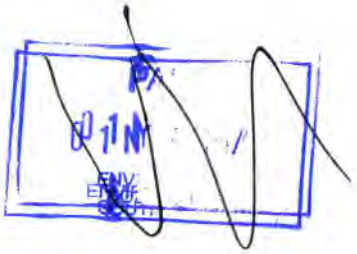
civil tech

1 November 2017



credit
$1650

The General Manager
Environment Southland
Private Bag 90116
INVERCARGILL

Dear Sir

RE: Application for an Expanded Dairy Farm Including Renewal of Discharge and Water Permits and Land use for Storage pond Construction – Miraka Farms Ltd

Attached is an application for an expanded dairy farm and renewals of the existing discharge and water permits and land use consent for a storage pond. Most of the additional land has been used for the past 7 years and the land is leased from a family member.

Attached is the application plus the nutrient budgets and the .xml files of these can be sent electronically directly to the person processing the consent. The Appendix N is also attached.

The old storage pond will be used while the new pond is built. But if the application is processed quickly it can be built before April 2018. It has been inspected by a CPEng rep and there is no reason to believe that it is leaking. A drop test will be carried out and a full structural inspection when it is empty as the applicant would like to retain the pond which would allow a standoff pad to be constructed at a later time but this is not part of the application.

The application fee of $1650.00 was paid at reception.

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

MIRAKA FARMS LTD

Application to expand dairy farm.

Renewal of Discharge Dairy Effluent to Land

Take Groundwater

Proposal Overview and Assessment of Environment Effects

Prepared by

Civil Tech Ltd
P O Box 1558
INVERCARGILL 9840
T: (03) 216 9745
F: (03) 216 9735
M: 0274 357 957
E: murray@civiltech.co.nz

Table of Contents

Application for Resource Consent (PART A)

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: Miraka Farms Ltd c/- Peter Dykes

Address: 162 Boyle Road
Heddon Bush 9783

Email: mirakafarms@gmail.com

Phone: 027 222 4578 *Preferred* _____ *Additional* Fax: _____

Consultant contact details *(if different from above)*

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

Address: PO Box 1558
Invercargill 9840

Email: murray@civiltech.co.nz

Phone: 03 216 7945 *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
- [x] 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
- [x] 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:

204990 Discharge – 26/03/2018
204991 Water – 26/03/2018

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:

Land use for effluent storage

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

Expand dairy farm, renew consent for discharge effluent to land, take ground water, construct effluent pond.

4 Location of proposed activity

Address: 162 Boyle Road

Heddon Bush 9783

Legal Description: Lt 3 & Part Lt 5 DP 168 & Lt 1 DP 4967 & Sec 234 Oreti HD

Lt 1 & 2 DP 471006 and Sec 144 Oreti HD

Map Reference (NZTM 2000): 1226988E 4886360 N

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

Name: Phone:

Address:

3 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)*
- [ ] Written approval from all potentially affected parties *(forms available from the Environment Southland website)*
- [x] Site plan/location map/sketch of the proposed activity
- [x] 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 _____ **Date** 1/11/2017

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

NOTE: The *Assessment of Effects* and the *Fee Schedule* pages have been removed, but are included in other parts of the application.

Effluent Disposal Area Details				
Soils	**Soil Type**	**Vulnerability Factors**		
		Structural Compaction	**Nutrient leaching**	**Waterlogging**
	Braxton	moderate	slight	severe
	Glenelg	slight	very severe	nil
FDE land classification	95% Category A – Artificial drainage or coarse soil structure 5% Category E – Other well drained but very stony flat land			

Physiographic zone (s)	**Zone**	**Contaminant pathway(s) for Physiographic zone**	
	Central Plains – artificial drainage and overland flow	Protect soil structure, particularly in gullies	Avoid pugging pastures and repair bare areas Using along the contour cultivation 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	Reduce use of N in autumn and use silage or pro-gibb Wintering stock off over winter Use small applications of N as pasture requires 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 effluent at low rates Have sufficient effluent storage
		Capture contaminants at drainage outflows	Look at possible locations of wetlands Identify critical source areas Review riparian areas and increase if necessary
	Central Plains – deep drainage	Reduce the accumulation of surplus nitrogen in the soil particularly during autumn and winter	Reduce use of N in autumn and use silage or pro-gibb Wintering stock off over winter Use small applications of N as pasture requires Re-sow bare or pugged areas of soil
	Oxidising	Protect soil structure, particularly in gullies	Avoid pugging pastures and repair bare areas Using along the contour cultivation 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	Reduce use of N in autumn and use silage or pro-gibb Wintering stock off over winter Use small applications of N as pasture requires 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 effluent at low rates Have sufficient effluent storage
		Capture contaminants at drainage outflows	Look at possible locations of wetlands Identify critical source areas Review riparian areas and increase if necessary
		Manage critical source areas	Look at possible locations of wetlands

Resource Consent Application for the Discharge of Agricultural Effluent (Part B)

environment SOUTHLAND

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.

Section A: Application details

1. **Please provide details of your existing resource consent to discharge agricultural effluent:**

Consent number	204990
Expiry date	26/03/2018

2. **What is the maximum number of animals from which you propose to collect effluent from under this resource consent application?**

750 animals

Note: if you wish to increase the size of your milking herd, this form is not suitable for your use. Please contact Environment Southland staff for more information.

Section B: Location of discharge and description of surrounding environment

3. **Location of the proposed discharge:**

Address:	162 Boyle Road, Heddon Bush 9783
Map reference:	1226988E, 4886360N
Legal description	Lt 3 & Part Lt 5 DP 168 & Lt 1 DP 4967 & Sec 234 Oreti HD, Lt 1 & 2 DP 471006 and Sec 144 Oreti HD

4. **Please complete the following tables which tell us about your property and effluent disposal area. Information can be found on the Environment Southland Website in the Beacon application, or by contacting Environment Southland.**

Property Details:-	
Total Farm Area (ha)	260.9
Effective Farm Area (ha)	255.0
Size of effluent disposal area (ha)	219.1
Stocking rate	2.9
Freshwater Management Unit	Oreti

			Identify critical source areas Review riparian areas and increase if necessary

5 Are there are any permanent or intermittent rivers, streams, lakes, drains, ponds or wetlands within 20 metres of the discharge area?

Yes		(Go to question 7)
No	✔	(Go to question 8)

6 Features of the rivers, streams, lakes, drains, ponds or wetlands within 20 metres from the discharge area include:

		Yes	No
(a)	signs of instream life (e.g. fish, eels, bullies, crayfish, native birds, frogs)		✔
(b)	areas where food is gathered from a water body (e.g. watercress, eels, wildfowl)		✔
(c)	bird nesting habitats		✔
(d)	Areas of particular aesthetic, cultural, heritage or scientific value (e.g. archaeological sites)?		✔

7 Are there are any bores or soakholes within 20 metres of the discharge area?

Yes	
No	✔

8 How many metres is the discharge area from any:

		Metres from discharge area
(a)	feature	no features
(b)	surface waterbodies	20
(c)	artificial watercourses	20
(d)	subsurface drains	0
(e)	the coastal marine area	30,200
(f)	residential dwellings and places of assembly	200
(g)	landholding boundaries	20
(h)	water abstraction points	100
(i)	registered drinking water supplies	none downstream

(c) Please attach a scaled farm plan or a coloured aerial photograph, showing:

farm boundaries;
paddock boundaries;
effluent disposal paddocks (numbered and size in hectares);
irrigation system layout;
tile drains/mole drains;
streams, rivers, farm drains, springs and wetlands;
bores within 100 m of the disposal area;
any known water abstraction points within 100 m of the disposal area;
buildings (houses, sheds, wintering pads) and/or other places of assembly;
effluent storage pond(s) and any effluent treatment infrastructure;
cow races;

dairy shed location;
any other discharge areas (such as whey);
any areas prone to flooding;
any swampy areas (i.e. where water builds up in the sediments close to the ground surface above layers of poorly draining soils) within the discharge area.

