboratory certificates are provided in Attachment 2. The results are summarised as follows:

- The pH of the raw product is acidic with a pH of 4.01 and 4.3 but is more neutral in the four compost samples with pH ranging between 6.5 in the Sawdust Mix sample and 7.78 in the Lanfax compost analysis;
- The nitrogen level detected in the SGS analysis in the raw product of 10% is elevated above the compost samples and the raw material (collected from McDowalls Rural Services) which ranges between 1 and 3%;
- The TP levels range between 0.054% in the raw material sample collected from McDowalls Rural Services to 0.371 in the compost sample collected from the Gelita Beaudesert plant in Queensland. The TP levels are relatively consistent between the raw product analysed by SGS and the compost samples collected from Gelita Beaudesert and McDowalls Rural Services;
- Boron levels detected range from 4 mg/kg in the Saw Dust Mix sample to 36 mg/kg in one of the Gelita Beaudesert samples. All boron results exceed the adopted SQG of 2 mg/kg;

- Arsenic, copper, mercury, lead, nickel and zinc levels in all compost samples are within the background range as reported by Adam *et. al.* (2017);
- Arsenic mercury lead and zinc levels are below the adopted SQG in the four compost samples;
- Cadmium is elevated above background levels and the adopted SQG in the bark mix compost sample. This result is anomalous with the other three samples where cadmium was reported below laboratory detection limits. This may indicate a sampling issue or fertiliser may have migrated into the bark mix stockpile; and
- Chromium is elevated above background levels and the adopted SQG in the bark mix compost sample. As with the cadmium, this may be the result of fertiliser migrating into the bark mix. This view is supported by the elevated levels of heavy metals in the bark mix sample compared to the sawdust sample.

In summary, the results of the analysis on the raw skutch and compost show the skutch has a high nitrogen level which has been diluted when composted at both the Beaudesert site is Queensland and the McDowalls site in Winton. Furthermore, the acidity of the skutch is neutralised during the composting process. The raw skutch material appears to contain levels of copper and zinc that are in the range of background pastoral soils and can be slightly above the adopted SQG for agricultural landuse. Elevated levels of cadmium, chromium and copper in the bark mix are most likely associated with migration of additional materials into the stockpile such as a fertiliser.

The effects of the heavy metals upon application of compost to paddocks is discussed in section 5.

Table 1 Raw Skutch And Composted Skutch Analytical Results

Analyte	Client	Gelita Australia Pty Ltd	Gelita Australia Pty Ltd	Gelita Australia Pty Ltd	McDowalls RS	McDowalls RS	McDowalls RS	Reference Guidelines	
	Laboratory	SGS Laboratories	Lanfax, NSW	Lanfax, NSW	Eurofins	Eurofins	Eurofins	Typical pastoral background - Range reported with median in brackets [1]	CCME SQG [2]
	Sample Name	Skutch	-	-	Raw Material	Saw Dust Mix	Bark Mix		
	Sample Type	Raw Product	Compost	Compost	Raw Material	Compost	Compost		
	Date Sampled	12-Nov-09	2-Nov-16	2-Aug-16	10-May-17	26-May-17	26-May-17		
	Units								
pH		4.01	7.78	7.57	4.3	6.5	7.3	-	-
Electrical conductivity	mS/cm	2.77	9.32	10.32	2.2	-	-	-	-
Moisture (%)	%	67.1	37.2	49.4	60.7	-	-	-	-
Organic Matter	%	-	-	-	-	89	21.3	-	-
Organic Carbon	%	53.9	17.6	18.6	-			-	-
Total Organic Carbon	%	-	20.2	22.1	25.3	51.6	12.3	-	-
Nitrate	mg/kg	-	116	214	10	30	50	-	-
Ammonium (NH4-N)	mg/kg	-	3854	4695	30	1000	50	-	-
Nitrogen	%	10	2.07	2.72	2.9	2.51	1.09	-	-
Phosphorus (total)	%	0.31	0.371	0.294	0.054	0.25	0.25	-	-
C:N ratio	ratio	5:4	9.6:1	8.1:1	8:9	20:6	11:3	-	-
Chloride (soluble)	%	-	0.384	0.445	0.009	-	-	-	-
Calcium	%	-	3.98	3.10	-	2.47	1.72	-	-
Iron	%	-	1.90	1.83	-	<0.0001	0.0004	-	-
Potassium	%	0.01	0.290	0.338	0.004	0.03	0.47	-	-
Magnesium	%	-	0.237	0.266	-	0.03	0.63	-	-
Manganese	mg/kg	-	363	278	-	469	930	-	-
Sodium	%	0.03	0.357	0.319	0.017	0.12	0.06	-	-
Sulphur (total)	%	2.2	1.66	1.37	0.598	0.73	0.29	-	-
Boron	mg/kg	-	45	36	-	4	13	-	2
Cobalt	mg/kg	-	-	-	-	<2	10	-	40
Molybdenum	mg/kg	-	-	-	-	3	<2	-	5
Aluminium	%	-	0.397	0.490	-	-	-	-	-
Arsenic	mg/kg	-	-	-	-	1.1	5.6	0.4-10.9 (3.8)	12
Cadmium	mg/kg	-	<0.001	<0.001	-	<1	2	0.005 - 1.31 (0.1)	1.4
Chromium	mg/kg	-	-	-	-	49	256	3.7 - 72 (13.3)	64
Copper	mg/kg	-	75	64	-	90	140	2.4-179 (11.7)	63
Mercury	mg/kg	-	-	-	-	<0.1	<0.1	0.011 - 0.2234 (0.058)	6.6
Nickel	mg/kg	-	-	-	-	19	111	1- 278 (7.8)	45
Lead	mg/kg	-	-	-	-	1.3	12.1	3 - 449 (10.6)	70
Zinc	mg/kg	-	206	180	-	103	156	7.5 - 203 (50.7)	200

Notes:
Blue shading denotes exceedence of Canadian Soil Quality Guideline for protection of Agricultural landuse including grazing of stock
Bold text denotes exceedence of pastoral background levels
[1] Typical median background levels in Southern New Zealand pastoral soils (Martin et. al., 2017)
[2] CanadianSoil Quality Guidelines - Agricultura Landuse

4.2 Leachate Analysis

To characterise the leachability and mobility of nutrients and contaminants within the raw skutch and composted skutch, e3s collected four samples from the stockpile located at the KIT farm and submitted the samples to Eurofins for leachate (SPLP) analysis. In addition, the Gelita Environmental Process Engineer collected a sample of the raw skutch product from their site in Christchurch and couriered the product to the laboratory.

For the purpose of this assessment e3s has adopted water quality guidelines for the protection of freshwater ecological values. Freshwater ecological values are considered to be the key environmental receptor on the KIT property with a number of waterways present on the farm. The following freshwater ecological guidelines have been adopted for the assessment:

- ANZECC Freshwater and Marine Guidelines for the protection of 95% of species
- National Policy Statement for Freshwater Management – 99% species protection

In addition to the freshwater guidelines e3s has also considered irrigation guidelines for nutrients and heavy metals given effluent may be irrigated onto pastures. The following irrigation guideline has been adopted for the assessment:

- ANZECC Freshwater and Marine Guidelines – Long term irrigation guideline.

4.2.1 Leachate Analytical Results

The leachate analytical results are presented Table 2 and the laboratory certificates are provided in Attachment 1. The results are summarised as follows:

- The pH of the compost leachate results (S1-S4) are consistent and neutral with the raw product slightly acidic with a pH of 6.2;
- The TN levels in the leachate analysis range from 5.84 mg/L to 109 mg/L and in all cases significantly exceed the ANZECC guideline for protection of 95% of species and the ANZECC long term irrigation trigger value;
- Ammonia Nitrogen levels are consistent with the TN levels in all compost samples (S1-S4) indicating ammonia is the dominant form of nitrogen in the leachate; Ammonia Nitrogen is approximately 35% of the TN in the skutch raw product sample. This indicates the composting process is converting organic nitrogen to Ammonia Nitrogen;

- The TP levels in the leachate analysis range from 0.161 mg/L to 3.02 mg/L and in all cases, exceed the ANZECC guideline for protection of 95% of species and the ANZECC long term irrigation trigger value;
- BOD levels in the leachate analysis are elevated in the raw skutch sample and in S1 and S4 while the levels in S2 and S3 low. The variability in the BOD levels across the five samples is consistent with the variability in nitrogen and conductivity;
- The conductivity of the leachate varies considerable across the five samples ranging from 7.8 mS/m in S2 to 73.1 in S4. The raw skutch sample and S1 and S4 are elevated compared to samples S2 and S3; Nitrogen appears to the be the dominant element controlling the conductivity of the leachate;
- Chloride levels range from 0.25 mg/L in S2 to 11.5 mg/L in the raw skutch. In all cases the chloride levels exceed the ANZECC guideline for protection of 95% of species;
- The sodium and chloride levels in the raw skutch are elevated above compost samples S1-S4 indicating the composting of the material has diluted the salinity level of the raw product;
- Arsenic, cadmium, chromium, lead and nickel concentrations in all samples analysed are below ANZECC guidelines for protection of 95% of species;
- Copper levels consistently exceed the ANZECC guidelines for protection of 95% of species in compost samples S1-S4 but are below the laboratory limit of detection in the skutch sample. This result indicates the source of the copper is in the wood chip/sawdust and bark mixed with the raw skutch;
- Zinc levels consistently exceed the ANZECC guidelines for protection of 95% of species in all samples analysed;
- All heavy metal levels detected in the leachate are below the ANZECC long term irrigation trigger values.

In summary, the leachate analysis shows that the raw product and the composted material contain high levels of nitrogen, phosphorus and chloride that could present a risk to waterways. Management of the leachate will be necessary to mitigate the risk of leachate entering waterways and disturbing freshwater ecosystems. Management of the product is detailed in section 5 of this report.

Table 2 SPLP Analytical Results – All results in mg/L unless otherwise stated

Analyte	Sample Name					Reference Guidelines			
	Skutch Raw Product	S1	S2	S3	S4	ANZECC 95%[1]	ANZECC Irrigation Guidelines[2]	NPS[3]	Class B LAC[4]
pH	6.2	7.4	6.9	7.1	7	7.2-7.8	-	-	-
Conductivity at 25°C - mS/m	66.2	65.4	7.8	9.4	73.1	-	-	-	-
Total Nitrogen	**78.8**	**84.7**	**5.84**	**6.65**	**109**	0.614	5	-	-
Total Kjeldahl Nitrogen	86.6	83.6	5.2	6.4	112	-	-	-	-
Nitrite Nitrate Nitrogen	0.026	<0.005	<0.005	0.045	<0.005	0.444	-	<1.0	-
Ammonia Nitrogen	**29.1**	**81.6**	**4.62**	**4.98**	**92.9**	0.9	-	-	-
Dissolved Reactive Phosphorus	1.26	0.171	0.22	0.064	2.31	0.01	-	-	-
Total Phosphorus	**1.5**	**0.33**	**0.308**	**0.161**	**3.02**	0.033	0.05	-	-
BOD5 - Total	492	452	7	<6	714	-	-	-	-
Sodium - Acid Soluble by OES	13.8	3.18	1.93	3.54	3.99	-	-	-	-
Sodium Adsorption Ratio	0.496	0.735	0.209	0.394	2.01	-	-	-	-
Chloride	11.5	1.51	0.25	2.69	0.98	0.003	-	-	-
Calcium - Acid Soluble by OES	58.1	1.01	5.73	5.59	0.24	-	-	-	-
Magnesium - Acid Soluble by OES	0.49	0.25	0.44	0.32	0.03	-	-	-	-
Arsenic	< 0.001	0.004	0.002	0.003	0.001	0.024	0.1	-	0.5
Cadmium	< 0.001	<0.001	<0.001	<0.001	<0.001	0.0002	0.01	-	0.1
Chromium	< 0.001	<0.001	<0.001	<0.001	0.001	0.001	0.1	-	0.5
Copper	< 0.001	0.012	0.003	0.005	0.006	0.0014	0.2	-	0.5
Lead	< 0.001	0.001	<0.001	<0.001	<0.001	0.0034	2	-	0.5
Nickel	< 0.001	0.002	<0.001	<0.001	0.002	0.011	0.2	-	1
Zinc	0.04	0.081	0.097	0.116	0.053	0.008	2	-	1

Notes:

Blue shading denotes exceedence of ANZECC guideline for 95% level of protection

Bold text denotes exceedence of ANZECC long term irrigation guideline

[1] Australian and New Zealand Guidelines for Fresh and Marine Water Quality - 95% level of protection

[2] Australian and New Zealand Guidelines for Fresh and Marine Water Quality - Long term trigger values in irrigation water

[3] National Policy Statement for Freshwater Management - 99% species protection level

[4] MfE Class B Landfill Acceptance Criteria (TLCP)

5 Assessment of Environmental Effects

The following section examines the effects of the application of the skutch compost to soil quality and the risk to freshwater ecology values associated with the stockpiling, composting of the skutch compost and subsequent application to land.

5.1 Soil Quality

To understand the effect of the discharge of the skutch waste to soil e3s has examined the loading rate of the skutch compost based on a TN application rate of 100 kg/ha/year. Based on a TN concentration in compost of 3% the application of skutch compost would be at a rate of approximately 3 tonne/ha/year. Table 3 below presents median heavy metal concentrations in soil and uses the concentrations in the bark mix to determine what the effect on soil heavy metal levels will be at a rate of 3 tonne per hectare. The assessment approach uses the top 10 cm of soil only and assumes background levels are consistent through this portion of the soil.

The calculations presented in Table 3 show the effect of applying skutch compost to the soils range from 0.2% for lead to 4% for cadmium. The percentage change in soil concentrations of heavy metals is very low and will be almost undetectable. The reason for the very low change is due to low volume of skutch compost proposed for application onto the farm.

e3s concludes that while some heavy metal levels are elevated in the skutch the application rates will result in minimal changes to current background concentrations. Given the low impact to soil quality it is highly unlikely the application of the skutch waste would result in an impact to stock.

Table 3: Application of skutch composts effect on heavy metal concentrations in soils (based on application rate of 3 tonne/ha)

Analyte	Background Median Concentrations (mg/kg)	Background Mass (mg/ha)[1]	Skutch Concentrations (mg/kg)	Total Mass (mg/3 tonne)	Total Mass (mg/ha)	Percent Increase	Expected Total Concentrations (mg/kg)
Arsenic	3.8	5700000	5.6	16800	5716800	0.3	3.8
Cadmium	0.1	150000	2.0	6000	156000	4.0	0.1
Chromium	13.3	19950000	256.0	768000	20718000	3.8	13.8
Copper	11.7	17550000	140.0	420000	17970000	2.3	12.0
Mercury	0.1	87000	0.1	300	87300	0.3	0.1
Nickel	7.8	11700000	111.0	333000	12033000	2.8	8.0
Lead	10.6	15900000	12.1	36300	15936300	0.2	10.6
Zinc	50.7	76050000	156.0	468000	76518000	0.6	51.0

Notes:
[1]Background mass based on a soil depth of 10 cm which approximates to 1500 tonne (or 1,500,000 kg) soil (based on 1000 m3 * 1.5)

5.2 Freshwater Ecological Values

The leachate analysis found elevated levels of nutrients, particularly total nitrogen and ammonia above the adopted SQG. Chloride, copper and zinc were also at levels exceeding the adopted SQG.

Leachate will result from the stockpiling and composting of the skutch material. Leachate will also occur from the compost discharged onto paddocks.

5.2.1 Risk Associated with the Storage Pond

The CTL consent application sets out a proposal for the construction of a composting area on the KIT farm and a leachate collection pond. Figure 1 shows the location of the composting area. e3s understands the leachate from the composting pad will be collected in holding pond and irrigated back onto the skutch compost. The composting pad is located approximately 400 metres to the west of the tributary of the Parawa Stream. Providing the composting pad and leachate holding pond are operated appropriately the risk of leachate loss to surface water bodies appears to be low.

5.2.2 Risk Associated with Application of Skutch Compost to Paddocks

There is a risk that the application of the skutch compost to paddocks will result in runoff that could enter waterways and effect freshwater ecological values. e3s understands this risk will be mitigated by only applying the compost in Spring and Summer. Further, KIT advises that waterways in the vicinity of paddocks are fenced off and a buffer zone of 10 metres from all waterways excluding the application of the compost will be maintained.

5.3 Summary of Environmental Effects

In summary, e3s has identified that there are a number of environmental risks associated with the storage, composting and discharge of the skutch compost. However, we consider the risks can be appropriately managed through the construction of an appropriately designed compost and leachate pond, limiting the application the TN application of the product to 100 kg/ha/yr and maintaining buffer zones of 10 metres to any waterways.

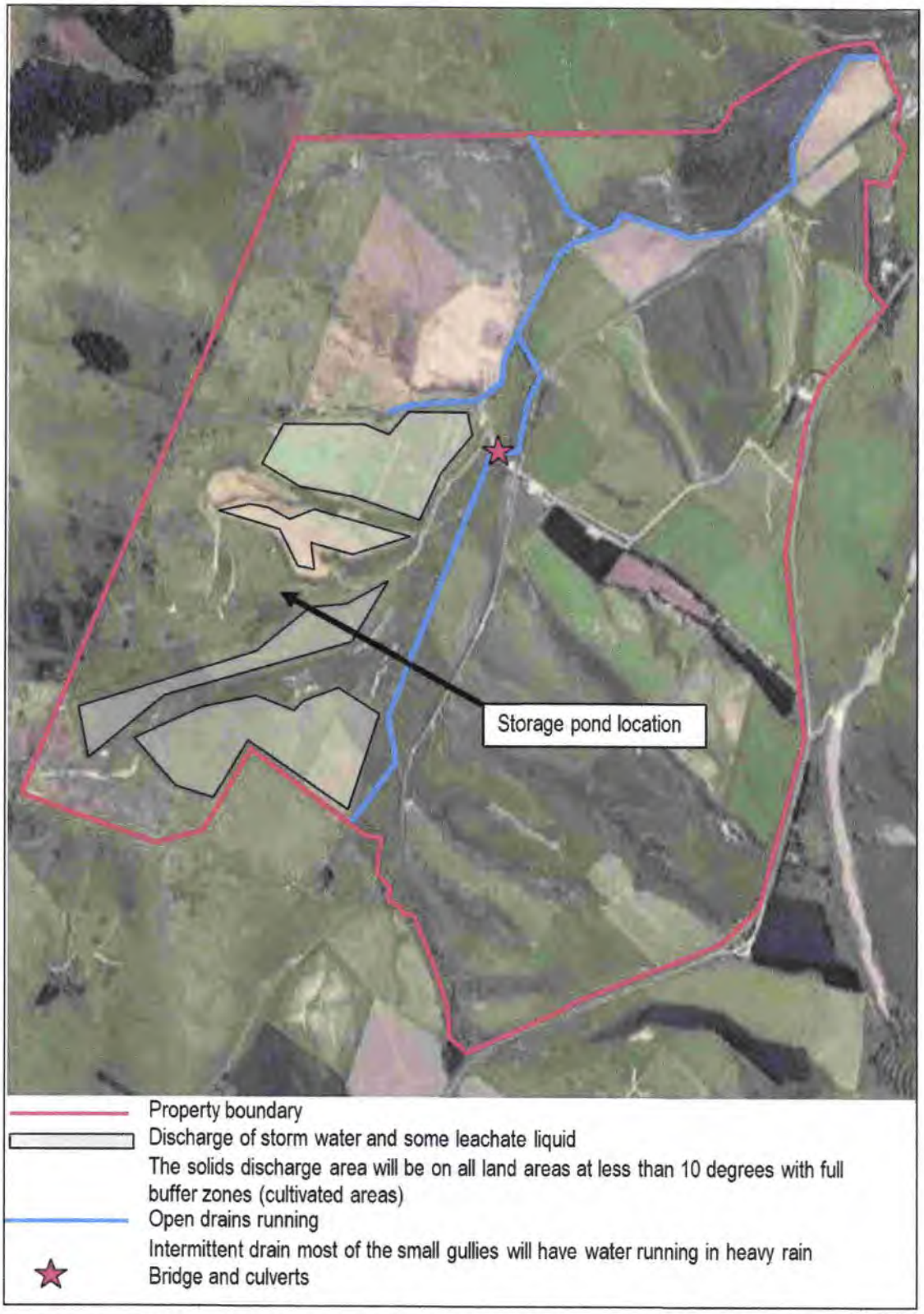


Figure 1: Location of storage pond and composting pad (taken from CTL application)

6 Statutory Review

This section provides a review of the information provided in the CTL consent application regarding Part 2 matters of the RMA and relevant objectives, policies and rules contained in NES, NPS, Regional Policy Statements and Regional Plans.