Section C: Description of proposed activity

11. Dairy shed effluent

(a) How many cows will be milked each day? 750

(b) How many times per day will you milk (maximum)? Twice per day

(c) What is the length of the milking season? 305 (days)

25 July – 31 May (Heifers)
8 July – 31 May (Cows) (dates)

(d) What is the volume of wash down effluent generated per day? 37,500 (litres/day)

12. Winter milking

(a) Does your milking season include winter milking? No

(b) If yes, what is the number of cows to be milked in winter? cows

(c) How many times per day will you milk? (per day)

(d) Dates of winter milking season (provide dates)

13. Feed pad/wintering pad/stand-off pads

(a) Number of cows on feed/wintering/stand-off pad 0 cows

(b) What is the size of the area? N/A square metres

(c) Is the feed/wintering/stand-off pad roofed? Yes/No

(d) Is rainwater diversion in place? Yes/No

(e) Is it mechanically swept? Yes/No

(f) If it is washed down, amount of water used litres/day

(g) How is effluent from this facility disposed of?

(h) Intended length of time the area is to be used days per year

14. Please describe any other sources of effluent that is collected for discharge e.g. stock underpasses and silage pads

No other sources

15. **Total volume of effluent:**

Using your answers to questions 11-14 (above) what is the total volume of effluent to be discharged (in cubic metres/day)?

50l per cow per day gives a total of 37.5m3 of effluent.

Effluent irrigation rate and method

16. **Please describe how effluent will be collected, treated and discharged to land and when it will be discharged to land:**

All effluent from shed and yards flows by gravity to two sludge beds. Liquid effluent will drain through the weeping walls to a sump and then by pipe to the effluent pond. The proposal is to increase the pond size. Irrigation will occur from the pond to land when soil moisture levels permit. For discharge, a travelling irrigator and large pods will be used. A slurry tanker and umbilical system will be used when required.

Proposed instantaneous effluent application rate*		mm/hr
Proposed effluent application depth	Travelling irrigator: 10mm Large pods up to 5mm (4mm per hour pulsing on and off for 15min each) Slurry and umbilical 5mm	mm per application

*This is the depth of effluent that would be applied to a soil surface if the irrigation system was run continuously for one hour.

17. **Has the effluent irrigator discharge rate been checked and calibrated recently? This is particularly recommended for high rate irrigators.**

✔	No	As per supplier / installer.
	Yes, evidence provided	

If yes, then please include the results of the test.

Section D: Storage facility

18. What volume of effluent storage and treatment do you have on site (m^3)?
Please include a Massey Effluent Pond Calculation to show that you have, or will have sufficient effluent storage.

Effluent Pond/Tank	1,510	Cubic metres
Sump(s)	0	Cubic metres
Weeping wall/sludge bed	500	Cubic metres
Other (please specify)	Stone trap - 15	Cubic metres

19. Are you increasing storage on site?

Yes ☑ (Go to question 20)
No ☐ (Go to question 21)

If you are increasing your storage then please complete the land use consent application form for effluent storage.

20. By how much and to what volume?

Increasing 2,900 to 4,410 Cubic metres

21. When was your effluent storage and treatment installed?

The pond was constructed in 2007

22. Has your current effluent storage pond, tank or structure been certified by a Chartered Professional Engineer as being structurally sound?

No ☑

Old pond to be expanded

23. Have you undertaken an Effluent Pond Drop Test that has been certified by a Chartered Professional Engineer?
(Refer to Appendix P of the proposed Southland Water and Land Plan for the Effluent Pond Drop Test methodology (shown at the back of this form))

Yes ☐
No ☑

If you have certification from a Chartered Professional Engineer, please attach the certification to your consent application

24. Pond level drop

There has been no check, the existing pond will be decommissioned.

Information in this section will be known if you have had a drop test performed on your existing pond. Please contact the Consent Authority for advice as to whether or not you need to perform this test on your storage.

(a) What is the pond level drop for your storage facility? _____ (mm per 24 hrs)

(b) What is the maximum depth of your pond (excluding Freeboard) _____ (metres)

(c) Does your pond level drop exceed the maximum allowable pond level drop (see table below)?

☐ No

☐ Yes

Maximum Depth of Pond (m) excluding freeboard	Maximum Allowable Pond Level Drop (mm per 24 hours)
<0.5	1.2
0.5 to 1.0	1.4
1.0 to 1.5	1.6
1.5 to 2.0	1.8
>2.0	2.0

Section E: Assessment of Effects

25. 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 human health:

The full assessment is described in other parts of the application.

Section F: Good Management Practices and Mitigation Measures

Please include a description of the monitoring or good management practices to be undertaken to help avoid, reduce, remedy or mitigate the actual or potential effects on environmental features and values.

26. Are there any times when you will avoid disposing the effluent to land?

Yes [✔] No [ ]

If **yes**, please indicate below the times you will avoid effluent disposal

(a) When there is snow on the ground	✔
(b) Areas where food is gathered from watercourses (e.g. watercress, eels, wildfowl)?	✔
(c) When rainwater or irrigation water has ponded on the land surface	✔
(d) When the soil temperature is at or below 5 degrees Celsius	✔
(e) When the soil moisture conditions as per Council's monitoring site, or my own soil moisture site say it is unsuitable	✔
(f) Other (please state)	

To minimise the risk of adverse effects from odour and spray drift, it is recommended that effluent shall not be discharged within 20 metres of the property boundary or 200 metres of any residential dwelling other than those on the subject property. If you cannot adhere to this buffers, then please describe what effects there may be beyond the property boundary resulting from odour and/or spray drift.

27. What contingency plans do you have in place in the event you are unable to discharge the effluent to land, including during bad weather conditions or if any equipment breaks down:

Examples: The capacity of my storage facility is sufficient to defer irrigation in unfavourable weather conditions; or I plan to have the effluent taken off my property.

See collected agricultural effluent management plan.

28. **What good management practices will you use to avoid or mitigate the effects and the risks of your discharge to the environment? For example: low rate effluent discharge.**

These can be found on the Environment Southland website, including on the relevant Physiographic zone information sheets.

See attached documentation. This will include low rate irrigation, full storage, and spreading option.
My maintenance for my effluent system includes: See collected agricultural effluent management plan.
The checks I will undertake on my effluent storage and treatment and disposal system to ensure it is not leaking or is not broken are: See collected agricultural effluent management plan.
I monitor my effluent discharge by: Discharge volumes and locations including depths are recorded every day.

Section F: Other matters

29. Please specify the duration sought for the resource consent:

10 years

Please say why you think this consent duration is appropriate for your operation:

Given our significant investment and infrastructure.

30. Do you have a current collected agricultural effluent management plan?

Yes ☑ No ☐

This plan can be part of the plan that you have prepared for your farm to meet the requirements of Appendix N of the proposed Plan. If you do have a plan which sets out how you manage your effluent then please include it in this application.

31. Have you identified any parties which may be affected by the activity?

Yes ☐ No ☑

If yes, please indicate below

(a) Neighbours

(b) Other consent holders in the immediate area

(c) Department of Conservation

(d) Iwi (Te Ao Marama Inc; Te Rūnanga O Ngāi Tahu)

(e) Local authorities

(f) Fish & Game New Zealand

(g) Other (please state)

Please include evidence of any consultation undertaken for this application.

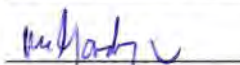
Section G: Planning Assessment and Declaration

The Resource Management Act 1991 requires you to make your own assessment of your proposal against relevant policies. A separate planning assessment sheet is available to use, or you can do your own assessment. The planning assessment can be found on our website, under the application forms. An assessment must be included with your application.

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 (please print) MURRAY GARDYNE

Signed 

Date 1/11/2017

END OF FORM

Appendix P: Effluent Pond Drop Test methodology

- Testing is undertaken over a minimum period of 48 hours.
- Testing recording equipment is to be accurate to not more than 0.8 mm.
- Continuous readings are to be taken over the entire test period at not more than 10 second intervals.
- Data analysis is undertaken by a party independent of equipment installer.
- Any change in pond fluid level over the test period needs to be accounted for.
- Ponds must be at or over 75% design depth before a test can be undertaken.
- The pond has been de-sludged in the 12 months prior to the test being undertaken and there shall be no sludge or crust on the pond surface during the test.
- The pond surface is not frozen during any part of the testing.
- An anemometer shall be installed for the duration of the test and at no time shall the wind speed exceed 10 metres per second during the test.

Application for a Water Permit (PART B) - To Take and Use Groundwater

environment SOUTHLAND

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.**

User Charges: Please note that annual User Charges will apply to all water permits. Schedule 6 of Environment Southland's User Charges and Fees document outlines the Annual Research and Monitoring Charges, which you should consider before applying for a water permit. Please refer to www.es.govt.nz/resource-consent/fees for more information on annual user fees and charges.

To: Environment Southland
Private Bag 90116
Invercargill 9840

1 What is this application for?

☐ a new groundwater take ☑ the renewal of existing consent no: 204991

2 What duration of resource consent is sought? 10 years

3 For what purpose(s) will the water be used?

☑ Stock water and/or dairy shed use ☐ Irrigation ☐ Community supply ☐ Commercial/industrial

☐ Other

If other please describe: _____

4. Please provide details of the bore(s) from which you wish to take water. *If you do not have an existing bore, you will need to apply for a consent to construct a bore before you apply to take groundwater. Please refer to the relevant Part B form.*

Bore 1: NZTM 2000 1227001 E 4886365 N Bore number: E45/0404

Bore 2: NZTM 2000 _____ E _____ N Bore number: -

	Bore depth (m)	Screen depth (m)	Diameter (mm)	Pump type	Pump capacity (l/s)
Bore 1	35		100	Submersible	1.8
Bore 2					

5. **How much water do you propose to take and at what rate will it be taken?**

Maximum rate of take	1.8	litres per second
Maximum daily volume	90	cubic metres per day
Maximum weekly volume	630	cubic metres per week
Maximum monthly volume	2790	cubic metres per month
Maximum annual volume	32850	cubic metres per year

6. **What is the frequency of the proposed water take?**

How many hours per day (maximum)?	14
How many days per week (maximum)?	7
How days per month (maximum)?	31

7. **Please state the name of the aquifer that you propose to take water from.**

Central Plains

8. **Do you intend to store your water before subsequent use?**

If yes, what/how much storage will be provided? 100 m^3

What type of storage facilities are proposed? Existing 4x 25m3 plastic tanks

You may need a building permit and/or additional resource consents for the construction of storage facilities.

9. **What type of water metering system is installed or proposed to be installed?** Environment Southland prefers all takes for 5 l/s or more to be fitted with telemetry to report in line with the Resource Management (Measurement and Reporting of Water Takes) Regulations 2010.

☑ Water meter At bore ☐ Data logger ☐ Telemetry

10 If you propose to use water for stock and/or dairy shed use – please answer the following:

(a) What type of animal and numbers of stock will be supplied with water for drinking?

☐	Sheep	Number:		Water required:		litres/head/day
☐	Beef cattle	Number:		Water required:		litres/head/day
✔	Dairy cows	Number:	750	Water required:	70	litres/head/day
☐	Other	Number:		Water required:		litres/head/day

How much water do you require for your dairy shed? 50 litres/head/day

11 If you propose to use water to irrigate land – please answer the following:

a. How many hectares of land will be irrigated? N/A

b. What is the soil type(s) of the land being irrigated N/A

c. What will you be irrigating (i.e. crop, pasture etc)? N/A

d. What type of irrigation system will be used? N/A

e. What is the target application rate (mm/day and mm/year)?

f. How have you calculated the amount of water you need? (attach separate pages if required)

12 If you propose to use water for industrial use – please answer the following:

a. What type of industry will be using the water and how will the water be used?

N/A

b. How have you calculated the amount of water you need? (attach separate pages if required)

13 If you propose to use water for commercial/domestic supply – please answer the following:

(a) What type of establishment will use the water?

☐	Households – number of households to be supplied: _____
☐	Camping grounds – maximum number of visitors and staff per year: _____
☐	Schools – maximum number of students and staff per year: _____
☐	Motel units – number and expected occupancy: _____
☐	Other: _____

(b) How have you calculated the amount of water you need? (attach separate pages if required)

_____

14 If you propose to use water for any other purpose, please describe the amount of water you will need and how this has been calculated (please attach a separate sheet to this application, if necessary).

N/A

15 Please describe any other sources of water available for the property. Describe how much water is available and what it is used for.

When bore water levels and abstraction rates are low, additional water can be abstracted from the stream at the foot of the hills.

16 Please also describe any measures you are proposing to minimise wastage of water and maximise its efficient use:

Volume used is considered best practice

17 Does your proposed water take have any associated discharges? If yes, please describe.

☑ Yes ☐ No

Please note that a discharge into the environment may require a resource consent application to be made specifically for the discharge (please refer to the relevant Part B form).

See part B for more details about effluent discharge to land.

Existing Environment

18 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 a water body (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, heritage or scientific value (e.g. archaeological sites)?		✔
(f)	Waste discharges and/or monitoring sites?		✔
(g)	Other water takes?		✔
(h)	Surface water bodies? Natural springs?		✔

Assessed through discussion with farm owner. The owner lives on the property.

No wetlands, but there are three ponds on the farm which are home to ducks.

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

- the location(s) of the existing points of take;
- the location of proposed points of take(s);
- the location of water measuring device(s);
- the total property area boundary;
- the area(s) to be irrigated (if relevant);
- the area(s) of community supply (if relevant);
- distances to any discharge activities;
- other surface water bodies and wetlands nearby and the distance from the point of take(s) to them;
- the coastline and the distance to it (if relevant);
- the location of any dairy sheds (if relevant).

Assessment of Effects

19 Will the take and use of groundwater have any effects on the following:

		Yes	No
(a)	Aquifer storage volumes		✔
(b)	Existing bore or well yields		✔
(c)	River and stream flows, including minimum flows and allocation levels		✔
(d)	Wetland and lake water levels		✔
(e)	Groundwater quality		✔

For those answered No above, please describe why there will be no effects. For those answered Yes, please describe how these effects may occur.

These are discussed in the documentation.
Low abstraction rates.

20 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

This is an existing permitted activity however the number of cows on farm will increase from 599 to 750. The neighbourhood will not change.

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

There only change to the physical landscape will be the slightly larger new pond, this will be landscaped to reduce the visual effect.

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

There will be no physical disturbance of the habitats because of the buffer zones.

(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

No change in values. Planning for future generations. There are two families and one individual who live and work on the farm.