6.1 Part 2 Matters of the RMA

The CTL consent application provides the following comments on the Part 2 Matters of the RMA:

> *This application is consistent with the purpose and the principles of the Act, as set out in Section 5. The proposed activities will have no more than minor adverse effects on the ability of the receiving environment to meet the reasonable foreseeable needs of future generations, or on the life – supporting capacity of the land or any ecosystem associated with it. Proposed consent conditions will ensure that any potential adverse effects of the activities will be avoided, remedied or mitigated.*
>
> *There are no matters of national importance, as outlined in Section 6 of the Act, that may be affected by the proposed activities. The application is also consistent with Section 7 of the Act, with particular regard given to the maintenance and enhancement of the quality of the environment. With regard to Section 8 of the Act, the proposed activities are not inconsistent with the principles of the Treaty of Waitangi.*

e3s agrees with CTLs review of Part 2 matters. As discussed in section 5 of this report, the application of skutch compost onto the KIT farm will have a minimal effect on heavy metal concentrations in soils. Heavy metal levels will remain consistent with agricultural soils in southern New Zealand. Nitrogen loading rates will also be consistent with the permitted levels in the SRC RWP.

The stockpiling and composting of the skutch material will result in a leachate elevated in nitrogen and phosphorus that is a risk to groundwater, surface water quality and freshwater ecological values. e3s understands the compost pad and leachate holding pond can adequately contain leachate produced from storage of the skutch product and can therefore mitigate the risk the potential loss of leachate to sensitive receptors. Furthermore, the skutch compost will be

stored away from any surface water features with the nearest waterway approximately 400 metres to the east of the storage site.

6.2 National Policy Statement on Freshwater Management

Further to the CTL assessment of the NPS e3s considers the following water quality objectives are relevant to the application:

Objective A1 To safeguard:
a) the life-supporting capacity, ecosystem processes and indigenous species including their associated ecosystems, of fresh water; and
b) the health of people and communities, as affected by contact with fresh water; in sustainably managing the use and development of land, and of discharges of contaminants.

Objective A2 The overall quality of fresh water within a freshwater management unit is maintained or improved while:
a) protecting the significant values of outstanding freshwater bodies;
b) protecting the significant values of wetlands; and
c) improving the quality of fresh water in water bodies that have been degraded by human activities to the point of being over-allocated.

Objective A3 The quality of fresh water within a freshwater management unit is improved so it is suitable for primary contact more often, unless:
a) regional targets established under Policy A6(b) have been achieved; or
b) naturally occurring processes mean further improvement is not possible.

Objective A4 To enable communities to provide for their economic well-being, including productive economic opportunities, in sustainably managing freshwater quality, within limits.

As discussed in section 5 of this report, the storage, composting and application of the skutch compost can be managed such that there will be no measurable effect on soil quality or water quality. The application can therefore be managed in accordance with objectives A1- A4 of the NPS.

6.3 Relevant Provisions of the Southland Regional Policy Statement

The CTL application has identified the following relevant policies in the Southland Regional Policy Statement:

Policy 4.5 In considering resource consents, local authorities shall assess the effects of land use and development on the quality and sustainability of water in water bodies and provide for any adverse effects to be avoided, remedied or mitigated.

Policy 5.4 Utilise land treatment of liquid wastes where this can be undertaken in a sustainable manner and without significant adverse environmental effects.

Policy 5.5 In considering resource consents, local authorities shall assess the effects of land use and development on groundwater and surface water, including both point and non-point source discharges, and provide for any adverse effects to be avoided, remedied or mitigated.

6.3.1 Commentary

CTL comments on these policies are set out below:

These provisions seek to avoid or to minimize adverse effects on the Region's water resources and encourage the conservation of water and its efficient allocation and use. In particular, Policy 5.5 refers to non-point source discharges which may affect water quality which is an important consideration when assessing the potential cumulative effects of intensive grazing. The proposed activities are not contrary to the Southland Regional Policy Statement as these provide for the proposed activity.

e3s concurs with CTLs comments. Importantly, the nitrogen loading rates associated with the application are below 150 kg/ha/yr and the effect on heavy metals in soils will be minimal given the low application rates of the skutch compost. Providing the compost storage pad and leachate holding pond are constructed appropriately there should be no point source loss of leachate to either groundwater or surface waters.

6.4 Relevant Provisions of the proposed Southland Regional Policy Statement

The following objectives and policies in the proposed Regional Policy Statement are of particular relevance to this application:

Objective TW.2 *provision for iwi management plans*

Policy TW.3 *Take iwi management plans into account*

Objective WQUAL.1 Water quality goals

Policy WQUAL.1 *Identify values of surface water and groundwater that should be maintained, and manage discharges and land use activities to maintain or enhance water quality.*

Objective WQUAL.2 Lowland water bodies

Policy WQUAL.2 *Maintain and enhance water quality by managing activities to reduce the levels of nitrogen and phosphorus, sediment, and microbiological contaminants.*

Policy WQUAL.5 *Prefer discharges to land over discharge to water.*

Objective WQUAL.1 Sustainably managing the region's water resources

Objective RURAL.1 Sustainable land use in rural areas

Policy RURAL.1 *Use and development of rural resources enables economic, social and cultural wellbeing*

6.4.1 Commentary

CTLs commentary on the above objectives and policies is set out below:

The proposed activity is consistent with water quality policies in maintaining through management of discharges and land use, the existing surface and groundwater quality in the area [WQUAL.1, WQUAL.2, WQUAL.5]. The proposed works meet the Council's preference for discharge to land [WQUAL.5].

Policy TW. Requires that iwi management plans, such as Te Tangi a Tauira, be taken into account.

The proposed activity is partly consistent with water quality objectives and policies of the Proposed Southland Regional Policy Statement in maintaining, through management of discharges and land use, the existing surface and groundwater quality in the area. Proposed mitigation measures include more than adequate liquid storage for deferred irrigation, and low rate irrigation. The farm also uses the preference for discharge to land. The conditions requiring any water quality monitoring will contribute to data already held regarding the region's water resources. The property is within a rural area and an established sheep, beef and dairy grazing and must be considered with regard for environmental, economic, social and cultural values. The new storage pond that will ensure adverse effects on the environment are avoided, remedied, or mitigated.

6.5 Operative SRC Regional Water Plan

CTL has set out the relevant objectives and policies of the operative Regional Water Plan and have been grouped according to topic:

- *Water Quality:*

Policy A4 When considering an application for discharge the consent authority must have regard to:

- *The extent to which the discharge would avoid contamination that will have an adverse effect on the life-supporting capacity of freshwater, and on the health of people*
- *Any more than minor adverse effect resulting from the discharge would be avoided*

Policy 3 Allow no discharges to surface water bodies that will result in a reduction in water quality

Policy 13 Avoid the point source discharge of raw sewage, foul water and untreated agricultural effluent to water

Policy 25 Adverse effects arising from point and non-point source discharges

Policy 26 Avoid adverse effects on groundwater quality and quantity arising from bores and wells

Policy 42 Avoid adverse effects on water quality associated with the application of farm dairy effluent to land by matching farm dairy effluent management to receiving environment risk

Policy 7 Prefer discharge to land

- *Water Quantity*

Policy B7 Consent authority must have regard to:

- *The extent to which the change would adversely affect safeguarding the life-supporting capacity of freshwater.*
- *Any adverse effect resulting from the change would be avoided*

Policy 28 Manage abstraction of groundwater to avoid significant adverse effects on:

Long term aquifer storage volumes
Existing water users
Surface water flows and aquatic ecosystems and habitats
Groundwater quality

- *Land and soil health*

Policy 31A Match the level of management that is required for discharges of contaminants onto or into land to the level of environment risk posed

Policy 31C Manage discharge of contaminants onto land or into land to avoid, remedy or mitigate adverse effects

- *Cultural considerations*

Policy 1.A Take iwi management plans into account

6.5.1 Commentary

CTLs commentary is set out as follows:
Consideration of the term of consent is addressed under Policy 43. Policy 43 matches consent duration to the level of environmental risk associated with the activity. Where it is likely that a resource consent will be reapproved in future, the consent duration represents the period that the Council considers the existing conditions will be effective to manage the adverse effects of the activity.

Overall, the proposed activities comply with the above policies. The applicant has proposed mitigation measures for potential adverse effects on the environment arising from the proposed activities. Any other potential adverse effect will be mitigated through consent conditions, providing the applicant adhere to these.

6.6 Proposed SRC Water and Land Plan

CTL has set out the relevant objectives and policies of the proposed Water and Land Plan Regional Water Plan and have been grouped according to topic:

- *Water quality:*

Objective 1 Integrated management of land and water

Objective 2 Water and land recognized as enabler of wellbeing

Objective 3 Inherent health

Objective 4 Tangata Whenua values and interest

Objective 6 No reduction in the quality of freshwater

Objective 8 Water quality to meet Drinking-Water Standards

Objective 9 Quality of freshwater is managed

Objective 18 All activities operate at good management practice.

Policy 4 – 12 Physiographic zones, avoid, remedy or mitigate

Policy 13 *Manage land use activities and discharges*

Policy 14 *Prefer discharge to land*

Policy 15 *Maintain and improve water quality*

Policy 16 *Minimising the environmental effects from farming activities*

Policy 17 *Avoid adverse effects on water quality*
Manage effluent systems
Maintain and operate effluent systems
Avoiding surface run-off/overland flow
Avoiding discharge of untreated agricultural effluent to water

- *Water quantity*

Objective 7 *Avoidance of over allocation*

Objective 11 *Water is allocated and used efficiently*

Objective 12 *Ground water levels and minimum surface water levels are maintained*

Policy 20 *Manage the taking, abstraction, use of ground water*

Policy 21 *Manage the allocation of surface and groundwater*

Policy 22 *Managing the effects of surface and groundwater abstraction*

Policy 23 *Manage stream depletion effects resulting from ground water takes*

6.6.1 Comment

CTLs comments are set out as follows:

Overall, the proposed activities comply with the above objectives and policies. The applicant has proposed mitigation measures for potential adverse effects on the environment arising from the proposed activities. Any other potential adverse

will be mitigated through consent conditions, providing the applicant adhere to these.

e3s concurs with CTLs commentary

6.7 Te Tangi a Tauria

The following policies in Te Tangi a Tauria (iwi management plan) are of particular relevance to this application:

Policy 3.5.1(3)	Discharge of FDE must always require a consent
Policy 3.5.1(4)	Sustain and safeguard the life-supporting capacity of soils
Policy 3.5.1(5)	Avoid using high-risk soils for irrigation
Policy 3.5.1(6)	Oppose discharge of FDE to water
Policy 3.5.1(8)	Require best practice for land application for managing FDE
Policy 3.5.1(11)	Avoid surface run-off, ponding or contamination of water resulting from the application of FDE to pasture
Policy 3.5.1(13)	require buffer zones between discharge areas and waterways
Policy 3.5.1(14)	require a buffer distance between discharge areas and bores of at least 100m
Policy 3.5.1(15)	All spray drift as a product of irrigation of effluent must be managed and contained within the boundaries of the consent area
Policy 3.5.8(1)	Accidental Discovery Protocol
Policy 3.5.11(15)	Avoid the use of rivers as a receiving environment for the discharge of contaminants
Policy 3.5.11(17	Ensure activities in upper catchments have no adverse effects on mahinga kai, water quality and water quantity in lower catchments
Policy 3.5.13(4)	Avoid compromising water quality as a result of water abstraction
Policy 3.5.13(5)	Avoid water as a receiving environment for discharge of contaminants
Policy 3.5.13(6)	Avoid impacts on water as a result of inappropriate discharge to land activities
Policy 3.5.13(11)	Require monitoring of discharge permits to detect non-compliance with consent conditions

Policy 3.5.14(4)	Preference to bore takes rather than surface takes
Policy 3.5.14(11)	Avoid excessive drawdown of aquifer levels as a result of groundwater abstraction
Policy 3.5.14(16)	Encourage the installation and use of water meters
Policy 3.5.14(17)	Advocate for duration not exceeding 25 years

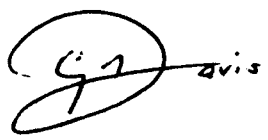
6.7.1 Commentary

CTL makes the following comments on the policies of the Te Tangi a Tauria:

Provided the applicant adheres to consent conditions, the adverse effects of the proposed activities should be no more than minor, and will comply with the above policies.

e3s concurs with CTLs commentary.

Yours sincerely,



Glenn Davis
Principal Environment Scientist

References

Martin, A. P, Turnbull, R. E, Rissmann C. W, Rieger, P (2017) Heavy metal and metalloid concentrations in soils under pasture of southern New Zealand. Geoderma Regional 11 (2017) 18-27.

Attachments

Attachment 1: Gelita Information
Attachment 2: Laboratory Certificates

Attachment 1: Gelita Information

GELITA
Improving Quality of Life™

20 March 2017

Dear Cameron,

Futher to your request for information regarding GelitaNZ's waste protien (spent hide, also referred to as skutch in the industry) for use in composting; I provide answers to the questions relating to GelitaNZ, from Environment Southland in their letter to you dated 3 March 2017.

1. **A description of where the meat industry byproduct has been sourced from (which meatworks and gelatine processing factory)**

   Material sourced from GelitaNZ is residual extracted cow hide head-pieces(skin) only. It does not contain any offal or bone products. Processing of the cow hide removes collagen which is dried and made into gelatine. The waste from this process is residual extracted cow hide (hide with some collagen and fat removed, also called skutch or waste protien).

   GelitaNZ is the only land animal gelatine manufacturer in NZ and is located in Christchurch. (Some manufacturers also source gelatine from fish, poultry,pig skin and bones(pig and beef).

   The cow hide used to manufacture gelatine is primarily face pieces, that is, sourced from the head and neck areas of the animal. These parts of the hide are not able to be used by other value adding hide processing facilities and would otherwise go to landfill as waste.

   GelitaNZ sources in excess of 11,00 tons of raw material (hide) from approximately 43 abottoirs /meat processors from throughout the North and South Islands of NZ.

   On occasion NZ will import salted (preserved) hide from other countries (last imports were 2015 from Australia) All imports are very tightly regulated by MPI for biosecurity. All imports are approved by MPI.

2. **Clarification as to whether ear tags and other non-putrescible waste will be removed prior to arrival on the property and a description of how this will be done and where any non-putrescibles will be disposed of.**

   The only non-putrescible waste associated with the spent hide from GelitaNZ (after extraction of collagen from the skin) are ear tags. Currently ear tags are not removed by GelitaNZ. Plant upgrades at GelitaNZ, expected to be completed by the end of 2017 or early 2018, will possibly separate the ear tags. Once this infrastructure is in place the recovered ear tags will be disposed in landfill.

3. **A detailed description of all processes and treatments that the meat industry byproduct has been through, including any processing done at the meat works, treatment for transport, processes to enable gelatine extraction, treatments following completion of gelatine processing and details fo chemicals, nutirents, or other substances added to the materia at any stage.**

   GelitaNZ does not process offal waste. The only product GelitNZ processes is cow hide (skin). The process, including chemical treatments is summarised below:

   I. Hide is recieved as fresh (no treatment), salted (hide +30% salt for preservation), or dehaired (treated with sodium sulphide to remove hair).

GELITA NZ Ltd. • 135-145 Connal Street, Christchurch 8023, New Zealand
P.O.Box 19-542, Woolston, Christchurch 8241
Phone +64 3 384 3093 • Fax +64 3 384 3231
www.GELITA.com

II. Hair is removed (at GelitaNZ or at Lowes in the NI) by soaking the hide in sodium sulphide (Na2S) solution pH >11 for approximately 24hours

GELITA NZ Ltd. • 135-145 Connal Street, Christchurch 8023, New Zealand
P.O.Box 19-542, Woolston, Christchurch 8241
Phone +64 3 384 3093 • Fax +64 3 384 3231
www.GELITA.com

III. Hide is conditioned for 15 to 30 days by soaking in a solution of primarily hydrated lime (Ca(OH)2), pH >11. Occasionally caustic is also added to the solution (NaOH).

IV. The hide is washed with water to rinse alkaline chemicals and salt solution from the product.

V. The hide is conditioned with sulphuric acid and hydrogen peroxide (H2SO4 and H2O2) for about 4 days with pH<3.

VI. The hide is washed with water to remove acid chemicals from the product.

VII. The pH of the conditioned hide is approximately pH 3. It is transferred to the food processing part of the plant where the collagen is extracted using steam in stainless steel vats.

VIII. Once the collagen is removed the spent hide (skutch) is discharged to the waste stream and stockpiled for removal from site for composting or disposal to landfill.

No chemicals are added to the raw materials for transport. No other chemicals are added to the spent hide.

4. **Identification of whether any of the substances added are hazardous substances as defined by the Hazardous Substances and New Organisms Act and, if so, which requirements of that Act apply.**

   Lime, sulphuric acid, hydrogen peroxide and sodium sulphide are all classed as *approved hazardous substances with controls* under the HSNO Act. These substances are required to be transported, stored and handled according to regulations.

5. **The results of analysis undertaken of samples of the solid waste and of leachate, taken from the material following all processing and treatment and before it is removed from the gelatin processing facotry. Please also confirm in the application where and when the samples were taken.**

   GelitaNZ has not undertaken any analysis of our spent hide (skutch) since it was not required for disposal in land fill. However Gelita Australia, which undertakes a very successful composting operation on their site in Beaudesert, Queensland, and uses the same raw materials and process as GelitaNZ, has undertaken analysis for their compost operation.