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

No

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

No

21. **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.**

Water volumes are recorded.

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

Existing farm and settled worker
Best to expand
Better position to farm environmentally

23. **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.**

24. **Appendix A of the Regional Water Plan for Southland, 2010, details the level of further assessment required as part of your application. This may include the following assessments (please attach as a separate report):**
    - interference effects/drawdown;
    - radius of influence;
    - stream depletion effects;
    - an assessment of the dynamic aquifer response to abstraction.

25. **Appendix L of the proposed Southland Water and Land Plan, 2016, details the level of further assessment required as part of your application. This may include the following assessments (please attach as a separate report):**
    - aquifer test requirements;
    - stream depletion effects;
    - interference effects;
    - calculation of seasonal groundwater allocation;
    - establishing allocation volumes for confined aquifers.

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
(b) Proposed Southland Regional Policy Statement, 2012 (and any proposed/subsequent versions)
(c) Regional Water Plan for Southland, 2010
(d) Proposed Southland Water and Land Plan, 2016 (and any proposed/subsequent versions)
(e) National Policy Statement for Freshwater Management, 2014
(f) National Environmental Standard for Sources of Human Drinking Water, 2007
(g) Resource Management (Measurement and Reporting of Water Takes) Regulations, 2010

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

environment SOUTHLAND

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: 162 Boyle Road, Heddon Bush 9783

Legal Description(s): Lt 3 & Part Lt 5 DP 168 & Lt 1 DP 4967 & Sec 234 Oreti HD

Lt 1 & 2 DP 471006 and Sec 144 Oreti HD

Map Reference (NZTM 2000): 1226988 E, 4886360 N

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: TBA

Name of construction supervisor: Murray Gardyne

Proposed timing of construction: Within 2 years

5. 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:	180	metres
Nearest artificial watercourse:	160	metres
Registered drinking water supplies:	25,000	metres
Nearest underground drain:	120	metres
Property boundary:	280	metres
Dwellings on neighbouring properties:	1,100	metres
Coastal marine area:	29,000 (Woodworker shop H43)	metres
Historic heritage	12,000	metres
Urban areas	(Drummond) 8,200	metres

7 What is the total volume of the pond and the the storage and purpose? 4,489 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 from the dairy shed and yards. This will include effluent and the waste water from the wash-down. The total volume will be 50l per cow per day that is 37.5m3. The total storage capacity will be 4,489m3 that will hold at least 119 days of effluent.

The Massey Pond Calculator assessment is included in the appendices.

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.

See collected agricultural effluent management plan.

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:

2 the location of the proposed storage;
3 the total property area boundary;
4 surface water bodies, artificial watercourses, installed subsurface drains and wetlands nearby;
5 water supplies - bores, registered drinking etc.;
6 the coastal marine area and the distance to it (if relevant);
7 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	**SL8B/626**
Land Registration District	**Southland**
Date Issued	08 June 1987

Prior References
SL54/186

Estate	Fee Simple
Area	79.3007 hectares more or less
Legal Description	Lot 3 Block I Deposited Plan 168
Proprietors	
Miraka Farms limited	

Interests

9536638.5 Mortgage to Rabobank New Zealand Limited - 14.10.2013 at 3:51 pm

COMPUTER FREEHOLD REGISTER
UNDER LAND TRANSFER ACT 1952

Search Copy

R. W. Muir
Registrar-General
of Land

Identifier	**SL189/164**
Land Registration District	**Southland**
Date Issued	02 November 1955

Prior References
SL47/133

Estate	Fee Simple
Area	40.4433 hectares more or less
Legal Description	Part Lot 5 Block I Deposited Plan 168
Proprietors	
Miraka Farms limited	

Interests

69702 Transfer creating the following easements

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Right of way	Section 145 Block XV Oreti Hundred - CT SL89/46	Part	Part Lot 5 Block I Deposited Plan 168 - herein	

9536638.5 Mortgage to Rabobank New Zealand Limited - 14.10.2013 at 3:51 pm

COMPUTER FREEHOLD REGISTER
UNDER LAND TRANSFER ACT 1952

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**SL189/163**
Land Registration District	**Southland**
Date Issued	02 November 1955

Prior References
SL47/133

Estate	Fee Simple
Area	40.2814 hectares more or less
Legal Description	Lot 1 Deposited Plan 4967
Proprietors	
Miraka Farms Limited	

Interests

9536638.5 Mortgage to Rabobank New Zealand Limited - 14.10.2013 at 3:51 pm

COMPUTER FREEHOLD REGISTER
UNDER LAND TRANSFER ACT 1952

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**SL175/122**
Land Registration District	**Southland**
Date Issued	11 February 1952

Prior References
SLPR34/295 WA 621

Estate	Fee Simple
Area	1.4240 hectares more or less
Legal Description	Section 234 Block XV Oreti Hundred

Proprietors
Miraka Farms limited

Interests

Subject to Section 59 Land Act 1948

Subject to Section 8 Coal Mines Amendment Act 1950

9536638.5 Mortgage to Rabobank New Zealand Limited - 14.10.2013 at 3:51 pm

COMPUTER FREEHOLD REGISTER
UNDER LAND TRANSFER ACT 1952

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**637659**
Land Registration District	**Southland**
Date Issued	15 January 2014

Prior References
SLB2/437

Estate	Fee Simple
Area	39.9645 hectares more or less
Legal Description	Lot 1 Deposited Plan 471006

Proprietors
Miraka Farms Limited

Interests
9636905.2 Mortgage to Rabobank New Zealand Limited - 13.2.2014 at 11:52 am

COMPUTER FREEHOLD REGISTER
UNDER LAND TRANSFER ACT 1952

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**637660**
Land Registration District	**Southland**
Date Issued	15 January 2014

Prior References
SL24/71 SLB2/437

Estate	Fee Simple
Area	119.4291 hectares more or less
Legal Description	Lot 2 Deposited Plan 471006 and Section 144 Oreti Hundred

Proprietors
Alan Hamilton Dykes

Interests
Subject to Section 241(2) Resource Management Act 1991 (affects DP 471006)

This land is owned by the brother of the owners of Miraka Farms Ltd

1.0 Overview

Applicant:	Miraka Farms Ltd
Application:	Expand cow numbers. Replace discharge and water permits for dairy farm, construct effluent pond for dairy farm.
Location;	162 Boyle Road, Heddon Bush 9783
Legal description:	Lt 3 & Part Lt 5 DP 168 & Lt 1 DP 4967 & Sec 234 Oreti HD, Lt 1 & 2 DP 471006 and Sec 144 Oreti HD
Map Reference:	NZTM 2000 1226988 E, 4886360 N

Property details:

Catchment	Terrace Creek catchment
Total farm area (ha)	260.9
Replacement consents	Yes, increased cow numbers, increased water take, new pond
Physiographic	Central Plains, Oxidising
Freshwater Management Unit	Oreti

Soils

	Vulnerability Factors		
Soil name	Structural compaction	Nutrient leaching	Waterlogging
Braxton	moderate	slight	Severe
Glenelg	slight	very severe	nil

FDE land classification

Category A – Artificial drainage or coarse soil structure
Category E – Other well drained soil

Groundwater nitrate levels

85% - 3.5 – 8.5 mg/l – Moderate to high land use impacts
15% - 8.5 – 11.3 mg/l – Drinking water limits

Physiographic Zones

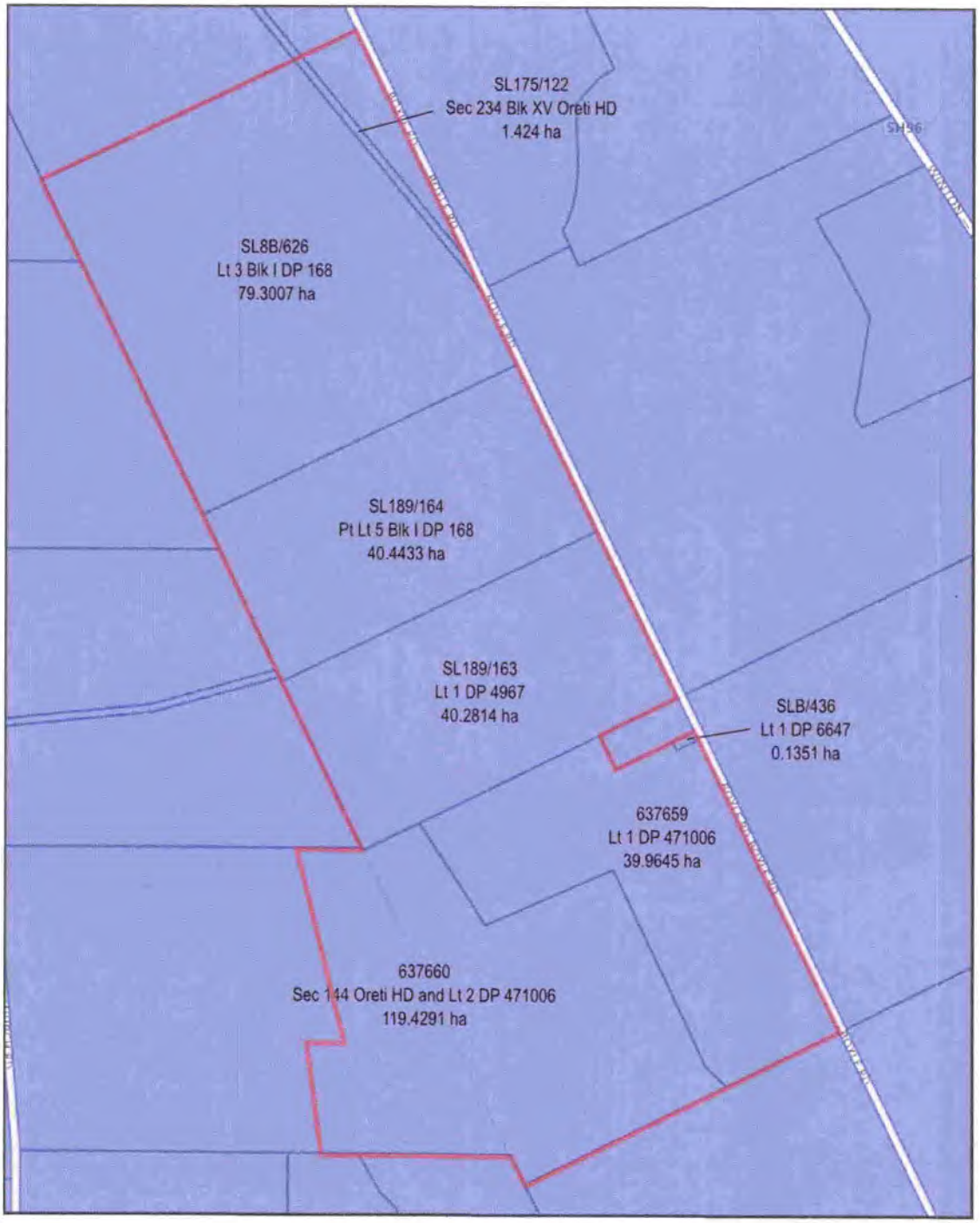
Zone	Contaminants pathways for zone
Central Plains	During wet periods, artificial drainage rapidly moves excess soil water and contaminants to rivers and streams. Rain during dry spells, rapidly moves contaminants to ground water through cracks and fissures in the soil.
Oxidising	Following heavy or prolonged rainfall, contaminant losses to rivers and streams may occur via overflow or artificial drainage. There is a high risk of nitrogen build-up in groundwater.

The dairy farm requires a renewal of the existing permit for ground water take and to discharge effluent to land but with increased cow numbers, discharge and water take. A new effluent pond will be constructed to replace the existing pond.

.

LOCALITY MAP

LEGAL PLAN


SL175/122
Sec 234 Blk XV Oreti HD
1.424 ha
SL8B/626
Lt 3 Blk I DP 168
79.3007 ha
SL189/164
Pt Lt 5 Blk I DP 168
40.4433 ha
SL189/163
Lt 1 DP 4967
40.2814 ha
SLB/436
Lt 1 DP 6647
0.1351 ha
637659
Lt 1 DP 471006
39.9645 ha
637660
Sec 144 Oreti HD and Lt 2 DP 471006
119.4291 ha

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 dairy shed effluent to land is a discretionary activity under Rule 5.4.6.

Regional Water Plan for Southland

- The taking of water is a restricted discretionary activity under Rule 18 (d) (iv)

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

Proposed Southland Water and Land Plan

- The taking of water is a permitted activity under Rule 49 (a)
- The use of land for dairying is a permitted activity under Rule 21.
- The use of land for dairy farming of cows that did not exist at 30 May 2016 under Rule 22.
- The discharge of effluent to land is a discretionary activity under Rule 35 (c).
- 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.

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 B2	Regional Council making or changing regional plans to be the extent needed to provide for the efficient allocation of freshwater.
Policy B5	Ensuring that no decision will likely result in future over-allocation.
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 effluent 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 irrigation, sufficient storage to enable deferred irrigation during adverse soil conditions will minimize groundwater surface water degradation. The farm uses green wash for yard cleaning and so the volume of abstraction is considered to be at a rate and daily volume sufficiently low that there would be a less than minor effect on ecosystem processes and water quality. The abstraction volume represents very efficient use of water. The total volume allocation statuses from the Oreti and Castlerock aquifers are low. This take is from the Oreti aquifer. 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 4.3	Manage abstraction of water on the basis of the effects of that abstraction, taking into account the standards set for the waterbody and the use to which the water is to be put.
Policy 4.4	Encourage the conservation of water and its efficient allocation and use.
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 WQUAL.1	Sustainably managing the region's water resources
Objective WQUAL.2	The efficient use of water
Policy WQUAL.2	Avoid over-allocation of surface water and groundwater
Policy WQUAN.6	Efficient use of 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 application is consistent with Policy WQUAN.6 that seeks to ensure that the water use for the activity is efficient. The activity is seeking an abstraction in accordance with Council's estimated use for dairy operations.

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 effluent storage for deferred irrigation, and low rate irrigation. The farm also uses the preference for discharge to land. The conditions requiring water quality and quantity monitoring will contribute to data already held regarding the region's water resources. The aquifer is not fully allocated. The property is within a rural area and an established dairy farm and must be considered with regard for environmental, economic, social and cultural values. There is an existing effluent 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:

1. **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

2. **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 21	Ensure the rate of abstraction and abstraction volumes specified on water permits to take and use water are no more than reasonable for the intended end use
Policy 22	Require, where appropriate, the installation of water measuring devices on all new permits to take and use water
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
Policy 30	Groundwater abstraction Recognise the different characteristics of different aquifer types Provide for level of permitted abstraction, primary allocation for consented abstraction and use, and supplementary allocation for consented water abstraction and use

	Require water abstraction applications to include relevant information for the associated risk of adverse effects Impose monitoring on groundwater resource consents that correspond to the environmental risk Where monitoring shows significant adverse effects, mitigate those effects

3. **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

4. **Cultural considerations**

Policy 1A	Take iwi management plans into account

Comment

Policy 21 seeks to ensure that the rate of abstraction and abstraction volumes specified on water permits to take and use water are no more than reasonable for the intended end use.