   The most recent analysis of skutch by Gelita Australia was undertaken in November 2009 by SGS Laboratories. The table from *Operations Manual, Composting of Gelatine By-Products at Sunny Hills, Beaudesert, October 2011, Compiled by The Organic Force* is shown in its entirity for completeness, but please note that the only column relevant to the proposed NZ composting operation is the Skutch column. Sludge and alkaline fats are currently not separated from the GelitaNZ waste effluent stream and are disposed to trade waste. Ash is generated from coal fired boilers and while it is produced at GelitaNZ it is not part of the current composting proposal.

Table 1 Characteristics of gelatine manufacturing by-products recorded in 2009

Material	Unit	Sludge	Skutch	Ash	Alk Fat
Date of sampling		1.11.09	12.11.09	1.11.09	26.11.09
Laboratory		SGS	SGS	SGS	SGS
Moisture	%	82.4	67.1	31.0	42.6
pH (water)		6.39	4.01	6.26	7.30
Conductivity	mS/cm	7.45	2.77	0.64	10.41
Organic carbon (LOI)	% DM	44.0	53.9	17.1	57.4
Nitrogen	% DM	5.4	10.0	0.8	0.4
Nitrate-N	mg/L	170	< 45	< 45	n.d.
Ammonia-N	mg/L	340	180	< 1	n.d.
Phosphorus	% DM	0.34	0.31	0.01	0.04
Phosphate	mg/L	< 200	750	< 200	n.d.
Potassium	% DM	0.17	0.01	0.09	0.02
Sulphur	% DM	2.40	2.20	0.19	0.06
Sodium	% DM	0.48	0.03	0.08	0.09
Chloride	mg/L	4500	310	35	n.d.
C/N Ratio		8.1	5.4	21.4	143.5

---

n.d. = not determined

From *Operations Manual, Composting of Gelatine By-Products at Sunny Hills, Beaudesert, October 2011, Compiled by The Organic Force*

If you require any further information please do not hesitate to contact me. GelitaNZ is supportive of initiatives to reduce waste to landfill and looks forward to being able to supply your operation into the future.

Regards

Mary Askey
Environmental Process Engineer
GelitaNZ

Attachment 2: Laboratory Certificates

Phone Office/Lab (02) 6775 1157

email: lanfaxlabs@bigpond.com.au
Website: http://www.lanfaxlabs.com.au
Lab address: 493 Old Inverell Road
Postal address: PO Box 4690 Armidale NSW 2350
Director: Dr Robert Patterson FIEAust, CPSS(3), CPAg
Soil Scientists and Environmental Engineers

Lanfax Laboratories

ABN 72 212 385 096
Quality Assurance and Quality Control by Approved Methods

Analysis of Compost/Manure Sample

Client Gelita Australia Pty Ltd *Date 16th November 2016*
Date Sample received 4th November 2016 *Sample date: 16th November 2016*
Source of plant material: Screened Stockpile (Bottom) in line with Trommel

***RESULTS** - Screened Stockpile (Bottom) Job No 3982*

Parameter	02-Nov-16			02AUG16	*Units*	*Method*
pH (1:5 in water)	7.78			7.57		4A1
Electrical conductivity (1:5)	9.32			10.32	dS/m	3A1
Organic Carbon	17.6			18.6	%	6A1
Total Organic Carbon	20.2			22.1	(%)	Heanes wet oxid.
Mineral nitrogen (NO_3-N)	116			214	mg/kg	7B2
Ammonium (NH4-N)	3854			4695	mg/kg	
Nitrogen	2.07			2.72	(%)	TKN digest
C:N ratio	9.6:1			8.1:1	ratio	calculation
Moisture (%)	37.2			49.4	%	
Volatile (%)	40.5			44.2	%	
Percentage passing 2 mm	78			52	%	Sieve 2 mm
Chloride (soluble)	0.384			0.445	%	APHA 4110B
Aluminium	0.397			0.490	%	Duplicate digest - Nitric acid + hydrogen peroxide
Boron	45			36	mg/kg	
Calcium	3.98			3.10	(%)	
Cadmium	<0.001			<0.001	mg/kg	
Copper	75			64	mg/kg	
Iron	1.90			1.83	%	
Potassium	0.290			0.338	(%)	
Magnesium	0.237			0.266	(%)	
Manganese	363			278	mg/kg	
Sodium	0.357			0.319	(%)	
Phosphorus (total)	0.371			0.294	(%)	
Sulphur (total)	1.66			1.37	(%)	
Zinc	206			180	mg/kg	

<0.x = measured but reading below detection level mg L^{-1} = part per million

General comments. All values based upon oven dry weight, unless shown as "as received"
Sample run in duplicate. Results are average of duplicates.

Form No:	5015021
Sampled:	10-May-2017
Received:	11-May-2017
Reported:	23-May-2017

Any interpretation or recommendations are prepared independently by your consultant

Client Details

McDowall Rural Services
1465 Limehills Browns Road
RD1
WINTON 9781

Telephone: 03 236 4039

Property Name McDowall Rural Services

Consultant Details

Eurofins NZ Laboratories Ltd

PO Box 12545
35 O'Rorke Road
Penrose
AUCKLAND 1642

Test Results

Sample Name	N Nitrogen %	NH4_N† Ammonium N %	NO3_N† Nitrate N %	P Phosphorus ppm	K Potassium ppm	S Sulfur ppm	Na† Sodium ppm	Cl† Chloride ppm
Raw Material	2.9	0.003	0.001	540	40	5,980	170	90

Test Results

Sample Name	TC† Total Carbon %	C:N† Carbon to Nitrogen Ratio	H2O† Moisture %	pH† Acidity / Alkalinity	Cond† Conductivity mS/cm
Raw Material	25.3	8.9	60.7	4.3	2.2

Test Units and Test Methods

Test	Unit	Unit Description	Test Method
N	%	g N per 100g	Combustion elemental analyser: Thermal conductivity detection.
NH4_N	%	g N per 100g	Water extraction, FIA determination
NO3_N	%	g N per 100g	Water extraction, FIA determination
P	ppm	mg P per kg	Microwave digestion, colorimetry
K	ppm	mg K per kg	Microwave digestion, ICP_OES determination
S	ppm	mg S per kg	Microwave digestion, ICP_OES determination
Na	ppm	mg Na per kg	Microwave digestion, ICP_OES determination
Cl	ppm	mg Cl per kg	Water extraction, Ion Chromatography
TC	%	g C per 100g	Combustion elemental analyser: Thermal conductivity detection.
C:N	Ratio		Calculation: TC/TN
H2O	%	g per 100g	Oven dried
pH		pH = -log10[H+]	1:5 w/v sample/water slurry, pH Electrode determination
Cond	mS/cm	millisiemens/centimetre	1:5 w/v sample/water slurry, conductivity reading at 25 °C

† Indicates tests which are not IANZ Registered.

§ Indicates Subcontracted Tests

Signed

Brent Miller: Team Leader Agricultural Chemistry

International accreditation new zealand

All results reported on material AS RECEIVED unless stated otherwise.

FREEPHONE: 0800 695 227 Tel: 09 579 2669 Fax: 09 571 2285 Email: info@eurofins.co.nz Website: www.eurofins.co.nz

Form No:	5015045
Sampled:	26-May-2017
Received:	29-May-2017
Reported:	09-Jun-2017

Any interpretation or recommendations are prepared independently by your consultant

Client Details

McDowall Rural Services
1465 Limehills Browns Road
RD1
WINTON 9781

Telephone: 03 236 4039

Consultant Details

Eurofins NZ Laboratories Ltd

PO Box 12545
35 O'Rorke Road
Penrose
AUCKLAND 1642

Property Name McDowall Rural Services

Test Results

Sample Name	N Total Nitrogen %	NH4_N† Ammonium N %	NO3_N† Nitrate N %	P Phosphorus %	K Potassium %	S Sulfur %	Ca Calcium %	Mg Magnesium %
Bark Mix	1.09	0.005	0.005	0.25	0.47	0.29	1.72	0.63

Test Results

Sample Name	Na† Sodium %	Fe Iron ppm	Cu Copper ppm	Mn Manganese ppm	Zn Zinc ppm	B† Boron ppm	Co† Cobalt ppm	Mo† Molybdenum ppm
Bark Mix	0.06	4	140	930	156	13	10	<2

Test Results

Sample Name	As† Arsenic ppm	Cd† Cadmium ppm	Cr† Chromium ppm	Hg† Mercury ppm	Ni† Nickel ppm	Pb† Lead ppm	TC† Total Carbon %	C:N† Carbon to Nitrogen Ratio
Bark Mix	5.6	2	256	<0.1	111	12.1	12.3	11.3

Test Results

Sample Name	OM† Organic Matter %	DM† Dry Matter %	pH† Acidity / Alkalinity
Bark Mix	21.3	58.2	7.3

1. Sample(s) reported on dry weight basis. As received basis (wet weight) conversion: divide results by (100/DM)

† Indicates tests which are not IANZ Registered.

§Indicates Subcontracted Tests

Signed

Brent Miller: Team Leader Agricultural Chemistry

International accreditation new zealand

All results reported on material AS RECEIVED unless stated otherwise.

Form No:	5015045
Sampled:	26-May-2017
Received:	29-May-2017
Reported:	09-Jun-2017

Any interpretation or recommendations are prepared independently by your consultant

Client Details

McDowall Rural Services
1465 Limehills Browns Road
RD1
WINTON 9781

Telephone: 03 236 4039

Consultant Details

Eurofins NZ Laboratories Ltd

PO Box 12545
35 O'Rorke Road
Penrose
AUCKLAND 1642

Property Name McDowall Rural Services

Test Units and Test Methods

Test	Unit	Unit Description	Test Method
N	%	g N per 100g	Combustion elemental analyser: Thermal conductivity detection.
NH4_N	%	g N per 100g	Water extraction, FIA determination
NO3_N	%	g N per 100g	Water extraction, FIA determination
P	%	g P per 100g	Microwave digestion, colorimetric determination
K	%	g K per 100g	Microwave digestion, ICP_OES determination
S	%	g S per 100g	Microwave digestion, ICP_OES determination
Ca	%	g Ca per 100g	Microwave digestion, ICP_OES determination
Mg	%	g Mg per 100g	Microwave digestion, ICP_OES determination
Na	%	g Na per 100g	Microwave digestion, ICP_OES determination
Fe	ppm	mg Fe per kg	Microwave digestion, ICP_OES determination
Cu	ppm	mg Cu per kg	Microwave digestion, ICP_OES determination
Mn	ppm	mg Mn per kg	Microwave digestion, ICP_OES determination
Zn	ppm	mg Zn per kg	Microwave digestion, ICP_OES determination
B	ppm	mg B per kg	Microwave digestion, ICP_OES determination
Co	ppm	mg Co per kg	Microwave digestion, ICP_OES determination
Mo	ppm	mg Mo per kg	Microwave digestion, ICP_OES determination
As	ppm	mg As per kg	Microwave digestion, Eurofins ELS ICP_MS determination
Cd	ppm	mg Cd per kg	Microwave digestion, ICP_OES determination
Cr	ppm	mg Cr per kg	Microwave digestion, ICP_OES determination
Hg	ppm	mg Hg per kg	Microwave digestion, Eurofins ELS ICP_MS determination
Ni	ppm	mg Ni per kg	Microwave digestion, ICP_OES determination
Pb	ppm	mg Pb per kg	Microwave digestion, Eurofins ELS ICP_MS determination
TC	%	g C per 100g	Combustion elemental analyser: Thermal conductivity detection.
C:N	Ratio		Calculation: TC/TN
OM	%	g per 100g	Calculation: (Carbon x 1.724)
DM	%	g per 100g	Dried at 105 Degrees Celcius
pH		pH = -log10[H+]	1:5 w/v sample/water slurry, pH Electrode determination

Form No:	5015044
Sampled:	26-May-2017
Received:	29-May-2017
Reported:	09-Jun-2017

Any interpretation or recommendations are prepared independently by your consultant

Client Details

McDowall Rural Services
1465 Limehills Browns Road
RD1
WINTON 9781

Telephone: 03 236 4039

Consultant Details

Eurofins NZ Laboratories Ltd

PO Box 12545
35 O'Rorke Road
Penrose
AUCKLAND 1642

Property Name McDowall Rural Services

Test Results

Sample Name	N Total Nitrogen %	NH4_N† Ammonium N %	NO3_N† Nitrate N %	P Phosphorus %	K Potassium %	S Sulfur %	Ca Calcium %	Mg Magnesium %
Saw Dust Mix	2.51	0.10	0.003	0.25	0.03	0.73	2.47	0.03

Test Results

Sample Name	Na† Sodium %	Fe Iron ppm	Cu Copper ppm	Mn Manganese ppm	Zn Zinc ppm	B† Boron ppm	Co† Cobalt ppm	Mo† Molybdenum ppm
Saw Dust Mix	0.12	<1	90	469	103	4	<2	3

Test Results

Sample Name	As† Arsenic ppm	Cd† Cadmium ppm	Cr† Chromium ppm	Hg† Mercury ppm	Ni† Nickel ppm	Pb† Lead ppm	TC† Total Carbon %	C:N† Carbon to Nitrogen Ratio
Saw Dust Mix	1.1	<1	49	<0.1	19	1.3	51.6	20.6

Test Results

Sample Name	OM† Organic Matter %	DM† Dry Matter %	pH† Acidity / Alkalinity
Saw Dust Mix	89.0	31.9	6.5

1. Sample(s) reported on dry weight basis. As received basis (wet weight) conversion: divide results by (100/DM)

† Indicates tests which are not IANZ Registered.

§ Indicates Subcontracted Tests

Signed

Brent Miller: Team Leader Agricultural Chemistry

All results reported on material AS RECEIVED unless stated otherwise.

Form No:	5015044
Sampled:	26-May-2017
Received:	29-May-2017
Reported:	09-Jun-2017

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AUCKLAND 1642

Property Name McDowall Rural Services

Test Units and Test Methods

Test	Unit	Unit Description	Test Method
N	%	g N per 100g	Combustion elemental analyser: Thermal conductivity detection.
NH4_N	%	g N per 100g	Water extraction, FIA determination
NO3_N	%	g N per 100g	Water extraction, FIA determination
P	%	g P per 100g	Microwave digestion, colorimetric determination
K	%	g K per 100g	Microwave digestion, ICP_OES determination
S	%	g S per 100g	Microwave digestion, ICP_OES determination
Ca	%	g Ca per 100g	Microwave digestion, ICP_OES determination
Mg	%	g Mg per 100g	Microwave digestion, ICP_OES determination
Na	%	g Na per 100g	Microwave digestion, ICP_OES determination
Fe	ppm	mg Fe per kg	Microwave digestion, ICP_OES determination
Cu	ppm	mg Cu per kg	Microwave digestion, ICP_OES determination
Mn	ppm	mg Mn per kg	Microwave digestion, ICP_OES determination
Zn	ppm	mg Zn per kg	Microwave digestion, ICP_OES determination
B	ppm	mg B per kg	Microwave digestion, ICP_OES determination
Co	ppm	mg Co per kg	Microwave digestion, ICP_OES determination
Mo	ppm	mg Mo per kg	Microwave digestion, ICP_OES determination
As	ppm	mg As per kg	Microwave digestion, Eurofins ELS ICP_MS determination
Cd	ppm	mg Cd per kg	Microwave digestion, ICP_OES determination
Cr	ppm	mg Cr per kg	Microwave digestion, ICP_OES determination
Hg	ppm	mg Hg per kg	Microwave digestion, Eurofins ELS ICP_MS determination
Ni	ppm	mg Ni per kg	Microwave digestion, ICP_OES determination
Pb	ppm	mg Pb per kg	Microwave digestion, Eurofins ELS ICP_MS determination
TC	%	g C per 100g	Combustion elemental analyser: Thermal conductivity detection.
C:N	Ratio		Calculation: TC/TN
OM	%	g per 100g	Calculation: (Carbon x 1.724)
DM	%	g per 100g	Dried at 105 Degrees Celcius
pH		pH = -log10[H+]	1:5 w/v sample/water slurry, pH Electrode determination

eurofins

Eurofins ELS Limited

Analytical Report

e3 Scientific Limited
Arrow Lane
Arrowtown 9302
Attention: Glenn Davis

Report Number: 17/52370
Issue: 2
12 September 2017

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
17/52370-01	Miscellaneous Sample		15/08/2017 00:00	22/08/2017 08:30	0

Notes: SKUTCH, GELITA, spent beef hide

	Test	Result	Units	Signatory
0001	pH	6.2		Marylou Cabral KTP
0055	Conductivity at 25°C	66.2	mS/m	Marylou Cabral KTP
0083	Total Kjeldahl Nitrogen	86.6	g/m³	Marylou Cabral KTP
0085	BOD5 - Total	492	g/m³	Marylou Cabral KTP
0515	Nitrite Nitrate Nitrogen	0.026	g/m³	Divina Lagazon KTP
0593	Sodium Adsorption Ratio	0.496		Shanel Kumar .
0602	Chloride	11.5	g/m³	Shanel Kumar KTP
0760	Ammonia Nitrogen	29.1	g/m³	Divina Lagazon KTP
1610	Calcium - Acid Soluble	58.1	g/m³	Shanel Kumar KTP
1622	Magnesium - Acid Soluble	0.49	g/m³	Shanel Kumar KTP
1634	Sodium - Acid Soluble	13.8	g/m³	Shanel Kumar KTP
2080	Total Phosphorus	1.50	g/m³	Divina Lagazon KTP
2088	Dissolved Reactive Phosphorus	1.26	g/m³	Divina Lagazon KTP
2127	Total Nitrogen	78.8	g/m³	Divina Lagazon KTP
6803-S	Arsenic - SPLP	< 0.001	g/m³	Sharon van Soest KTP
6808-S	Cadmium - SPLP	< 0.001	g/m³	Sharon van Soest KTP
6811-S	Chromium - SPLP	< 0.001	g/m³	Sharon van Soest KTP
6813-S	Copper - SPLP	< 0.001	g/m³	Sharon van Soest KTP
6818-S	Lead - SPLP	< 0.001	g/m³	Sharon van Soest KTP
6824-S	Nickel - SPLP	< 0.001	g/m³	Sharon van Soest KTP
6838-S	Zinc - SPLP	0.040	g/m³	Sharon van Soest KTP
O1420	Comments	All analysis done on modified SPLP extraction, due to complex matrix.		Sharon van Soest .
P1864	SPLP Extraction	Completed		Chantelle Struwig KTP

Comments:

* Not an accredited test.

Sampled by customer using ELS approved containers.

This report cancels and replaces report 17/52370-1. Please dispose of all previous versions.

Test Methodology:

Test	Methodology	Detection Limit
pH	Dedicated pH meter following APHA 22nd Edition Method 4500 H.	0.1
Conductivity at 25°C	APHA 22nd Edition Method 2510 B.	0.1 mS/m
Total Kjeldahl Nitrogen	APHA 22nd Edition 4500-N(org) B	0.8 g/m³
BOD5 - Total	APHA 22nd Edition Method 5210 B.	1 g/m³

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Eurofins ELS Limited

Analytical Report

e3 Scientific Limited
Arrow Lane
Arrowtown 9302
Attention: Glenn Davis

Report Number: 17/49853
Issue: 2
12 September 2017

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
17/49853-01	Miscellaneous Sample		04/08/2017 12:00	22/08/2017 08:30	0

Notes: S1, project no/property name: 17096

	Test	Result	Units	Signatory
0001	pH	7.4		Marylou Cabral KTP
0055	Conductivity at 25°C	65.4	mS/m	Marylou Cabral KTP
0083	Total Kjeldahl Nitrogen	83.6	g/m³	Marylou Cabral KTP
0085	BOD5 - Total	452	g/m³	Marylou Cabral KTP
0515	Nitrite Nitrate Nitrogen	< 0.005	g/m³	Divina Lagazon KTP
0593	Sodium Adsorption Ratio	0.735		Shanel Kumar .
0602	Chloride	1.51	g/m³	Shanel Kumar KTP
0760	Ammonia Nitrogen	81.6	g/m³	Divina Lagazon KTP
1610	Calcium - Acid Soluble	1.01	g/m³	Shanel Kumar KTP
1622	Magnesium - Acid Soluble	0.25	g/m³	Shanel Kumar KTP
1634	Sodium - Acid Soluble	3.18	g/m³	Shanel Kumar KTP
2080	Total Phosphorus	0.330	g/m³	Divina Lagazon KTP
2088	Dissolved Reactive Phosphorus	0.171	g/m³	Divina Lagazon KTP
2127	Total Nitrogen	84.7	g/m³	Divina Lagazon KTP
6803-S	Arsenic - SPLP	0.004	g/m³	Sharon van Soest KTP
6808-S	Cadmium - SPLP	< 0.001	g/m³	Sharon van Soest KTP
6811-S	Chromium - SPLP	< 0.001	g/m³	Sharon van Soest KTP
6813-S	Copper - SPLP	0.012	g/m³	Sharon van Soest KTP
6818-S	Lead - SPLP	0.001	g/m³	Sharon van Soest KTP
6824-S	Nickel - SPLP	0.002	g/m³	Sharon van Soest KTP
6838-S	Zinc - SPLP	0.081	g/m³	Sharon van Soest KTP
O1420	Comments	All analysis done on modified SPLP extraction, due to complex matrix.		Sharon van Soest .
P1864	SPLP Extraction	Completed		Chantalle Struwig KTP

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
17/49853-02	Miscellaneous Sample		04/08/2017 12:00	22/08/2017 08:30	0

Notes: S2, project no/property name: 17096

	Test	Result	Units	Signatory
0001	pH	6.9		Marylou Cabral KTP
0055	Conductivity at 25°C	7.8	mS/m	Marylou Cabral KTP
0083	Total Kjeldahl Nitrogen	5.2	g/m³	Marylou Cabral KTP
0085	BOD5 - Total	7	g/m³	Marylou Cabral KTP
0515	Nitrite Nitrate Nitrogen	< 0.005	g/m³	Divina Lagazon KTP
0593	Sodium Adsorption Ratio	0.209		Shanel Kumar .
0602	Chloride	0.25	g/m³	Shanel Kumar KTP
0760	Ammonia Nitrogen	4.62	g/m³	Divina Lagazon KTP
1610	Calcium - Acid Soluble	5.73	g/m³	Shanel Kumar KTP

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Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
17/49853-02	Miscellaneous Sample		04/08/2017 12:00	22/08/2017 08:30	0

Notes: S2, project no/property name: 17096

	Test	Result	Units	Signatory
1622	Magnesium - Acid Soluble	0.44	g/m³	Shanal Kumar KTP
1634	Sodium - Acid Soluble	1.93	g/m³	Shanal Kumar KTP
2080	Total Phosphorus	0.308	g/m³	Divina Lagazon KTP
2088	Dissolved Reactive Phosphorus	0.220	g/m³	Divina Lagazon KTP
2127	Total Nitrogen	5.84	g/m³	Divina Lagazon KTP
6803-S	Arsenic - SPLP	0.002	g/m³	Sharon van Soest KTP
6808-S	Cadmium - SPLP	< 0.001	g/m³	Sharon van Soest KTP
6811-S	Chromium - SPLP	< 0.001	g/m³	Sharon van Soest KTP
6813-S	Copper - SPLP	0.003	g/m³	Sharon van Soest KTP
6818-S	Lead - SPLP	< 0.001	g/m³	Sharon van Soest KTP
6824-S	Nickel - SPLP	< 0.001	g/m³	Sharon van Soest KTP
6838-S	Zinc - SPLP	0.097	g/m³	Sharon van Soest KTP
O1420	Comments	All analysis done on modified SPLP extraction, due to complex matrix.		Sharon van Soest .
P1864	SPLP Extraction	Completed		Chantalle Struwig KTP

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
17/49853-03	Miscellaneous Sample		04/08/2017 12:00	22/08/2017 08:30	0

Notes: S3, project no/property name: 17096

	Test	Result	Units	Signatory
0001	pH	7.1		Marylou Cabral KTP
0055	Conductivity at 25°C	9.4	mS/m	Marylou Cabral KTP
0083	Total Kjeldahl Nitrogen	6.4	g/m³	Marylou Cabral KTP
0085	BOD5 - Total	< 6	g/m³	Marylou Cabral KTP
0515	Nitrite Nitrate Nitrogen	0.045	g/m³	Divina Lagazon KTP
0593	Sodium Adsorption Ratio	0.394		Shanel Kumar .
0602	Chloride	2.69	g/m³	Shanel Kumar KTP
0760	Ammonia Nitrogen	4.98	g/m³	Divina Lagazon KTP
1610	Calcium - Acid Soluble	5.59	g/m³	Shanel Kumar KTP
1622	Magnesium - Acid Soluble	0.32	g/m³	Shanel Kumar KTP
1634	Sodium - Acid Soluble	3.54	g/m³	Shanel Kumar KTP
2080	Total Phosphorus	0.161	g/m³	Divina Lagazon KTP
2088	Dissolved Reactive Phosphorus	0.064	g/m³	Divina Lagazon KTP
2127	Total Nitrogen	6.65	g/m³	Divina Lagazon KTP
6803-S	Arsenic - SPLP	0.003	g/m³	Sharon van Soest KTP
6808-S	Cadmium - SPLP	< 0.001	g/m³	Sharon van Soest KTP
6811-S	Chromium - SPLP	< 0.001	g/m³	Sharon van Soest KTP
6813-S	Copper - SPLP	0.005	g/m³	Sharon van Soest KTP
6818-S	Lead - SPLP	< 0.001	g/m³	Sharon van Soest KTP
6824-S	Nickel - SPLP	< 0.001	g/m³	Sharon van Soest KTP
6838-S	Zinc - SPLP	0.116	g/m³	Sharon van Soest KTP
O1420	Comments	All analysis done on modified SPLP extraction, due to complex matrix.		Sharon van Soest .

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Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
17/49853-03	Miscellaneous Sample		04/08/2017 12:00	22/08/2017 08:30	0

Notes: S3, project no/property name: 17096

	Test	Result	Units	Signatory
P1864	SPLP Extraction	Completed		Chantelle Struwig KTP

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
17/49853-04	Miscellaneous Sample		04/08/2017 12:00	22/08/2017 08:30	0

Notes: S4, project no/property name: 17096

	Test	Result	Units	Signatory
0001	pH	7.0		Marylou Cabral KTP
0055	Conductivity at 25°C	73.1	mS/m	Marylou Cabral KTP
0083	Total Kjeldahl Nitrogen	112	g/m³	Marylou Cabral KTP
0085	BOD5 - Total	714	g/m³	Marylou Cabral KTP
0515	Nitrite Nitrate Nitrogen	< 0.005	g/m³	Divina Lagazon KTP
0593	Sodium Adsorption Ratio	2.01		Shanal Kumar .
0602	Chloride	0.98	g/m³	Shanel Kumar KTP
0760	Ammonia Nitrogen	92.9	g/m³	Divina Lagazon KTP
1610	Calcium - Acid Soluble	0.24	g/m³	Shanel Kumar KTP
1622	Magnesium - Acid Soluble	0.03	g/m³	Shanal Kumar KTP
1634	Sodium - Acid Soluble	3.99	g/m³	Shanal Kumar KTP
2080	Total Phosphorus	3.02	g/m³	Divina Lagazon KTP
2088	Dissolved Reactive Phosphorus	2.31	g/m³	Divina Lagazon KTP
2127	Total Nitrogen	109	g/m³	Divina Lagazon KTP
6803-S	Arsenic - SPLP	0.001	g/m³	Sharon van Soest KTP
6808-S	Cadmium - SPLP	< 0.001	g/m³	Sharon van Soest KTP
6811-S	Chromium - SPLP	0.001	g/m³	Sharon van Soest KTP
6813-S	Copper - SPLP	0.006	g/m³	Sharon van Soest KTP
6818-S	Lead - SPLP	< 0.001	g/m³	Sharon van Soest KTP
6824-S	Nickel - SPLP	0.002	g/m³	Sharon van Soest KTP
6838-S	Zinc - SPLP	0.053	g/m³	Sharon van Soast KTP
O1420	Comments	All analysis done on modified SPLP extraction, due to complex matrix.		Sharon van Soest .
P1864	SPLP Extraction	Completed		Chantelle Struwig KTP

Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
17/49853-05	Miscellaneous Sample		04/08/2017 12:00	22/08/2017 08:30	0

Notes: DUPI, project no/property name: 17096

	Test	Result	Units	Signatory
0001	pH	7.4		Marylou Cabral KTP
0055	Conductivity at 25°C	6.1	mS/m	Marylou Cabral KTP
0083	Total Kjeldahl Nitrogen	3.5	g/m³	Marylou Cabral KTP
0085	BOD5 - Total	< 6	g/m³	Marylou Cabral KTP
0515	Nitrite Nitrate Nitrogen	0.049	g/m³	Divina Lagazon KTP
0593	Sodium Adsorption Ratio	0.236		Shanal Kumar .
0602	Chloride	0.83	g/m³	Shanal Kumar KTP
0760	Ammonia Nitrogen	1.79	g/m³	Divina Lagazon KTP
1610	Calcium - Acid Soluble	6.31	g/m³	Shanel Kumar KTP
1622	Magnesium - Acid Soluble	0.40	g/m³	Shanal Kumar KTP

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Sample	Site	Map Ref.	Date Sampled	Date Received	Order No.
17/49853-05	Miscellaneous Sample		04/08/2017 12:00	22/08/2017 08:30	0

Notes: DUPI, project no/property name: 17096

	Test	Result	Units	Signatory
1634	Sodium - Acid Soluble	2.26	g/m³	Shenel Kumar KTP
2080	Total Phosphorus	0.368	g/m³	Divine Legazon KTP
2088	Dissolved Reactive Phosphorus	0.204	g/m³	Divine Legezon KTP
2127	Total Nitrogen	4.18	g/m³	Divine Legazon KTP
6803-S	Arsenic - SPLP	0.002	g/m³	Sharon van Soest KTP
6808-S	Cadmium - SPLP	< 0.001	g/m³	Sharon van Soest KTP
6811-S	Chromium - SPLP	< 0.001	g/m³	Sharon van Soest KTP
6813-S	Copper - SPLP	0.073	g/m³	Sharon van Soest KTP
6818-S	Lead - SPLP	< 0.001	g/m³	Sharon van Soest KTP
6824-S	Nickel - SPLP	0.001	g/m³	Sharon van Soest KTP
6838-S	Zinc - SPLP	0.086	g/m³	Sharon van Soest KTP
O1420	Comments	All analysis done on modified SPLP extraction, due to complex matrix. *		Sharon van Soest .
P1864	SPLP Extraction	Completed *		Chantelle Struwig KTP

Comments:

* Not an accredited test.

Sampled by customer using ELS approved containers.

This report cancels and replaces report 17/49853-1. Please dispose of all previous versions.

Test Methodology:

Test	Methodology	Detection Limit
pH	Dedicated pH meter following APHA 22nd Edition Method 4500 H.	0.1
Conductivity at 25°C	APHA 22nd Edition Method 2510 B.	0.1 mS/m
Totel Kjeldahl Nitrogen	APHA 22nd Edition 4500-N(org) B	0.8 g/m³
BOD5 - Total	APHA 22nd Edition Method 5210 B.	1 g/m³
Nitrite Nitrate Nitrogen	Flow Injection Autoanalyser following APHA 22nd Edition Method 4500-NO3 I.	0.005 g/m³
Sodium Adsorption Ratio	Calculated from sodium, calcium end magnesium content.	0.001
Chloride	Ion Chromatography following USEPA 300.0 (modified).	0.02 g/m³
Ammonie Nitrogen	Flow Injection Autoanalyser following APHA 22nd Edition Method 4500 NH3-H.	0.01 g/m³
Calcium - Acid Soluble	ICP-OES following APHA 22nd Edition Method 3120 B (modified).	0.05 g/m³
Magnesium - Acid Soluble	ICP-OES following APHA 22nd Edition Method 3120 B (modified).	0.01 g/m³
Sodium - Acid Soluble	ICP-OES following APHA 22nd Edition Method 3120 B (modified).	0.05 g/m³
Total Phosphorus	Flow Injection Autoanalyser following APHA 22nd Edition Method 4500-P G. Persulphate digestion follows APHA 22nd Edition 4500-P B.	0.005 g/m³
Dissolved Reactive Phosphorus	Flow Injection Autoanalyser following APHA 22nd Edition Method 4500-P G.	0.005 g/m³
Total Nitrogen	Flow Injection Autoanalyser following APHA 22nd Edition Method 4500-NO3 I. Persulphate digestion follows APHA 22nd Edition 4500-N C.	0.05 g/m³
Arsenic - SPLP	ICP-MS following APHA 22nd edition method 3125 (modified).	0.001 g/m³
Cadmium - SPLP	ICP-MS following APHA 22nd edition method 3125 (modified).	0.001 g/m³
Chromium - SPLP	ICP-MS following APHA 22nd edition method 3125 (modified).	0.001 g/m³
Copper - SPLP	ICP-MS following APHA 22nd edition method 3125 (modified).	0.001 g/m³
Lead - SPLP	ICP-MS following APHA 22nd edition method 3125 (modified).	0.001 g/m³

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Test	Methodology	Detection Limit
Nickel - SPLP	ICP-MS following APHA 22nd edition method 3125 (modified).	0.001 g/m³
Zinc - SPLP	ICP-MS following APHA 22nd edition method 3125 (modified).	0.001 g/m³
SPLP Extraction	SPLP Extraction follows EPA Method 1312 (modified)	

Onsite Observation Methodology:

Test	Methodology	Detection Limit
Comments	Sample observation.	n/a

"<" means that no analyte was found in the sample at the level of detection shown. Detection limits are based on a clean matrix and may vary according to individual sample.

g/m3 is the equivalent to mg/L and ppm.

Samples will be retained for a period of time, in suitable conditions appropriate to the analyses requested.

All test methods and confidence limits are available on request. This report must not be reproduced except in full, without the written consent of the laboratory.

Report Released By

Rob Deacon

This laboratory is accredited by International Accreditation New Zealand and its reports are recognised in all countries affiliated to the International Laboratory Accreditation Co-operation Mutual Recognition Arrangement (ILAC-MRA). The tests reported have been performed in accordance with our terms of accreditation, with the exception of tests marked "not IANZ", which are outside the scope of this laboratory's accreditation.

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Test	Methodology	Detection Limit
Nitrite Nitrate Nitrogen	Flow Injection Autoanalyser following APHA 22nd Edition Method 4500-NO3 I.	0.005 g/m³
Sodium Adsorption Ratio	Calculated from sodium, calcium and magnesium content.	0.001
Chloride	Ion Chromatography following USEPA 300.0 (modified).	0.02 g/m³
Ammonia Nitrogen	Flow Injection Autoanalyser following APHA 22nd Edition Method 4500 NH3-H.	0.01 g/m³
Calcium - Acid Soluble	ICP-OES following APHA 22nd Edition Method 3120 B (modified).	0.05 g/m³
Magnesium - Acid Soluble	ICP-OES following APHA 22nd Edition Method 3120 B (modified).	0.01 g/m³
Sodium - Acid Soluble	ICP-OES following APHA 22nd Edition Method 3120 B (modified).	0.05 g/m³
Total Phosphorus	Flow Injection Autoanalyser following APHA 22nd Edition Method 4500-P G. Persulphate digestion follows APHA 22nd Edition 4500-P B.	0.005 g/m³
Dissolved Reactive Phosphorus	Flow Injection Autoanalyser following APHA 22nd Edition Method 4500-P G.	0.005 g/m³
Total Nitrogen	Flow Injection Autoanalyser following APHA 22nd Edition Method 4500-NO3 I. Persulphate digestion follows APHA 22nd Edition 4500-N C.	0.05 g/m³
Arsenic - SPLP	ICP-MS following APHA 22nd edition method 3125 (modified).	0.001 g/m³
Cadmium - SPLP	ICP-MS following APHA 22nd edition method 3125 (modified).	0.001 g/m³
Chromium - SPLP	ICP-MS following APHA 22nd edition method 3125 (modified).	0.001 g/m³
Copper - SPLP	ICP-MS following APHA 22nd edition method 3125 (modified).	0.001 g/m³
Lead - SPLP	ICP-MS following APHA 22nd edition method 3125 (modified).	0.001 g/m³
Nickel - SPLP	ICP-MS following APHA 22nd edition method 3125 (modified).	0.001 g/m³
Zinc - SPLP	ICP-MS following APHA 22nd edition method 3125 (modified).	0.001 g/m³
SPLP Extraction	SPLP Extraction follows EPA Method 1312 (modified)	

Onsite Observation Methodology:

Test	Methodology	Detection Limit
Comments	Sample observation.	n/a

"<" means that no analyte was found in the sample at the level of detection shown. Detection limits are based on a clean matrix and may vary according to individual sample.

g/m3 is the equivalent to mg/L and ppm.

Samples will be retained for a period of time, in suitable conditions appropriate to the analyses requested.

All test methods and confidence limits are available on request. This report must not be reproduced except in full, without the written consent of the laboratory.

Report Released By

Rob Deacon

This laboratory is accredited by International Accreditation New Zealand and its reports are recognised in all countries affiliated to the International Laboratory Accreditation Co-operation Mutual Recognition Arrangement (ILAC-MRA). The tests reported have been performed in accordance with our terms of accreditation, with the exception of tests marked "not IANZ", which are outside the scope of this laboratory's accreditation.