Policy 22 requires the installation of a water measuring device on all new permits to take and use water. As part of conditions of consent, Council will require the applicant to continue providing water meter readings from the meter on the bore.

The application is consistent with Policy 28 which seeks to manage groundwater abstraction to avoid significant adverse effect.

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:

5. **Water quality:**

Objective 1	Integrated management of land and water
Objective 2	Water and land recognised 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

6. 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

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
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 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(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

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.

The value in the investment in the existing dairy farm is very high.

4.0 Notification

Written approvals

No written approvals have been sought. The change to the farming activity is an increase in land area with an increase in cow numbers but at a lower stocking rate. There will be an increase in the water take at the same volume/cow. There will be a new effluent storage pond. The location of water take will not change.

5.0 Receiving Environment

5.1 Soils

The Southland Topoclimate maps and visual inspection has been used to determine the soils located on the farm. There is one soil type on the farm.

	Vulnerability Factors		
Soil name	Structural compaction	Nutrient leaching	Waterlogging
Braxton	moderate	severe	slight
Glenelg	slight	very severe	nil

Braxton
These soils are deep to moderately deep, poorly drained, and have silty clay to heavy silt loam textures.

Glenelg
Glenelg soils are well drained, with silt loam topsoil texture. The soils are stony in both the topsoil and subsoil, which limits the rooting depth and water holding capacity.

The FDE classifications assigned within the ES Beacon service are A – Artificial drainage or coarse soil structure (95%) and E – Other well drained soil (5%).

5.2 Water

There is one main stream (1) that flows through the farm, with a total length of more than 2km. It is fed by a number of intermittent streams, tiles and drains on the farm. The water generally flows north west to south east across the farm. The main flow enters from two points on the northern boundary and flows south for about 350m before joining with the smaller intermittent channel. This channel network is about 500m in length before it reaches the property. The other intermittent drain joins about 200m south of here, and the water in this drain flows east from the western boundary. The other intermittent stream joins this main flow of water about 50m south of the tanker entrance on Boyle Road.

The main stream is a tributary of Terrace Creek. Once water leaves the property, it travels for another 11.5km before reaching the Oreti River.

The other stream on the property (2) is intermittent and fed from the water to the west of the property as well as two tiles on the farm and a channel on the southern boundary. This stream is part of the Oreti River rather than the Terrace Creek catchment.

Context and catchment

The farm is located on the boundaries of the Terrace Creek, Middle Creek and Oreti River catchments, however the vast majority of the farm drains into Terrace Creek. These are all within the overall Oreti River catchment.

The Oreti River begins east of the Mavora Lakes and flows for approximately 170km before discharging into the New River Estuary at Sandy Point, then finally into Foveaux Strait. The upper catchment consists of pasture on the flat areas, and native trees on the hill country.

As the river flows down country it is joined after 40km by Windley River, then Acton Stream, Cromel and Irthing Streams. It is then joined by Dipton and Winton Streams, and then Terrace Creek that contains water from the applicant's property. The Oreti River is then joined by the Makarewa River and finally empties into the New River Estuary.

The Invercargill water intake comes from the Oreti River near Branxholme, about 40km downstream from the property.

Photos

Stream on property

Stream on property

Stream on property

Stream on property

Stream on property

Water quality monitoring

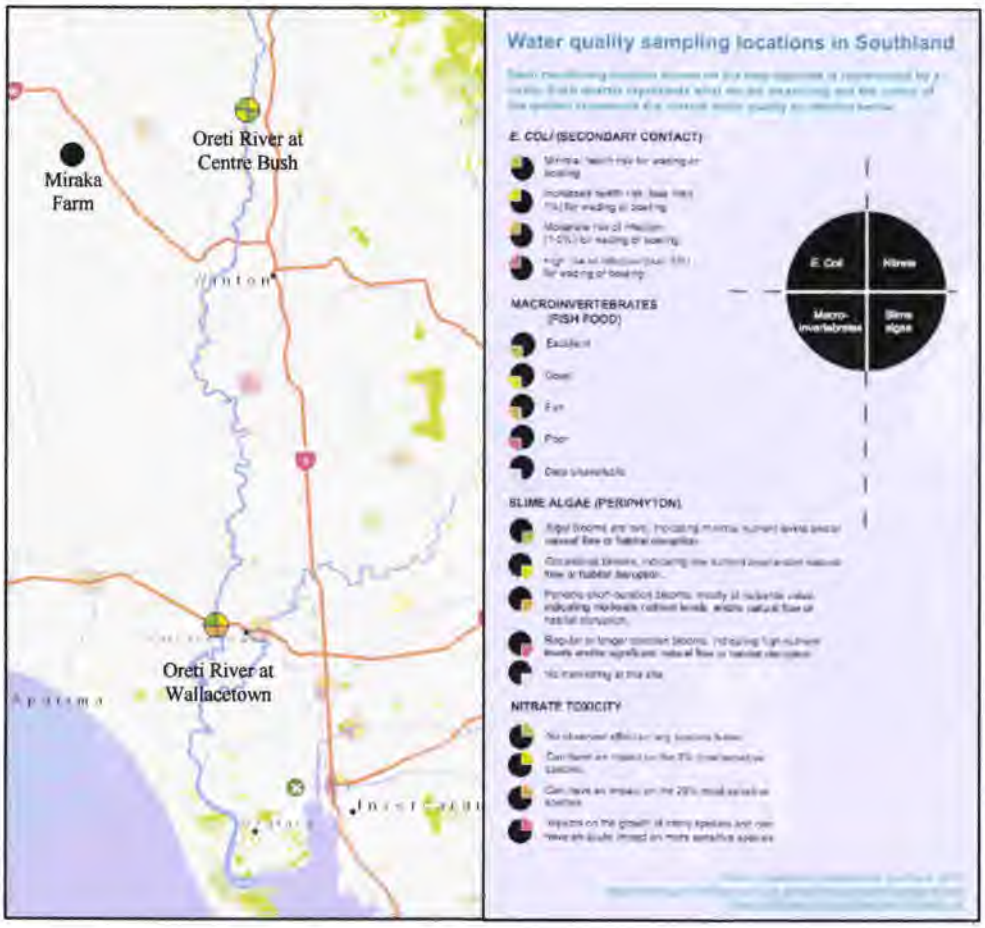


Figure 1 Water quality monitoring stations proximate to Drummond Farm.

The closest water quality monitoring station near the property is downstream at the Sandstone Stream at Kingston Crossing Road. This site is about 35km downstream from the property.

Figure 1 shows nitrate toxicity at the Wallacetown site can impact 5% of the most sensitive species, and macroinvertebrate levels are only fair at this measurement location. The E. coli health risk is 'minimal' for wading and boating. There are periodic short duration blooms that indicate moderate nutrient levels or habitat disruption. Further upstream on the Oreti River at Centre Bush is better water quality with rare algal blooms, good macroinvertebrates but a similar level of nitrate toxicity.

Lawa has not published any data that shows trends in the water quality at the Wallacetown site for the Oreti River, or any comparison information with other monitoring sites.

Groundwater

The pSWLP has sectioned groundwater management zones across Southland and the farm activity is located in the Central Plains groundwater zone. The subsurface geology of the Central Plains groundwater zone consists largely of moderately weather alluvial gravels in a silt and clay matrix. The thickness of the gravel deposits appears to vary across the Central Plains groundwater zone from 20 metres near Waianiwa to in excess of 50 metres near Hundred Line Road. The underlying Tertiary sediments are generally recorded as mudstone and sandstone with some lignite which is typical of the Eastern Southland Group.