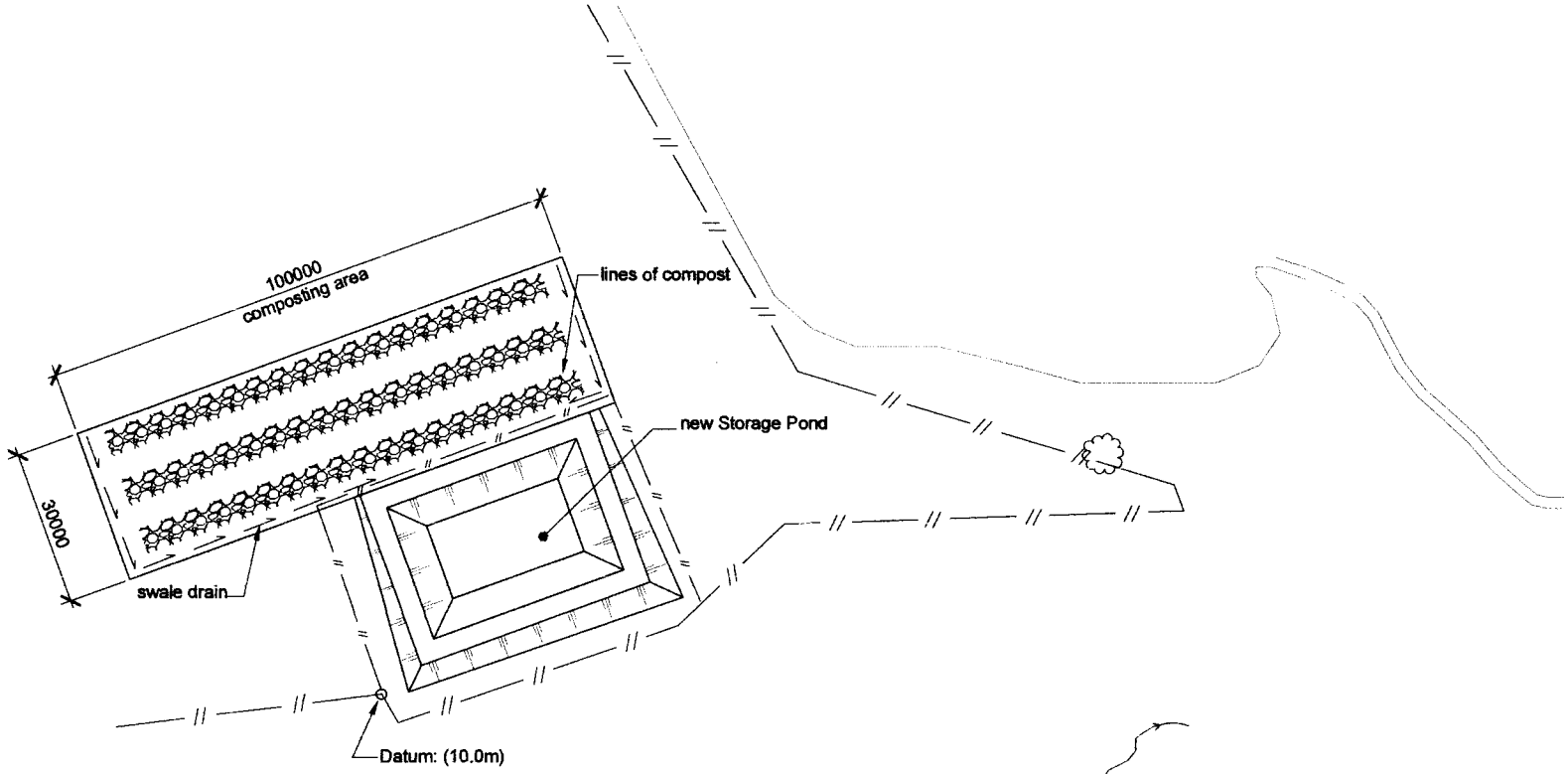
85 Port Road Seaview

Lower Hutt 5045 New Zealand

Phone: (04) 576 5016 Fax: (04) 576 5017

Email: mailto:reportselanz@eurofins.com Website: http://www.eurofins.co.nz

Note:
This design is site specific and is not to be used for other similar projects unless permission has been obtained in writing from Civil Tech Limited.



SITE PLAN
1:1000

DO NOT SCALE -- IF IN DOUBT ASK

REV	DATE	DESCRIPTION
A	2/17	Issued for Approval

DESIGNED: M Gardyne	DATE: 2/17	ORIGINAL SIZE: A3	
DRAWN: hb	DATE: 2/17		
CHECKED: M Gardyne	DATE: 2/17	SCALE: as shown @ A3	
APPROVED:	DATE:		

civil tech
PO Box 1556 Invercargill
Phone: 03 218 9746
Mobile Phone: 027 435 7957

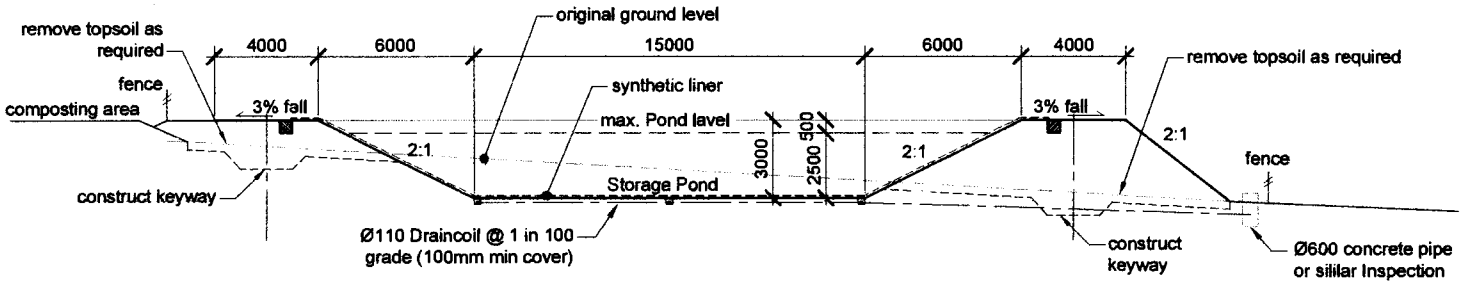
CLIENT:
Kerr Inverurie Trust
Parawa

DRAWING TITLE:
ORGANIC WASTE STORAGE POND CIVIL WORKS

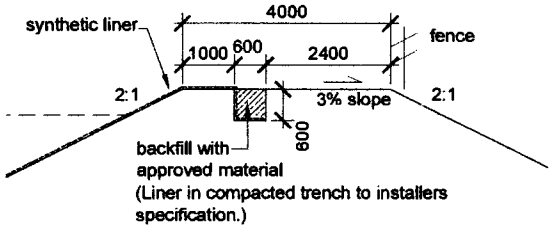
DRAWING NUMBER	REVISION
1430 C01	A

FILE No. 1701

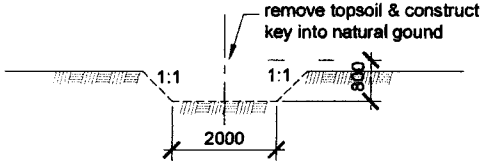
Note:
This design is site specific and is not to be used for other similar projects unless permission has been obtained in writing from Civil Tech Limited.



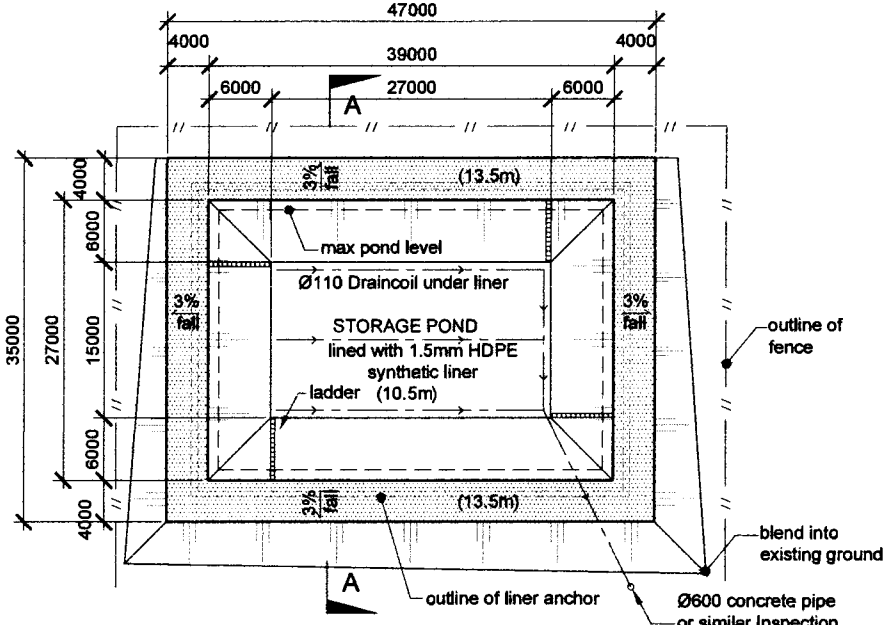
TYPICAL CROSS SECTION A-A
1:200



TYPICAL LINER ANCHOR DETAIL
1:100

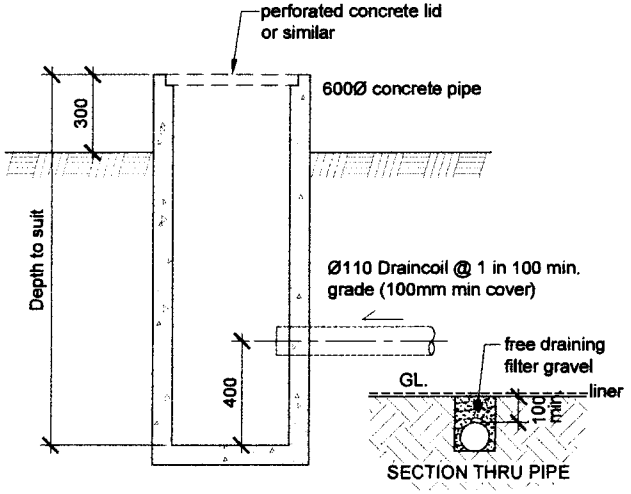


KEY DETAIL
1:100



STORAGE POND PLAN
1:500

Allow for safety fence around ponds



INSPECTION CHAMBER DETAIL
1:20

A	2/17	Issued for Approval	
REV:	DATE:	DESCRIPTION	

DESIGNED: M Gardyne	DATE: 2/17	ORIGINAL SIZE: A3
DRAWN: hb	DATE: 2/17	
CHECKED: M Gardyne	DATE: 2/17	SCALE: as shown @ A3
APPROVED:	DATE:	

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Phone 03 216 9745
Mobile Phone 027 435 7957

CLIENT:
Karr Inverurie Trust
Parawa

DRAWING TITLE:
ORGANIC WASTE STORAGE POND CIVIL WORKS

DRAWING NUMBER:	REVISION:
1430 C02	A

FILE NO. 1701

DO NOT SCALE - IF IN DOUBT ASK

Specification for Earthworks Construction

1. Scope

This specification covers the construction of earthworks including: the clearing and removal of all obstacles within the limits of the earthworks; Stripping of topsoil; excavation of all cuts, including excavation below the final subgrade surface; the excavation of borrow areas, benches, keyways and surface drainage facilities; the carting of excavated material to fill or waste; and construction of fills and subgrade; shaping, compacting, trimming and topsoiling. Any changes to the construction of the pond must be discussed with the certifier and any changes to the original plan will be confirmed in writing.

2. Initial site meeting

At the first meeting on site the location of the pond will be confirmed and any hazards identified that would affect the construction. Contractors shall confirm that the equipment that will be used on the site is appropriate and has sufficient roll over protection to work on slopes. All underground services about the site are to be confirmed. ie power, telecom, water and drainage etc.

3. Construction progress and recording

The contractor shall retain sufficient records to show what work was constructed each day, and suitable photographs held to record this.

4. Pond set out

The pond shall be set out so that the final dimensions of the pond and the levels of the walls correspond to the plans to ensure that the full design capacity of the pond is achieved and that the pond operates as it is designed.

5. Clearing

The area contained by the limits of the earthworks and any additional area shown on the drawings shall be cleared of all obstructions. Clearing shall include the complete removal fences, stumps, trees, scrub and disposal by dumping and burying as required.

6. Removal of topsoil

Topsoil shall be removed to outside of the top of the pond wall. Care shall be taken to avoid contamination of the structural fill material below the topsoil layer.

7. Surface drainage

Adequate provision shall be made for the control of surface water within the construction area to safeguard the integrity of the works. The earthworks shall be carried out in such a manner that their surfaces have at all times a sufficient fall to shed water and prevent flooding. No silt contaminated water shall be pumped into any open drain but spread to pasture to filter silt prior to entering an open drain.

Specification for Earthworks Construction

for Rainwater and Leachate Storage Pond

Client: Kerr Inverurie Trust

Location: 966 Athol Five Rivers Highway

Project No.: 1430

8. Excavation

Excavation shall be carried out in such a manner to avoid mixing of the materials if they are to be used for lining the pond rather than for the construction of the walls. Excavation shall be carried out so as to limit overbreak as far as is practical.

9. Unforeseen irregularities

If during excavation any of the following are exposed, the method of resolving the irregularities are to be discussed with the certifier and the best option to remove or modify the excavation confirmed. These may include mole or tile drains, under runners, sand or gravel inclusions, bog wood, trees or rubbish pits.

10. Keyway construction

On all walls of the pond that are to be constructed a keyway shall be constructed to a minimum depth of 600mm deep and 2m wide. The backfill to the keyways shall be compacted as detailed in section 14.

11. Filling

The earthworks shall be managed in such a manner that the best material for clay lining is reserved for placement on the inside of the main storage pond. The location of this material shall be discussed with the certifier. The material used in fill shall be spread and compacted in layers of uniform quality and thickness. The thickness of each layer shall be limited to ensure that the specified compaction is achieved for the full depth of each layer. The movement of construction traffic shall be even distributed over the full width of the filling area, so as to avoid damage or overstress the compaction. If material which has already been placed in fill is considered by the certifier to be too wet then, the Contractor shall either dry or mix the material so that it is suitable for fill or excavate the material to waste and replace it with suitable material.

12. Compaction Methods

The Contractor shall submit to the certifier details of the proposed compaction methods and details of the compaction equipment before filing commences.

13. Layer Thickness

The maximum thickness of each layer of fill before compaction shall be 200mm

14. Compaction

Compaction of each layer shall continue until the whole layer has obtained a dense condition. The degree of compaction of each layer shall be such that when trimmed to a smooth surface, the resultant impression in the surface under a smooth wheel roller having a minimum loading of 6260kg per metre width of fill shall not be greater than 5 mm. The maximum dry density achieved shall be 95%. This will require a minimum number of four passes over the total fill area and all layers. Construction will be accepted on the basis of an area at a time. Each area offered for acceptance shall consist of material which is basically the one soil type which appears to be constant moisture content and which has received a uniform number of roller

passes. The Certifier or his representative shall determine the locations of tests within each area. Test results shall be analysed in groups of five. When drying is necessary it shall be carried out to allow the full depth of the layer to dry uniformly. Drying and compaction shall be carried out under favourable weather conditions. Compaction shall not continue if the material shows signs of heaving or weaving excessively. In this situation the material shall be either left to dry naturally or where job progress would be affected by delay the material shall be dried to a moisture content at which heaving and weaving does not occur.

15. Disturbance and working of cut surfaces

Where the pond is cut into the existing clay subgrade that is of suitable quality for pond lining, it shall be scarified to a depth of 300mm and re compacted to provide a dense tight surface to the same density as any other compacted surface.

16. Synthetic Lining

The synthetic lining for the storage pond shall be installed by a qualified installer and provide the quality assurance documentation to provide a 20 year warranty for the liner.

17. Finished surface slopes

The pond walls shall be shaped to a maximum slope of two horizontal to one vertical or flatter. All outside top of walls shall be sloped to shed water to the outside of the storage pond or sludge beds so that excess stormwater does not enter the ponds

18. Trimming and rolling

The entire surface of the inside of the pond shall be made firm, uniform and smooth by blading, grading and rolling. Rolling associated with the surface finishing shall be the same as that which would produce the compaction for that material type.

19. Surface water channels

All areas where the existing ground surface slopes toward the ponds a shallow surface water channel shall be constructed as shown on the plans. This will lead water away from the pond to a suitable outfall.

20. Topsoiling

Topsoil shall be re spread to provide smooth and natural transitions between the ponds and the surrounding pasture areas. The topsoil shall be worked and trimmed to a tilth suitable for typical farm machinery to finish suitable for grass. The outside batters shall be topsoiled and sloped so that they can be cultivated, sown with grass and mown if required.

21. Fencing

Fencing, although required on all ponds, shall not be the responsibility of the contractor or certifier.

Building Code Clause(s) NA

PRODUCER STATEMENT – PS1 – DESIGN

(Guidance on use of Producer Statements (formerly page 2) is available at www.ipenz.nz)

ISSUED BY: Civil Tech Ltd
(Design Firm)

TO: Kerr Inverurie Trust
(Owner/Developer)

TO BE SUPPLIED TO: Environment Southland
(Building Consent Authority)

IN RESPECT OF: Storage Pond for Run-off from Composting of Organic Waste
(Description of Building Work)

AT: 966 Athol Five Rivers Highway, Parawa
(Address)

Town/City: ..... **LOT** Pt Sec 25 Eyre SD **DP** ..... **SO** .....
(Address)

We have been engaged by the owner/developer referred to above to provide:

Design of a agricultural effluent storage pond.

(Extent of Engagement)

services in respect of the requirements of Clause(s) NA of the Building Code for:

☐ All or ☐ Part only (as specified in the attachment to this statement), of the proposed building work.

The design carried out by us has been prepared in accordance with:

☐ Compliance Documents issued by the Ministry of Business, Innovation & Employment NA or
(verification method/acceptable solution)

☐ Alternative solution as per the attached schedule NA

The proposed building work covered by this producer statement is described on the drawings titled:

Storage Pond - Civil Works and numbered 1430 CO1 and CO2, Rev A
together with the specification, and other documents set out in the schedule attached to this statement.

On behalf of the Design Firm, and subject to:
(i) Site verification of the following design assumptions .....
(ii) All proprietary products meeting their performance specification requirements;

I believe on reasonable grounds that a) the building, if constructed in accordance with the drawings, specifications, and other documents provided or listed in the attached schedule, will comply with the relevant provisions of the Building Code and that b), the persons who have undertaken the design have the necessary competency to do so. I also recommend the following level of construction monitoring/observation:

☐ CM1 ☐ CM2 ☐ CM3 ☐ CM4 ☐ CM5 (Engineering Categories) or ☐ as per agreement with owner/developer (Architectural)

I, Murray Gardyne am: ☐ CPEng ..... # ☐ Reg Arch ..... #
(Name of Design Professional)

I am a Member of: ☒ IPENZ ☐ NZIA and hold the following qualifications: NZCE (civil), REA, AMIPENZ
The Design Firm issuing this statement holds a current policy of Professional Indemnity Insurance no less than $200,000*.
The Design Firm is a member of ACENZ: ☐

SIGNED BY Murray Gardyne (Signature)
(Name of Design Professional)

ON BEHALF OF Civil Tech Ltd Date 29/03/2017
(Design Firm)

Note: This statement shall only be relied upon by the Building Consent Authority named above. Liability under this statement accrues to the Design Firm only. The total maximum amount of damages payable arising from this statement and all other statements provided to the Building Consent Authority in relation to this building work, whether in contract, tort or otherwise (including negligence), is limited to the sum of $200,000.*

This form is to accompany **Form 2 of the Building (Forms) Regulations 2004** for the application of a Building Consent.

PRODUCER STATEMENT – PS2 – DESIGN REVIEW

ISSUED BY:	Hadley Consultants Limited, P.O. Box 1356, Queenstown. *(Design Review Firm)*
TO:	Kerr Inverurie Trust *(Owner/Developer)*
TO BE SUPPLIED TO:	Environment Southland *(Consent Authority)*
IN RESPECT OF:	The design of a Liquid Organic Waste Storage Pond with a proprietary HDPE liner. *(Description of Work)*
AT:	Athol Five Rivers Highway (SH6), Parawa, Southland.
LEGAL DESCRIPTION:	Pt Sec 25, Eyre SD

We Hadley Consultants Limited have been engaged by Civil Tech Limited to review the design documents for this project in respect of the requirements of IPENZ Practice Note 21.

This review is for part of the design wok prepared by Civil Tech Limited as described in drawings titled Organic Waste Storage Pond Civil Works and numbered 1430– C01 to C02 - Rev A together with the specification, and design and construction checklist according to which the Liquid Organic Waste Storage Pond is proposed to be constructed.

This review is in respect of the geotechnical suitability of the proposed location and risks, the stability of proposed embankments, the adequacy of liner protection and secondary drainage and the adequacy of liner anchorage, all for the proposed Organic Waste Storage Pond.

The Review confirms that these aspects of the design are in accordance with: IPENZ Practice Note 21.

On behalf of the firm undertaking this review, on the basis of the review undertaken, and subject to:

(i) Site verification of design assumptions with particular regard to the subgrade conditions and suitability of material for use as engineered fill,
(ii) The engineering work covered by this statement being inspected at appropriate times during construction by a representative of Hadley Consultants Ltd,
(iii) All construction work being carried out in accordance with the relevant sections of IPENZ Practice Note 21,
(iv) All proprietary products meeting their performance specification requirements;

I believe on reasonable grounds that a) the Farm Dairy Effluent Storage Pond if constructed in accordance with the drawings, specifications, and other documents provided or listed in the attached schedule, will comply with the relevant provisions of IPENZ Practice Note 21 and that b) the persons who have undertaken the review have the necessary competency to do so.

The Design Review Firm issuing this statement holds a current policy of Professional Indemnity Insurance no less than $200,000*. The Design Review Firm is a member of ACENZ.

.....

DATE: 7 April 2017

J.W.P Hadley on behalf of Hadley Consultants Limited

QUALIFICATIONS: B.E. (Hons), MIPENZ, IntPE, CPEng. REFERENCE No. 189829

Note: This statement shall only be relied upon by the Building Consent Authority named above. Liability under this statement accrues to the Design Review Firm only. The total maximum amount of damages payable arising from this statement and all other statements provided to the Building Consent Authority in relation to this building work, whether in contract, tort or otherwise (including negligence), is limited to the sum of $200,000.

FACTSHEET

WATER AND LAND 2020 & BEYOND

Physiographic zone: Oxidising

Southland's physiographic zones allow us to better understand why we have variations in water quality in different areas. We've divided Southland into nine different zones according to factors such as soil type, geology and topography. Through them we can target solutions to higher risk areas as opposed to a region-wide, generalised approach.

Understanding your zone

Each zone is different in the way contaminants build up and move through the soil, areas of groundwater, and into our streams and rivers. Physiographic zones allow us to target advice and management strategies to keep farm nutrients on the farm and out of waterways.

The Physiographics of Southland project was developed as part of *Water and Land 2020 & Beyond* so we can better understand:

- where our water comes from
- how water moves through the landscape
- why we have differences in water quality across the region

What does 'Oxidising' mean?

Oxidising means well aerated, with plenty of oxygen.

The Oxidising zone is characterised by soil water and groundwater that contains high levels of oxygen, which allows nitrogen to accumulate.

Key features of the Oxidising zone

- Low elevation, flat to gently undulating land on elevated terraces along the outer margins of the major river systems.
- Also located in inland basins and some lowland areas.
- Soils and aquifers have low denitrification potential.

Water source and movement

- A high density of small streams runs through the zone, which can rise rapidly during heavy rainfall.
- Alluvial deposits contain an extensive groundwater resource.
- Drainage to waterways varies depending on slope, soil texture and permeability.
- Flat, free-draining soils - water seeps straight down to underlying aquifers (areas of groundwater). Groundwater in this zone is 'recharged' (topped up) by rainfall that drains down through the soil.
- Slowly permeable soils may experience seasonal waterlogging. On flatter areas, they will often have artificial drainage when elevated above nearby streams. On more sloping areas, they will often have overland flow.

Contaminant movement

Groundwater in the Oxidising zone is susceptible to nitrate accumulation. Soils and underlying aquifers in the Oxidising zone have little ability to remove nitrogen (via a process called denitrification).

Streams in this zone rise rapidly during heavy rain when soils are wet. Soil water and groundwater carries with it contaminants, which continue to seep into streams after periods of heavy rain.

Oxidised soils can be very good at absorbing and storing water and any nitrogen it contains. During drier months, nitrogen is able to accumulate in soil to high levels. During winter when soils are wet, any nitrogen not used by plants leaches down into the underlying aquifer (deep drainage).

Artificial drainage (mole and tile drains) is used where soils have low subsoil permeability to help to reduce waterlogging. Contaminant loss through artificial drains to nearby streams can be high during wetter months. Overland flow may also occur during periods of heavy rain when soils are wet, especially where soils are sloping.

What does this mean for water quality?

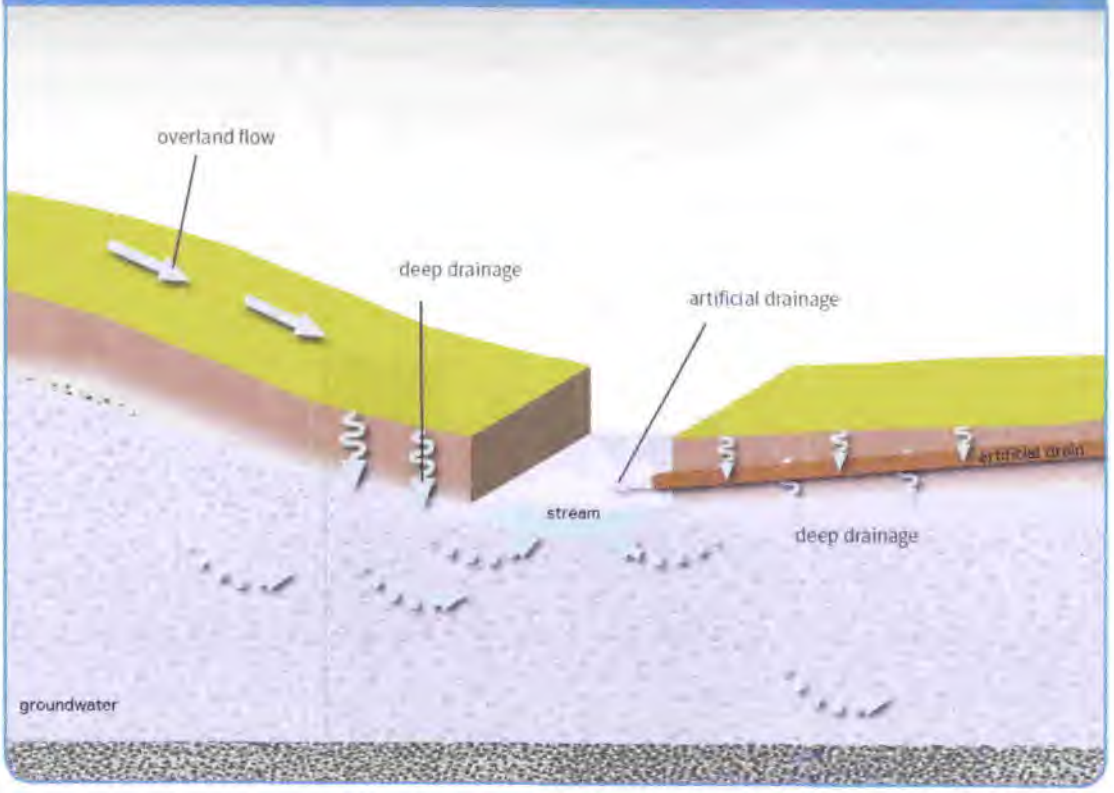
√ Soils have good phosphorus retention.

√ Limited potential for contaminant losses to rivers and streams as deep drainage is the main pathway.

X High risk of nitrogen build-up in groundwater.

X Following heavy or prolonged rainfall, contaminant losses to rivers and streams may occur via overflow or artificial drainage.

Contaminant loss during wet months



Deep drainage (leaching) of nitrogen to groundwater is the main contaminant pathway in this zone. Artificial drainage and overland flow are also important contaminant pathways in some parts of the zone and can carry nitrogen, phosphorus, sediment and microbes.

Improving water quality

The following good management practices are applicable to all physiographic zones in Southland:

- Capture nutrients, sediment and microbes in wetlands and sediment traps
- Nutrient management
- Riparian management
- Effluent management

Good management in the Oxidising zone

In addition to the above, good management in the Oxidising zone includes measures for reducing the effects of deep drainage, artificial drainage and overland flow.

Reduce the effects of deep drainage by reducing the accumulation of surplus nitrogen in the soil, particularly during autumn and winter.

Reduce the effects of artificial drainage by:

- Protecting soil structure, particularly in gullies and near stream areas
- Reducing phosphorus use and loss
- Reducing the accumulation of surplus nitrogen in the soil, particularly during autumn and winter
- Avoiding preferential flow of effluent through drains
- Capturing contaminants at drainage outflows

Reduce the effects of overland flow by:

- Protecting soil structure, particularly in gullies and near stream areas
- Managing critical source areas (CSA)
- Reducing phosphorus use or loss

Physiographic zones and the Southland Water and Land Plan

Environment Southland has developed a proposed Southland Water and Land Plan, using the science behind the physiographic zones to inform the plan and provide a tailored approach to particular issues that have been identified for each zone.

The main aim of the plan is to introduce new methods that help to halt any further decline in water quality by managing activities that we know adversely affect the quality of Southland's freshwater – such as land use intensification, wintering and stock in waterways. A key focus of the changes is to shift all land owners towards good management practices in ways that will give the best gains for maintaining water quality.

Further information

For more information about physiographic zones and good management practices contact Environment Southland. Phone 0800 76 88 45 or email service@es.govt.nz. You can also find out more about the Physiographics of Southland and your zone on our website, www.es.govt.nz.

What zone is your property in? View our map online: http://bit.ly/waterandlandmaps

environment SOUTHLAND REGIONAL COUNCIL
Te Taiao Tonga

Post: Private Bag 90116, Invercargill 9840 | Deliver: Cnr North Road and Price Street, Invercargill
Phone: 0800 76 88 45 | Email: service@es.govt.nz | Online: www.es.govt.nz

FACTSHEET

WATER AND LAND 2020 & BEYOND

Physiographic zone: Bedrock/Hill Country

Southland's physiographic zones allow us to better understand why we have variations in water quality in different areas. We've divided Southland into nine different zones according to factors such as soil type, geology and topography. Through them we can target solutions to higher risk areas as opposed to a region-wide, generalised approach.

Understanding your zone

Each zone is different in the way contaminants build up and move through the soil, areas of groundwater, and into our streams and rivers. Physiographic zones allow us to target advice and management strategies to keep farm nutrients on the farm and out of waterways.

The Physiographics of Southland project was developed as part of *Water and Land 2020 & Beyond* so we can better understand:

- where our water comes from
- how water moves through the landscape
- why we have differences in water quality across the region

What does 'Bedrock/Hill Country' mean?

Land with bedrock or glacial till* found near the surface, located below 800m above sea level.
There are no significant areas of groundwater.

***Glacial till is a mixture of rock debris and sediment that has been deposited by a glacier. It is relatively impermeable, allowing little water to get through.**

Key features of the Bedrock/Hill Country zone

- Mostly rolling to steep land, up to 800 metres above sea level (below the tree line).
- Prominent landforms.
- Soil overlies bedrock or glacial till.
- Either previously or currently densely covered with native forest, tussock or plantation forestry.
- Found throughout Southland.

Water source and movement

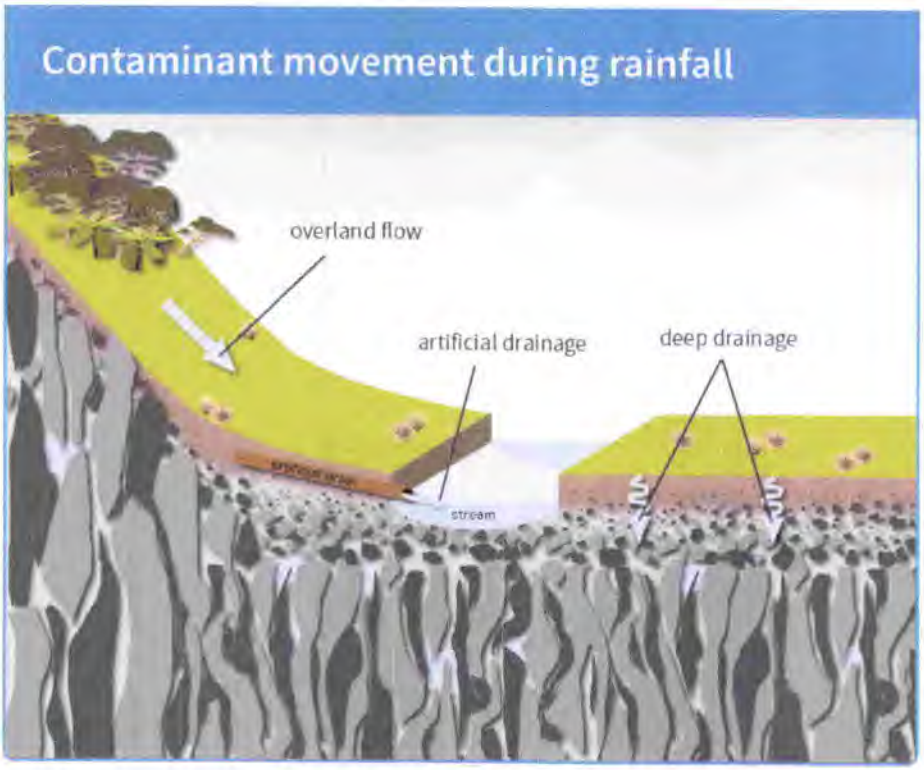
- High rainfall zone due to its elevation.
- Dense network of branching streams throughout the zone that flow to neighbouring lowland areas.
- No significant areas of groundwater.

Contaminant movement

Contaminant loss to streams is the main concern in this zone. Water quickly flows down-slope through wet soils and as overland flow to nearby streams following high or prolonged rainfall. Nitrogen, phosphorus, sediment and microbes are all carried with water, particularly during late autumn and winter.

In undeveloped areas Bedrock/Hill country streams can be a major source of recharge (top-up) water and dilution for lowland waterways and aquifers. However, in developed areas contaminants lost from Bedrock/Hill country streams contribute to the contamination loads in lowland streams in neighbouring zones.

Groundwater within the Bedrock/Hill Country zone is minimal and mainly found within rock fractures. Groundwater contaminants are typically not a concern for this zone.



Contaminant flow pathways for the Bedrock/Hill Country zone include overland flow (runoff) in the steeper areas, and artificial drainage where soils are poorly drained and deep drainage in flatter areas.

What does this mean for water quality?

√ Water from less developed areas of this zones provide a source of high quality water and dilution for downstream zones.

√ Little nitrogen build-up in groundwater due to denitrification in the soil zone.

X Water flowing over highly developed hills carries potentially large amounts of contaminants (nitrogen, phosphorus, sediment and microbes) to nearby streams, particularly following heavy rainfall.

X Water flowing through artificial drainage carries potentially large amounts of contaminants (nitrogen, phosphorus, sediment and microbes) to nearby streams, particularly following heavy rainfall.

Improving Southland's water quality

The following good management practices are applicable to all physiographic zones in Southland:

- Capture nutrients, sediment and microbes in wetlands and sediment traps
- Nutrient management
- Riparian management
- Effluent management

Good management in the Bedrock/Hill Country zone

In addition to the above, good management in the Bedrock/Hill Country zone includes measures for reducing the effects of overland flow and artificial drainage.

Reduce the effects of overflow by:

- Protecting soil structure, particularly in gullies and near stream areas
- Managing critical source areas (CSA)
- Reducing Phosphorus use and loss

Reduce the effects of artificial drainage by:

- Protecting soil structure, particularly in gullies and near stream areas
- Reducing phosphorus use and loss
- Reducing the accumulation of surplus nitrogen in the soil, particularly during autumn and winter
- Avoiding preferential flow of effluent through drains
- Capturing contaminants at drainage outflows

Physiographic zones and the Southland Water and Land Plan

Environment Southland has developed a proposed Southland Water and Land Plan, using the science behind the physiographic zones to inform the plan and provide a tailored approach to particular issues that have been identified for each zone.

The main aim of the plan is to introduce new methods that help to halt any further decline in water quality by managing activities that we know adversely affect the quality of Southland's freshwater – such as land use intensification, wintering and stock in waterways. A key focus of the changes is to shift all land owners towards good management practices in ways that will give the best gains for maintaining water quality.

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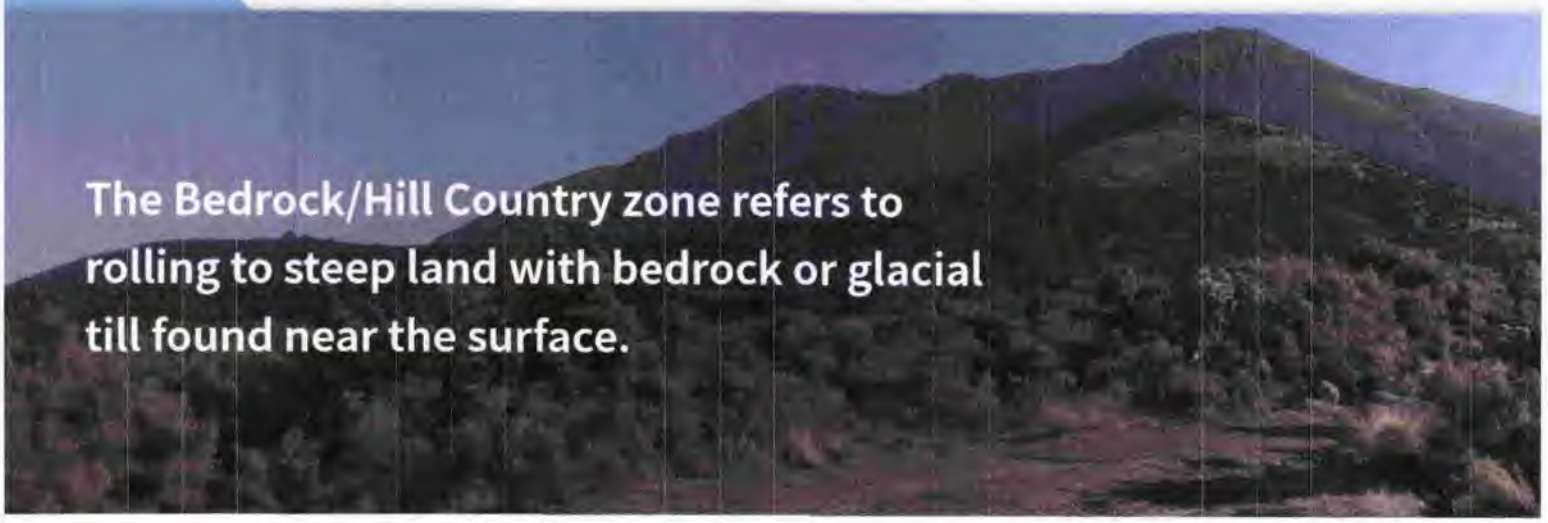

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FACTSHEET

WATER AND LAND 2020 & BEYOND

Physiographic zone: Gleyed

Southland's physiographic zones allow us to better understand why we have variations in water quality in different areas. We've divided Southland into nine different zones according to factors such as soil type, geology and topography. Through them we can target solutions to higher risk areas as opposed to a region-wide, generalised approach.