Recharge to the Central Plains groundwater zone is predominantly from rainfall recharge with some infiltration of runoff along the lower slopes of the Taringatura Hills.

Generally, groundwater quality within aquifers in the Central Plains groundwater zone comply with limits set in the Drinking Water Standards for New Zealand (DWSNZ), however there are areas that do not. Groundwater quality in the area around the applicants' property has been modelled by Environment Southland as having low denitrification potential based on geology, sediment geochemistry and geomorphology (Rissmann 2011[1]) which suggests shallow groundwater is susceptible to nitrate accumulation. Consistent with this risk, Environment Southland (Rissmann 2012[2]) have identified groundwater quality on the property as having nitrate levels reflecting moderate to high land use impacts (i.e. nitrate levels between 3.5-8.5mg/L) and at the drinking water limits (8.5-11.3mg/L).

Environment Southland have summarized regional nitrate levels measured between 2007 and 2012, and these are shown below for the applicant's property. The majority of the nitrate levels are moderate to high land use impacts (75%) with the remainder at the drinking water limits (25%). A test taken on the farm in November 2014 was 1.21 mg/l and much lower than 3.5 to 8.5 mg/l. This may indicate that the Figure 2 in much higher than what actually is occurring. The farm expansion will not affect this.

Figure 2 Regional nitrate levels. Environment Southland (2017)

[1] Rissmann, C. 2011. *Regional mapping of groundwater denitrification potential and aquifer sensitivity*. Environment Southland publication number 2011-12, Invercargill.
[2] Rissmann, C., 2012. *The extent of nitrate in Southland groundwaters: Regional 5 year median (2007-2012 (June))*. Environment Southland publication number 2012-09, Invercargill.

Water flow

The water flow monitoring site that gauges flow closest to this farm is at Wallacetown on the Oreti River. The hydrology statistics are published on the Environment Southland website.

The Oreti River has a mean flow of 40.6 m^3/s, a median flow of 28.2m^3/s, a minimum recorded flow of 1.6m^3/s. The highest recorded flow is under review at this site, but at the Lumsden cableway the maximum recorded flow of 1158m^3/s.

Council compliance

Environment Southland's science team has supplied the following ground water quality data. Based on measurement of water quality at bores within a 2km radius of the farm's groundwater take, the available data is consistent with nitrate levels that represent high nitrate levels, at or near the NZ drinking water standard. The most recent measurement at the farm suggests nitrate levels at moderate to high land use impacts.

E45/0060 is a monitoring well, about 2km north of the Miraka Farm.

The only E. coli measurements within the radius of the farm have been taken at the monitoring well, and these range from 1 CFU per 100ml up to 579, with an average of 74 CFU per 100ml.

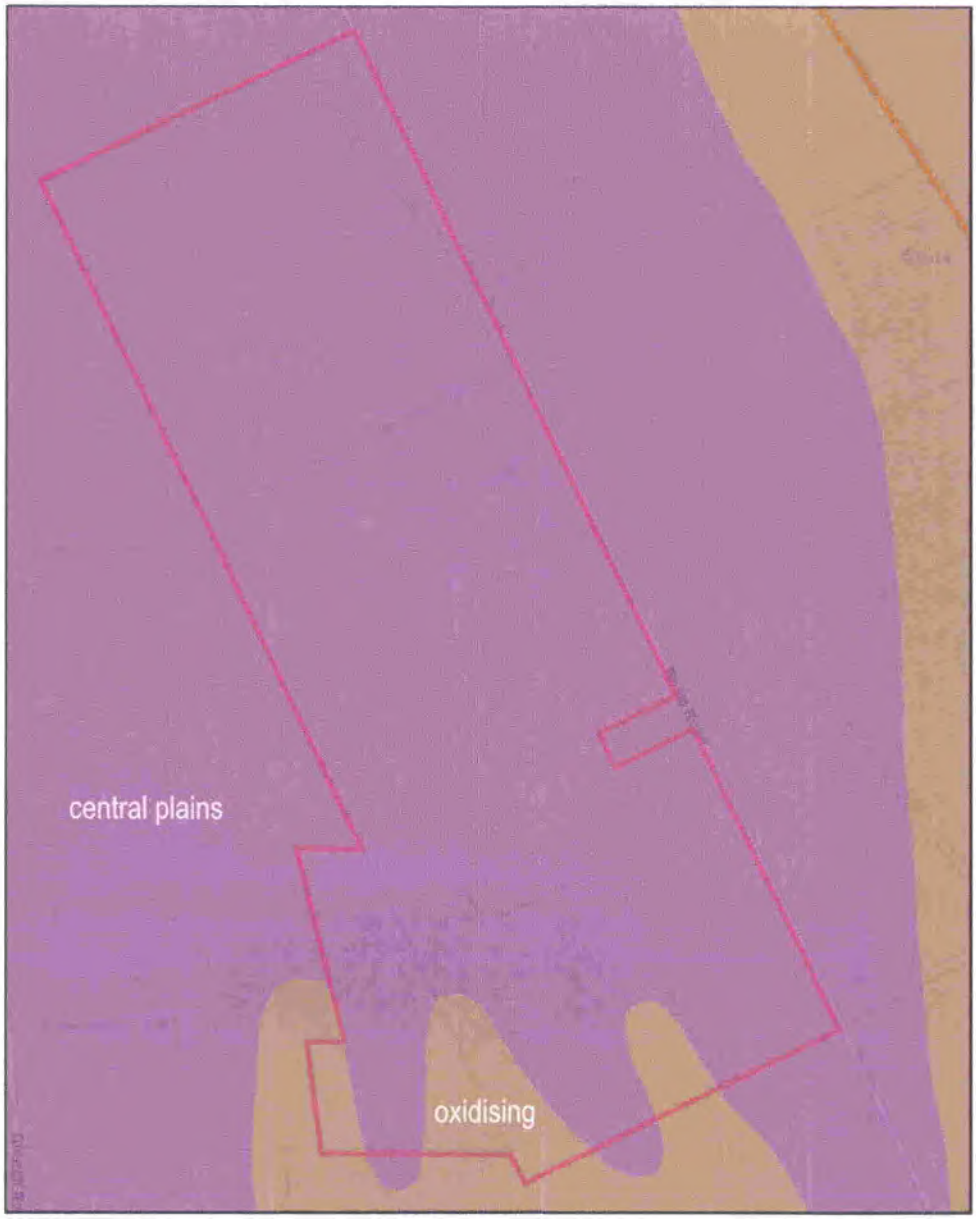
The locations of bores within 2km of the property have been provided also by Environment Southland and depicted on the following page.

Figure 3 Locations of wells within 2km of Miraka Farm. Colour wells have had data supplied by Environment Southland. ES (2017)

Other water quality monitoring

In addition to the environment southland data above, a separate groundwater report has been sourced: a test in November 2014 by Invercargill City Council (Reference B-18346). The results of this test are consistent with low to moderate land use impacts – not at the level of the NZDWS as indicated at the other proximate wells. The total nitrate reading is 1.31g N / m^3. The full results of this test are supplied as Appendix 10.