Understanding your zone

Each zone is different in the way contaminants build up and move through the soil, areas of groundwater, and into our streams and rivers. Physiographic zones allow us to target advice and management strategies to keep farm nutrients on the farm and out of waterways.

The Physiographics of Southland project was developed as part of *Water and Land 2020 & Beyond* so we can better understand:

- where our water comes from
- how water moves through the landscape
- why we have differences in water quality across the region

What does 'Gleyed' mean?

The Gleyed zone is found in low-lying areas.

Soils are poorly drained, prone to waterlogging, and have distinctive grey or rust-coloured spots or mottles.

Soils and aquifers can remove some to all nitrogen via denitrification.

Key features of the Gleyed zone

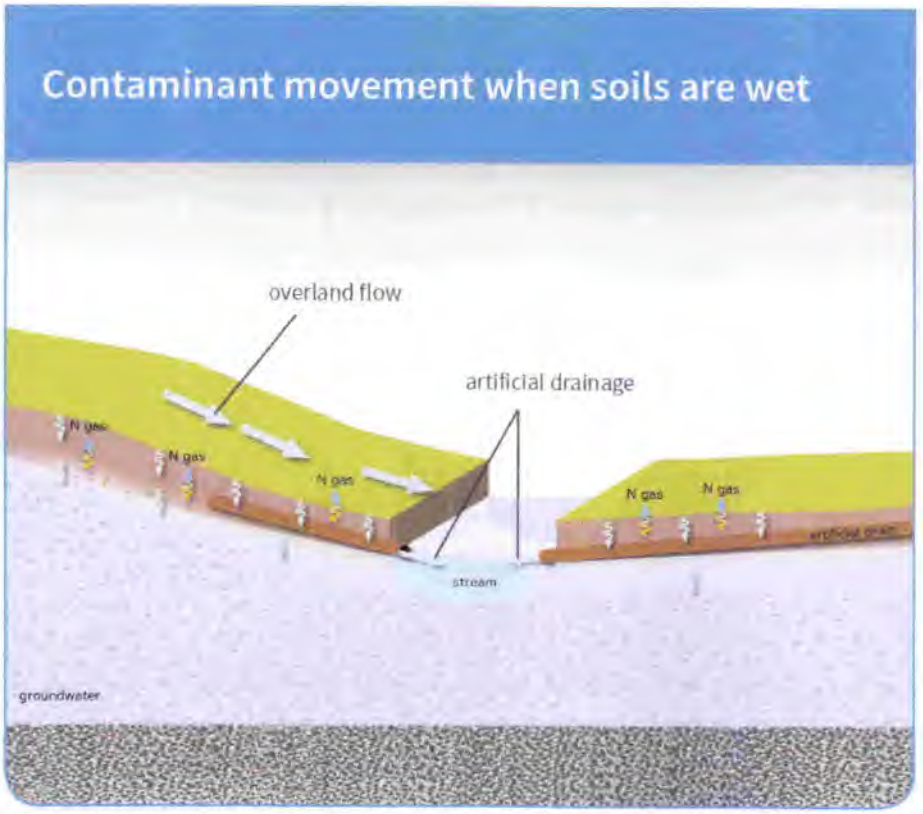
- Low-lying flat to undulating land on alluvial terraces, located between the major river systems on northern and southern plains.
- Generally found in historic wetland areas, and have a high water table during winter that's up to one metre below ground.
- Soils are generally fine textured, prone to water-logging, and have extensive artificial drainage (mole and tile drains).
- Some nitrogen is removed from water infiltrating through the soil zone via denitrification (lost as nitrogen gas).
- Loss of nutrients, sediments and microbes via artificial drains following heavy or prolonged rainfall are a key feature of this zone.
- Water in this zone is not directly linked to any of the major rivers and therefore does not experience dilution from Alpine or pristine Bedrock/ Hill Country zones.

Water source and movement

- When soils are wet, excess water from rainfall in flatter areas will flow via an extensive drainage network to nearby streams.
- In undulating areas excess water may also flow across the land surface as overland flow (runoff) during heavy rainfall.
- Some water will slowly make its way down to underlying aquifers.
- Aquifers are shallow and interconnect with streams and drains.

Contaminant movement

Soils may accumulate and store nitrogen during summer and early autumn when soil moisture levels are low. However, some nitrogen will be removed from the soil and aquifers via denitrification (lost as nitrogen gas), resulting in relatively low groundwater nitrate concentrations. Accumulated nitrogen starts moving with water when soils become wet in late autumn and winter and may be lost via artificial drains or overland flow.



During periods of heavy rain, phosphorus, nitrogen, sediment and microbes flow with water overland (overland flow) and via artificial drain networks to neighbouring streams. Some nitrogen is lost to underlying groundwater however the denitrifying ability of soils results in low levels of nitrogen contamination in groundwater.

What does this mean for water quality?

√ Some denitrification may occur within the soil zone.

X Artificial drainage rapidly move excess soil water and contaminants to rivers and streams particularly during heavy rainfall and wet periods.

Improving Southland's water quality

The following good management practices are applicable to all physiographic zones in Southland:

- Capture nutrients, sediment and microbes in wetlands and sediment traps
- Nutrient management
- Riparian management
- Effluent management

Good management in the Gleyed zone

In addition to the above, good management in the Gleyed zone includes measures for reducing the effects of artificial drainage and overflow drainage.

Reduce the effects of artificial drainage by:

- Protecting soil structure, particularly in gullies and near stream areas
- Reducing phosphorus use and loss
- Reducing the accumulation of surplus nitrogen in the soil, particularly during autumn and winter
- Avoiding preferential flow of effluent through drains
- Capturing contaminants at drainage outflows

Reduce the effects of overland flow by:

- Protecting soil structure, particularly in gullies and near stream areas
- Managing critical source areas (CSA)
- Reducing phosphorus use or loss

Physiographic zones and the Southland Water and Land Plan

Environment Southland has developed a proposed Southland Water and Land Plan, using the science behind the physiographic zones to inform the plan and provide a tailored approach to particular issues that have been identified for each zone.

The main aim of the plan is to introduce new methods that help to halt any further decline in water quality by managing activities that we know adversely affect the quality of Southland's freshwater – such as land use intensification, wintering and stock in waterways. A key focus of the changes is to shift all land owners towards good management practices in ways that will give the best gains for maintaining water quality.

Further information

For more information about physiographic zones and good management practices contact Environment Southland. Phone 0800 76 88 45 or email service@es.govt.nz. You can also find out more about the Physiographics of Southland and your zone on our website, www.es.govt.nz.

What zone is your property in? View our map online: http://bit.ly/waterandlandmaps

Soils in the Gleyed zone are poorly drained, often waterlogged and usually found in low-lying areas.

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Soil name: Lintley

Overview

Lintley soils occupy about 2700 ha in northern Southland on fans adjacent to the Lintley range between Balfour and Jollies Pass. They are formed into alluvial fan gravels mixed with a thin mantle of loess derived from greywacke. Lintley soils are shallow (<45 cm to gravel) and free draining. They are moderately fertile, with silty to sandy texture, but the rooting depth and water capacity is limited by the gravel. Present use is pastoral grazing with sheep deer and beef cattle with some cropping. Climate is cold in the winter with warm summers, when soils can seasonally dry out.

Lintley profile

Physical properties

Lintley soils have a slightly deep rooting depth and moderate plant available water, restricted by the subsoil gravelliness. The soils have good aeration and permeability through the profile, and may be excessively so in the stony soils of the shallow phase. Texture is silt loam in all horizons, but becomes sandy in extremely gravelly horizons. Topsoil clay content is 25–30%. The gravelliness of the subsoil can vary, and the rooting depth and water-holding capacity will improve in the less gravelly soils. Typically there is at least 35% gravel within 45cm depth.

Fertility properties

Topsoil organic matter levels are 6-7% and P-retention values 25–35%. pH vaues are moderate (5.8–6.1) in all horizons. Cation exchange and base saturation values are moderate. Available calcium and magnesium levels are moderate with potassium values low. Micronutrient levels are generally adequate, although molybdenum responses in legumes and boron responses in brassicas can be expected.

Associated and similar soils

Some soils that commonly occur in association with Lintley soils are:

- Longridge: poorly drained equivalent of the Lintley soil
- Waikoikoi: deep soils formed in loess; poorly drained soil with a fragipan
- Mossburn: deep to moderately deep soil formed in mixed loess and fan alluvium; poorly drained soil with a fragipan
- Crookston: well drained, deep to moderately deep soil formed in loess overlying fan or terrace gravels

Some soils that have similar properties to Lintley soils are:

- Gore: shallow soil formed on low river terraces
- Berwen: a Pallic soil formed on shallow fan alluvium from schist
- Dome: shallow recent soil, forming on the floodplain on fans from greywacke

Sustainable management indicators

Note: the vulnerability ratings given in the table below are generalised and should not be taken as absolutes for this soil type in all situations. The actual risk depends on the environmental and management conditions prevailing at a particular place and time. Specialist advice should be sought before making management decisions that may have environmental impacts. Where vulnerability ratings of Moderate to Very severe are indicated, advice may be sought from Environment Southland or a farm management consultant.

Vulnerability factor	Rating	Vulnerability compared to other Southland soils
Structural compaction	moderate	These soils have a moderate vulnerability to structural degradation by long-term cultivation, or compaction by heavy stocking and vehicles. This rating reflects the good drainage, moderate clay, and organic matter levels.
Nutrient leaching	very severe	These soils have a very severe vulnerability to leaching to groundwater. This rating reflects the good drainage, moderate water holding capacity and rapid permeability. .
Topsoil erodibility by water	minimal	Due to the moderate clay and organic matter levels, topsoil erodibility in these soils is minimal. Erodibility is highly dependent on management, particularly when there is no vegetation cover.
Organic matter loss	moderate	Vulnerability to long-term decline in soil organic matter levels is partly dependent on soil properties and highly dependent on management practices (e.g., crop residue management and cultivation practices).
Waterlogging	nil	These soils have a nil vulnerability to waterlogging during wet periods. This rating reflects the good drainage, and permeability.

General landuse versatility ratings

Note: The versatility ratings in the table below are indicative of the major limitations for semi-intensive to intensive land use. These ratings differ from those used in the past in that sustainability factors are incorporated in the classification. Refer to the Topoclimate district soil map or property soil map to determine which of the soil symbols listed below are applicable, then check the versatility ratings for that symbol in the appropriate table.

LiU3 (Lintley undulating shallow)
LiR3 (Lintley rolling shallow)

Versatility evaluation for soil LiU3, LiR3		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Limited	Vulnerability to leaching to groundwater; restricted rooting depth
Arable	Limited	Vulnerability to leaching to groundwater: restricted rooting depth.
Intensive pasture	Limited	Vulnerability to leaching to groundwater; restricted rooting depth.
Forestry	Limited	Restricted rooting depth

LiU3vi (Lintley undulating shallow imperfectly drained variant): as above, but main limitation for all landuses is restricted rooting depth.

LiU2 (Lintley undulating moderately deep)

Versatility evaluation for soil LiU2		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Moderate	Vulnerability to leaching to groundwater; restricted rooting depth
Arable	Moderate	Vulnerability to topsoil structural degradation by cultivation and compaction; vulnerability to leaching to groundwater
Intensive pasture	Moderate	Vulnerability to topsoil structural degradation by cultivation and compaction; vulnerability to leaching to groundwater
Forestry	Moderate	Restricted rooting depth

Management practices that may improve soil versatility

- Management of nutrient applications so as to minimise leaching losses

Soil name: Longridge

Overview

Longridge soils occupy about 2,400 ha in hollows and toe slopes of fans in northern Southland between Balfour and Athol and south of Tapanui in west Otago. They are formed into alluvial fan gravels mixed with a thin mantle of loess derived from greywacke. They are shallow, silty, poorly drained soils that have a high water table. Present use is pastoral grazing with sheep, beef cattle and deer. Climate is cool temperate with regular rain.

Longridge profile

Physical properties

Longridge soils have a slightly deep rooting depth and moderate plant available water that is limited by the subsoil gravelliness. Permeability is slow, with poor aeration due to the high water table. Textures are heavy silt loams to silty clay, grading to coarser loamy textures in the gravels. Topsoil clay content is 25–40% with a slight to moderate gravel content. Subsoils are very to extremely gravelly.

Fertility properties

Topsoil organic matter levels vary between 5 and 12%; P-retention 20–30% and pH values moderate (high 5s). Subsoil pH values are about 6.0. Cation exchange values are moderate and base saturation high. Available calcium and magnesium levels are moderate and potassium low. Reserve phosphorus levels are also low. Micronutrient levels are generally adequate although molybdenum responses in legumes can be expected.

Associated and similar soils

Some soils that commonly occur in association with Longridge soils are:

- Jacobstown: moderately deep to deep poorly drained silty soils formed in alluvium on the floodplains of major streams.
- Makarewa: moderately deep to deep poorly drained clayey soils formed in alluvium on the floodplains of major streams.
- Glenure: moderately deep to deep poorly drained gley soils formed into loess on fans and terraces.
- Lintley: well drained shallow soil forming in fan gravels.

Some soils that have similar properties to Longridge soils are:

- Dipton: shallow, poorly drained soil due to water perching on clay-bound gravels of intermediate to high terraces.
- Lumsden: shallow, poorly drained soil of floodplains and low terraces; due to a high groundwater table
- Caroline: shallow to moderately deep poorly drained soil on low terraces; due to a high groundwater table, with a cemented ironpan

Sustainable management indicators

Note: the vulnerability ratings given in the table below are generalised and should not be taken as absolutes for this soil type in all situations. The actual risk depends on the environmental and management conditions prevailing at a particular place and time. Specialist advice should be sought before making management decisions that may have environmental impacts. Where vulnerability ratings of Moderate to Very severe are indicated, advice may be sought from Environment Southland or a farm management consultant.

Vulnerability factor	Rating	Vulnerability compared to other Southland soils
Structural compaction	severe	These soils have a severe vulnerability to structural degradation by long-term cultivation, or compaction by heavy stocking and vehicles. This rating reflects the poor drainage and low P-retention.
Nutrient leaching	moderate	These soils have a moderate vulnerability to leaching to groundwater. This rating reflects the moderate water holding capacity, offset by the slow permeability and poor drainage.
Topsoil erodibility by water	minimal	Due to the moderate to high clay content, topsoil erodibility in these soils is minimal. Erodibility is highly dependent on management, particularly when there is no vegetation cover.
Organic matter loss	severe	Vulnerability to long-term decline in soil organic matter levels is partly dependent on soil properties and highly dependent on management practices (e.g., crop residue management and cultivation practices).
Waterlogging	severe	These soils have a severe vulnerability to waterlogging during wet periods on undulating and rolling slopes with a moderate and slight rating on hilly and steep slopes respectively. This rating reflects the poor drainage and slow permeability.

General landuse versatility ratings

Note: The versatility ratings in the table below are indicative of the major limitations for semi-intensive to intensive land use. These ratings differ from those used in the past in that sustainability factors are incorporated in the classification. Refer to the Topoclimate district soil map or property soil map to determine which of the soil symbols listed below are applicable, then check the versatility ratings for that symbol in the appropriate table.

LnU3 (Longridge undulating shallow)

Versatility evaluation for soil LnU3		
Landuse	Versatility rating	Main limitation
Non-arable horticulture	Limited	Inadequate aeration during wet periods; restricted rooting depth
Arable	Limited	Inadequate aeration during wet periods; short-term waterlogging risk after heavy rain.
Intensive pasture	Limited	Short-term waterlogging risk after heavy rain.
Forestry	Limited	Inadequate aeration during wet periods; restricted rooting depth

LnR3 (Longridge rolling shallow): as above, but rolling slopes replace short-term waterlogging as a limitation for arable landuse.

LnH3 (Longridge hilly shallow) and **LnS3 (Longridge steep shallow):** unsuitable for non-arable horticulture and arable landuse due to hilly or steep slopes; limited versatility for intensive pasture due to slope and risk of short-term waterlogging after heavy rain, and for forestry due to inadequate aeration during wet periods and restricted rooting depth (hilly phase) and steep slope and restricted rooting depth (steep phase).

Management practices that may improve soil versatility

- Careful management after heavy rain and wet periods will reduce the impact of short-term waterlogging. Intensive stocking, cultivation and heavy vehicular traffic use should be minimised during these periods.
- Installation of tile drains will reduce the risk of aeration limitations and short-term waterlogging.

Soil name: Hokonui

Overview

Hokonui soils occupy about 4000ha on fans flanking the Hokonui hills between Mandeville and Mossburn in northern Southland and in local areas in eastern Southland. They are formed in dominantly fine alluvium or in situ weathering of tuffaceous argillite, with varying minor inputs of loess derived from greywacke and schist rock. Hokonui soils have poor drainage, moderately deep rooting depth, moderate water holding capacity, and heavy silt loam to clay texture. They are used for pastoral farming with sheep, dairy and beef cattle with some cropping. Soils receive regular rain but can be dry in summer in some years.

Hokonui profile

Physical properties

Hokonui soils have moderate plant available water and a moderately deep rooting depth that is limited by the high bulk density in the lower subsoil. The rooting depth may also be limited by poor aeration during wet periods due to the poor drainage and slow subsoil permeability. Textures are heavy silt loam to clay in the upper horizons, and silty clay to clay in the lower subsoil. Topsoil clay content is 30–50%. The soils are typically stone free, although the moderately deep phases will have gravel or bedrock between 45 and 90cm depth.

Fertility properties

Topsoil organic matter levels are 6–8%; P-retention levels 30–40% and pH values moderate (mid 5s). Subsoil pH values tend to be higher. Cation exchange values are moderate to high with high base saturatuion. Available calcium and magnesium are moderate to high with potassium low. Reserve phosphorus levels are also low. Micro nutrient levels are generally adequate.

Associated and similar soils

Some soils that commonly occur in association with Hokonui soils are:

- Glenure: deep to moderately deep, silty textured poorly drained soil formed in dominantly loess with no fragipan.
- Waikoikoi: deep to moderately deep, silty textured poorly drained soil formed in dominantly loess with a fragipan
- Mandeville: well drained shallow soil, forming onto tuffaceous greywacke bedrock

Some soils that have similar properties to Hokonui soils are:

- Pukemutu: poorly drained due to the presence of a fragipan
- Mangapiri: poorly drained, formed in fine colluvium from soft siltstone and mudstone; has clayey textures throughout.
- Sobig: poorly drained due to water perching on clay-bound terrace gravels

Sustainable management indicators

Note: the vulnerability ratings given in the table below are generalised and should not be taken as absolutes for this soil type in all situations. The actual risk depends on the environmental and management conditions prevailing at a particular place and time. Specialist advice should be sought before making management decisions that may have environmental impacts. Where vulnerability ratings of Moderate to Very severe are indicated, advice may be sought from Environment Southland or a farm management consultant.

Vulnerability factor	Rating	Vulnerability compared to other Southland soils
Structural compaction	moderate	These soils have a moderate vulnerability to structural degradation by long-term cultivation, or compaction by heavy stocking and vehicles. This rating reflects the poor drainage, but is offset by the high clay content.
Nutrient leaching	slight	These soils have a slight vulnerability to leaching to groundwater. This rating reflects the poor drainage and slow permeability.
Topsoil erodibility by water	minimal	Due to the high clay content, topsoil erodibility in these soils is minimal. Erodibility is highly dependent on management, particularly when there is no vegetation cover.
Organic matter loss	moderate	Vulnerability to long-term decline in soil organic matter levels is partly dependent on soil properties and highly dependent on management practices (e.g., crop residue management and cultivation practices).
Waterlogging	severe	These soils have a severe vulnerability to waterlogging during wet periods. This rating reflects the slow permeability and poor drainage.

General landuse versatility ratings

Note: The versatility ratings in the table below are indicative of the major limitations for semi-intensive to intensive land use. These ratings differ from those used in the past in that sustainability factors are incorporated in the classification. Refer to the Topoclimate district soil map or property soil map to determine which of the soil symbols listed below are applicable, then check the versatility ratings for that symbol in the appropriate table.

HkU1 (Hokonui undulating deep) and **HkU2 (Hokonui undulating moderately deep)**

Versatility evaluation for soil HkU1, HkU2		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Limited	Inadequate aeration during wet periods; risk of short-term waterlogging after heavy rain
Arable	Limited	Inadequate aeration during wet periods; risk of short-term waterlogging after heavy rain.
Intensive pasture	Limited	Risk of short-term waterlogging after heavy rain
Forestry	Limited	Inadequate aeration during wet periods; vulnerability to sustained waterlogging

HkR1 (Hokonui rolling deep) and **HkR2 (Hokonui rolling moderately deep):** as above, but rolling slopes are a limitation to arable landuse.

HkH1 (Hokonui hilly deep)

Versatility evaluation for soil HkH1		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Unsuitable	Hilly slopes
Arable	Unsuitable	Hilly slopes
Intensive pasture	Limited	Hilly slopes; risk of short-term waterlogging after heavy rain
Forestry	Limited	Inadequate aeration during wet periods.

Management practices that may improve soil versatility

- Careful management after heavy rain and wet periods will reduce the impact of short-term waterlogging. Intensive stocking, cultivation and heavy vehicular traffic should be minimised during these periods.
- Installation and maintenance of sub-surface mole and tile drains will reduce the risk of short-term waterlogging.

Soil name: Pukemutu

Overview

Pukemutu soils occupy about 47,600 hectares on high terraces south of the Taringatura and Hokonui hills, extending across the Southland Plain. They also occur intermittently north of the Hokonui Hills on dissected terraces and fans from Mandeville to Mossburn. They are formed in deep loess derived from tuffaceous greywacke. They have heavy silt loam, grading with depth to silty clay, textures and are poorly drained, with a dense fragipan between 60 and 90cm depth which restricts water drainage. They respond well to mole and tile drainage and are used for intensive sheep, dairy and deer production, with some cropping. Regular summer rainfall occurs, though inland soils may be seasonally dry.

Pukemutu profile

Physical properties

Pukemutu soils have a moderately deep potential rooting depth that is severely restricted by the fragipan at 60–90 cm depth. The depth of the fragipan means the Pukemutu soils typically have moderately high to high plant available water. The soils are poorly drained, with very slow permeability in the subsoil and limited aeration during sustained wet periods. Textures are typically heavy silt loams, increasing to silty clay in the lower subsoil. Topsoil clay content is typically 25–30%, and stone free. The moderately deep variants have gravel between 45 and 90cm depth.

Fertility properties

Organic matter values range from 4 to 6%; P-retention values under 30%; pH values above 5.5 but tend to decline down the profile. Cation exchange values are low, with base saturation increasing in the subsoil, which also has higher magnesium values than the topsoil. Values for available calcium, potassium and sodium are low. Phosphorus reserves are low and sulphur levels increase in the subsoil. Good responses to lime and phosphate occur. Micro-nutrient levels are generally adequate, although boron responses in brassicas and molybdenum responses in legumes can occur.

Associated and similar soils

Some soils that commonly occur in association with Pukemutu soils are:

- Braxton: moderately deep to deep Gley soil on terraces with heavy silt loam to clayey textures; has no perch-gley properties or fragipan within 90cm depth
- Makarewa: Gley soil with clayey textures on the floodplain
- Woodlands: imperfectly drained Brown soil without a fragipan
- Tisbury: Gley soil on terraces of the Southland Plain; has silty textures throughout and is strongly leached, with moderate to high P-retention; has no perch-gley properties or fragipan within 90cm depth.

Some soils that have similar properties to Pukemutu soils are:

- Aparima: imperfectly drained equivalent of the Pukemutu soil
- Mossburn: similar profile form to Pukemutu, but has siltier textures throughout the profile; formed in mixed loess and colluvium on fans flanking the Taringatura Hills; commonly has stones scattered through the profile
- Waikoikoi: has silty textures throughout the profile; fragipan has prismatic structure and occurs at a shallower depth (45–60cm)
- Hokonui: has clayey textures, and formed in mixed loess and alluvium on fans from the Hokonui Hills; has perch-gley properties but not fragipan.

Sustainable management indicators

Note: the vulnerability ratings given in the table below are generalised and should not be taken as absolutes for this soil type in all situations. The actual risk depends on the environmental and management conditions prevailing at a particular place and time. Specialist advice should be sought before making management decisions that may have environmental impacts. Where vulnerability ratings of Moderate to Very severe are indicated, advice may be sought from Environment Southland or a farm management consultant.

Vulnerability factor	Rating	Vulnerability compared to other Southland soils
Structural compaction	Severe	These soils have a severe vulnerability to structural degradation by long-term cultivation, or compaction by heavy stocking and vehicles. This rating reflects the poor drainage, low clay and P-retention in the topsoil that results in low structural stability.
Nutrient leaching	Slight	These soils have a slight vulnerability of leaching to ground water. The vulnerability is strongly influenced by the moderately high water-holding capacity and the slow permeability of the subsoil. Lateral water flow in installed mole and tile drains would increase losses.
Topsoil erodibility by water	Moderate	Due to the low clay content, the topsoil erodibility of these soils is moderate. Erodibility is highly dependent on management, especially when there is no vegetation cover.
Organic matter loss	Slight	Vulnerability to long-term decline in soil organic matter levels is partly dependent on soil properties, and highly dependent on management practices (e.g., crop residue management and cultivation practices)
Waterlogging	Severe	These soils have severe vulnerability to waterlogging during wet periods. This rating reflects the poor drainage and slow permeability.

General landuse versatility ratings

Note: The versatility ratings in the table below are indicative of the major limitations for semi-intensive to intensive land use. These ratings differ from those used in the past in that sustainability factors are incorporated in the classification. Refer to the Topoclimate district soil map or property soil map to determine which of the soil symbols listed below are applicable, then check the versatility ratings for that symbol in the appropriate table.

PgU1 (Pukemutu undulating deep); PgU1vf (Pukemutu undulating deep flood plain variant); PgU2 (Pukemutu undulating moderately deep); PgU2vf (Pukemutu undulating moderately deep flood plain variant); PgR1 (Pukemutu rolling deep)

Versatility evaluation for soil PgU1, PgU1vf, PgU2, PgU2vf		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Limited	Inadequate aeration during wet periods; risk of short-term waterlogging after heavy rainfall.
Arable	Limited	Inadequate aeration during wet periods; risk of short-term waterlogging after heavy rainfall.
Intensive pasture	Limited	Risk of short-term waterlogging after heavy rainfall.
Forestry	Limited	Inadequate aeration during wet periods; vulnerability to sustained waterlogging.

Note: rolling slopes are an additional limitation for arable landuse on PgR1 soils

PgH1 (Pukemutu hilly deep)

Versatility evaluation for soil PgH1		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Unsuitable	Hilly slopes
Arable	Unsuitable	Hilly slopes
Intensive pasture	Limited	Hilly slopes; risk of short-term waterlogging after heavy rain.
Forestry	Limited	Inadequate aeration during wet periods.

Management practices that may improve soil versatility

- Careful management after heavy rain and wet periods will reduce the impact of short-term waterlogging. Intensive stocking, cultivation and heavy vehicular traffic should be minimised during these periods.
- Installation and maintenance of sub-surface mole and tile drains will reduce the risk of short-term waterlogging.
- If compaction occurs, aeration at the correct depth and moisture condition can be of benefit.

Soil name: Wendon

Overview

Wendon soils occupy about 6,400 ha on undulating to steep slopes of hilly land in northern and eastern Southland. They are formed into thin loess overlying bedrock or stony colluvium from greywacke. Wendon soils are well drained, with a shallow rooting depth and moderate water holding capacity that is limited by the graveliness and bedrock that commonly occurs within 45cm depth. They are used for extensive pastoral grazing with sheep and beef cattle. Climate is cool temperate with regular rain, though these soils can dry out in summer because of their shallow depth and good drainage.

Wendon profile

Physical properties

Wendon soils have a shallow rooting depth, restricted by the graveliness and bedrock in the subsoil, and moderate available water. These soils are well drained, with good aeration and permeability throughout the soil. Textures are typically silt loam, with topsoil clay content of 15–30%. The soils are gravelly throughout, and typically have at least 35% gravel within 45cm depth. Bedrock also typically occurs within 45cm depth.

Fertility properties

Topsoil organic matter levels are 6–9%; P-retention values <25% and pH values moderate (typically below 5.5 in the subsoil). Cation exchange is moderate throughout the profile. Base saturation is high in the topsoil but low in the subsoil. Availability of calcium, magnesium and potassium is moderate to low. Natural reserves of phosphorus and sulphur are low. Micro-nutrient levels are generally adequate but molybdenum may be required for legumes.

Associated and similar soils

Some soils that commonly occur in association with Wendon soils are:

- Waikoikoi: poorly drained, deep soil with a fragipan; formed in deep loess
- Glenure: poorly drained deep soil without a fragipan; formed in deep loess
- Josephville: well drained soil formed in a mix of stony colluvium and a significant proportion of loess; is gravelly but has <35% gravel within 45cm depth
- Waikaka: well drained Brown soil formed into deep loess

Some soils that have similar properties to Wendon soils are:

- Taringatura: moderately leached Brown soil; formed on tuffaceous greywacke and greywacke bedrock and stony colluvium of the Taringatura Hills
- Tyneholm: moderately leached Brown soil with tuffaceous greywacke bedrock within 45cm depth
- Mandeville: Melanic soil with tuffaceous greywacke bedrock within 45cm depth
- Pukekoma: strongly leached Brown soil with pH <4.8 formed on greywacke and subschist bedrock within 45cm depth.

Sustainable management indicators

Note: the vulnerability ratings given in the table below are generalised and should not be taken as absolutes for this soil type in all situations. The actual risk depends on the environmental and management conditions prevailing at a particular place and time. Specialist advice should be sought before making management decisions that may have environmental impacts. Where vulnerability ratings of Moderate to Very severe are indicated, advice may be sought from Environment Southland or a farm management consultant.

Vulnerability factor	Rating	Vulnerability compared to other Southland soils
Structural compaction	moderate	These soils have a moderate vulnerability to structural degradation by long-term cultivation, or compaction by heavy stocking and vehicles. This rating reflects the low P-retention and moderate to low clay percentage.
Nutrient leaching	very severe	These soils have a very severe vulnerability to leaching to groundwater. This rating reflects the good drainage, rapid permeability, and moderate water-holding capacity.
Topsoil erodibility by water	slight	Due to the silt loam texture, the topsoil erodibility of these soils is slight. Erodibility is highly dependent on management, particularly when there is no vegetation cover.
Organic matter loss	moderate	Vulnerability to long-term decline in soil organic matter levels is partly dependent on soil properties, and highly dependent on management practices (e.g., crop residue management and cultivation practices).
Waterlogging	nil	These soils have a nil vulnerability to waterlogging during wet periods. This rating reflects the good drainage, permeability, and the rolling to steep slopes.

General landuse versatility ratings

Note: The versatility ratings in the table below are indicative of the major limitations for semi-intensive to intensive land use. These ratings differ from those used in the past in that sustainability factors are incorporated in the classification. Refer to the Topoclimate district soil map or property soil map to determine which of the soil symbols listed below are applicable, then check the versatility ratings for that symbol in the appropriate table.

WeR3 (Wendon rolling shallow)

Versatility evaluation for soil WeR3		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Limited	Restricted rooting depth
Arable	Limited	Rolling slopes; restricted rooting depth
Intensive pasture	Limited	Vulnerability to leaching to groundwater; restricted rooting depth
Forestry	Unsuitable	Shallow rock depth

WeU3 (Wendon undulating shallow)

Versatility evaluation for soil WeU3		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Limited	Shallow rock depth.
Arable	Limited	Vulnerability to leaching to groundwater; restricted rooting depth
Intensive pasture	Limited	Vulnerability to leaching to groundwater; restricted rooting depth
Forestry	Unsuitable	Shallow rock depth

WeH3 (Wendon hilly shallow); WeS3 (Wendon steep shallow)

Versatility evaluation for soil WeH3, WeS3		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Unsuitable	Hilly and steep slopes
Arable	Unsuitable	Hilly and steep slopes
Intensive pasture	Limited	Hilly and steep slopes; restricted rooting depth
Forestry	Unsuitable	Shallow rock depth.

Management practices that may improve soil versatility

- Management of nutrient applications that minimise leaching losses

Description of the affected environment

The farm is at 966 Athol Five River Highway. A tributary of the Mataura River start on the west face of east dome at the south east end of the property.

Soils

Soil name	Vulnerability Factors Structural compaction	Nutrient leaching	Waterlogging
Lintley	moderate	very severe	nil
Longridge	severe	moderate	severe
Hokonui	moderate	slight	severe
Pukemutu	severe	slight	severe
Wendon	moderate	very severe	nil

FDE land classification	50% (category A) 50% (category C)
Characteristics of FDE classification	A mix of high risk and low risk soils
Groundwater nitrate levels	100% - 0.1 – 0.4 mg/l – Pristine, pre-European

Physiographic Zones	Zone	Contaminants pathways for zone
	Oxidizing	High risk of nitrogen build-up in groundwater. Following heavy or prolonged rainfall, contaminant losses to rivers and streams may occur via overflow or artificial drainage.
	Bedrock/hill	Overland flow in steeper areas Artificial drainage of contaminants in areas of poor drainage.
	Gleyed	Artificial drainage rapidly moved excess soil water and contaminants to rivers and streams.

Physiographic Zones

The farm is in three physiographic zones.

Oxidizing - This area has low elevation, flat to gently undulating land on elevated terraces along the outer margins of major river systems. They are located in inland basins and some lowland areas, the soils and aquifers have low denitrification. The aim is to spread the effluent over a wide area to spread the nitrogen widely. The flat land and stop banks will stop nutrients, sediment and microbes from entering the Oreti River. All open water areas have riparian areas that are well vegetated.

Bedrock/Hill Country – This area is mostly rolling to steep land, up to 800 metres above sea level or prominent landforms. The soil overlies bedrock or glacial till. It was previously covered with native forest or tussock. The aim is to protect the soil so that phosphorus loss is reduced. There are no open drains within 600m of the steeper areas. By using split nitrogen applications and not applying it during late autumn and winter N loss will be reduced. The effluent will not be applied when soil moisture levels are high and with the slurry tanker can apply very low rates if required. The hill country has flat buffer areas that allows any surface water to slow and drop sediment or faecal pathogens.

Gleyed - This area is low-lying flat to undulating land on alluvial terraces, located between the major rivers system and in this case on the southern plains. This area is historically wet and has a high water table during

environment SOUTHLAND

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(Private Bag 90116)
Invercargill

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Fax No. (03) 211 5252
Southland Freephone No. 0800 76 88 45

File No: _____
Officer in Charge: _____

To: The General Manager
Environment Southland
Private Bag 90116
Invercargill 9840

WRITTEN APPROVAL OF A POTENTIALLY AFFECTED PARTY

Approval by Person(s) Potentially Affected by an Application for a Resource Consent

To be completed by the person requesting approval

Applicant: Cameron Kerr

Type of Resource Consent: deposit substance / discharge.

Proposed Activity: Compost wood chips, Animal waste of face heifers after Collagen has been extracted

Location: Paerau 966, SH6, Athol Five rivers Hwy on farm 1.5km away from Boundary's

To be completed by the person giving his or her approval:

Name: Pat & Barbara McNamee

and/or Organisation: _____

Street/Road Address: 1222 Athol - Five Rivers H/Ways

I/we have sighted all the attached plans and supporting information for the above activity.

I/we hereby give approval for the proposal to be considered by Environment Southland without public notification.

I/we understand that, if I give my approval, Environment Southland shall not take into account any effects that the proposed activity may have on me, when considering the application (Section 104(3)(b) of the Resource Management Act 1991).

P & B McNamee
(Signature)

9/8/16
(Date)

NOTE: IF YOU DO NOT UNDERSTAND WHAT THIS FORM IS, OR DETAILS ABOUT THE APPLICATION ASSOCIATED WITH THIS FORM, DO NOT SIGN IT.

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Approval by Person(s) Potentially Affected by an Application for a Resource Consent

To be completed by the person requesting approval

Applicant: Cameron Kerr

Type of Resource Consent: deposit solutions / discharge.

Proposed Activity: Compost wood chips, Animal waste & bore holes after Collagen has been extracted

Location: Parawa 966, SH6, Athol Five Rivers Hwy
on from 1.5km away from Beaudesert's

To be completed by the person giving his or her approval:

Name: Rosie Hore

and/or Organisation: Parawa Farmlands Limited

Street/Road Address: 631 Athol Five Rivers Highway Lumsden

I/we have sighted all the attached plans and supporting information for the above activity.

I/we hereby give approval for the proposal to be considered by Environment Southland without public notification.

I/we understand that, if I give my approval, Environment Southland shall not take into account any effects that the proposed activity may have on me, when considering the application (Section 104(3)(b) of the Resource Management Act 1991).

(Signature) 9/8/16 (Date)

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Approval by Person(s) Potentially Affected by an Application for a Resource Consent

To be completed by the person requesting approval

Applicant: Cameron Kerr

Type of Resource Consent: deposit reclamation / discharge

Proposed Activity: Compost wood chips, Animal waste of face knives after Collagen has been extracted

Location: Parawa 966, SH6, Athol Five Rivers Hwy
on farm 1.5km away from Boundary's

To be completed by the person giving his or her approval:

Name: Allen John Baird

and/or Organisation: Farmer

Street/Road Address: No 3 RD Dunsdale 166 Bister Road

I/we have sighted all the attached plans and supporting information for the above activity.

I/we hereby give approval for the proposal to be considered by Environment Southland without public notification.

I/we understand that, if I give my approval, Environment Southland shall not take into account any effects that the proposed activity may have on me, when considering the application (Section 104(3)(b) of the Resource Management Act 1991).

A J Baird
(Signature)

7/8/2016
(Date)

NOTE: IF YOU DO NOT UNDERSTAND WHAT THIS FORM IS, OR DETAILS ABOUT THE APPLICATION ASSOCIATED WITH THIS FORM, DO NOT SIGN IT.