5.3 Physiographics



Purple	Central Plains
Copper	Oxidising

Physiographic Zones

Central Plains – artificial drainage and overland flow

Protect soil structure, particularly in gullies and near stream areas	Avoid pugging pastures and repair bare areas Using along the contour cultivation 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	Reduce use of N in autumn and use silage or pro-gibb Wintering stock off over winter Use small applications of N as pasture requires 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 effluent at low rates Have sufficient effluent storage
Capture contaminants at drainage outflows, manage critical source areas	Look at possible locations of wetlands Identify critical source areas Review riparian areas and increase if necessary

Central Plains – deep drainage

Reduce the accumulation of surplus nitrogen in the soil particularly during autumn and winter	Reduce use of N in autumn and use silage or pro-gibb Wintering stock off over winter Use small applications of N as pasture requires Re-sow bare or pugged areas of soil

Oxidising – overland flow

Protect soil structure, particularly in gullies	Avoid pugging pastures and repair bare areas Using along the contour cultivation Keep cultivation at correct distances from riparian areas
Reducing phosphorus use and loss	Keep Olsen P levels at optimum or less Maintain buffer zones
Capture contaminants at drainage outflows, manage critical source areas	Look at possible locations of wetlands Identify critical source areas Review riparian areas and increase if necessary

5.4 Topography

The farm is flat to undulating, and slopes gently from north west to south east.

6.0 Proposal Details

The discharge renewal applied for is for 750 cows increased from 599 on an expanded land area from 161.4 to 255.0ha. The stocking rate will reduce from 3.7 to same at 2.9 cows/ha.

All effluent is collected from the shed, yards and any concrete area around the dairy shed. It will flow by gravity to the twin sludge beds, and then the liquid effluent passes through the weeping wall and to a sump. From there it travels by pipe to the pond. Effluent is irrigated from here to the farm as soil moisture levels permit.

At present there is a storage pond adjacent to two sludge beds which can hold about 910m3 of effluent.

A slurry tanker or umbilical system will be used to take effluent to the areas that do not currently do not have underground effluent lines. If ground conditions are not suitable then effluent is stored in a 4,489m3 storage pond which will be constructed.

Until it is constructed the sludge beds, sump and small storage pond will be used. Effluent will be pumped from the pond out to the discharge area or picked up at the pond by slurry tanker or umbilical.

The application is for an increase of the discharge area within the increased farm boundary to cover the farm except buffer distances. The intensity of the operation is decreasing but with an increased number of cows on a larger total area. The farm will need to prepare a management plan and parts of this Appendix N are included in the application.

6.1 Effluent

Discharge Permit Details:	
Current permit specifies cow numbers? How many?	Yes - 599
Proposed cow numbers	750
Current stocking rate (cows/ha)	3.7
Proposed stocking rate	2.9
Winter milking	No
Stand-off/feed/calving/wintering shed	No
Area (m)	N/A
Covered	N/A
Other sources of effluent	None
Effluent disposal area (ha)	219
Effluent disposal area changing	Yes
FDE Classification	Category A and E discharge area
Irrigation method	Large pods Travelling irrigator Slurry tanker Umbilical system
Application rate and depth	
Large pods	4mm/hr (2-10mm per application)
Travelling irrigator	10mm
Slurry tanker	5mm
Umbilical system	5mm

6.2 Effluent Storage

Based on the Massey Farm Dairy effluent Storage Calculator the farm requires 4,427m3 of storage. A 4,489m3 pond will be constructed and certified by a Suitably Qualified Person.

Storage currently available (m3)	910
Storage proposed (m3)	Increase to 4,489
Effluent collection/storage liner	1.5mm HDPE
Number of days storage	As required by Massey storage calculator
Dairy Effluent Storage Calculator 90%	4,427 m3
Storage requirement m3	4,427
Monitoring proposed	Pond level inspection around base

6.3 Water Take

Water will be taken from an existing bore E45/0404. The coordinates are 1227001E, 4886365N. The bore extracts water from the Central Plains groundwater management zone.

Water Permit Details:	
Source of water	One bore
Groundwater zone	Central Plains
Aquifer type	Lowland
Rate of take (L/sec)	<2
Freshwater storage on site	Yes, 100m^3 in 4x tanks
Daily volume (m3/day)	90
Consistent with 120 and 140 L/cow/day	Yes
Yearly volume (m3/year)	32,850
Mean Annual LSR (m3/year)	123,403,200
Preliminary allocation	15%
Amount currently allocated	Low

7.0 Assessment of Environmental Effects/Mitigations

Overview

To supply an assessment of these effects, the relevant values are first outlined, then the modelled losses to the environment are discussed under both the current and proposed land-use scenarios and then the anticipated effects are considered. This is then summarised and our conclusions are drawn as follows.

Applicable values

Surface and ground water

Published plan	Values outlined
Regional Water Plan for Southland, 2010. **Objective 3** **(Lowland hardbed)**	To maintain and enhance the quality of surface water bodies so that the following values are protected where water quality is already suitable for them, and where water quality is currently not suitable, measurable progress is achieved towards making it suitable for them. (a) bathing, in those sites where bathing is popular; (b) trout where present, otherwise native fish; (c) stock drinking water; (d) Ngāi Tahu cultural values, including mahinga kai; (e) natural character including aesthetics.
Regional Water Plan for Southland, 2010. **Objective 8: Drinking water standard**	(a) To maintain groundwater quality in aquifers that already meet the Drinking-Water Standards for New Zealand 2000; and (b) To enhance groundwater quality in aquifers degraded by land use and discharge activities (with the exception of those aquifers where ambient water quality is naturally less than the Drinking-Water Standards for New Zealand 2000) to ensure general compliance with the Drinking-Water Standards for New Zealand 2000 by the year 2010.
Proposed Southland Water and Land Plan **Objectives 3, 6, 7, 8, 9 and 11**	(a) the mauri (inherent health) of waterbodies provide for te hauora o te tangata (health of the people), te hauora o te taiao (health of the environment) and te hauora o te wai (health of the waterbody); (b) there is no reduction in the quality of freshwater and water in estuaries and coastal lagoons; (c) avoid and reduce over-allocation (quality and quantity) of freshwater; (d) aquatic ecosystem health, life-supporting capacity, outstanding natural features and landscapes, recreational values, natural character and historic heritage values of surface water bodies and their margins are safeguarded; and, provided these values are met, water is available for instream and out-of- stream use to support the reasonable needs of people and communities to provide for their social, economic and cultural well-being;

	(e) water is allocated and used efficiently; (f) the quality of water in aquifers that meet both the Drinking-Water Standards for New Zealand 2005 (revised 2008) and any freshwater objectives, including for connected surface waterbodies, established under Freshwater Management Unit processes is maintained; (g) the quality of water in aquifers that have been degraded by land use and discharge activities (with the exception of those aquifers where ambient water quality is naturally less than the Drinking-Water Standards for New Zealand 2005 (revised 2008)) is improved.

New River Estuary

Value	Description
Areas containing significant values	The Department of Conservation has identified the area of the estuary generally eastward or upstream of a line drawn from "the spit" at the south end of the Oreti Beach, to Bombay Rock, to the point of land more or less east of that rock, as an area containing significant values (see ACSV 14-05 in Appendix 5). This is principally because the estuary is rated nationally important as a habitat for wader bird species, as well as a nationally important nursery area for numerous fish and invertebrate species, including galaxiids and toheroa.
Heritage and Archaeological Values	The Port of Invercargill jetty is registered by the New Zealand Historic Places Trust as a category II site. This site was the major port for Invercargill prior to the establishment of the port at Bluff. It was once linked to the city by a long jetty but that area has since been reclaimed. Other areas of the estuary also have significant heritage values. The coastline of Sandy Point between West's Point and Sandy Point was one of the first areas settled by Europeans in the greater Invercargill area and the site of early whaling activities. Prior to that it was the site of a Maori kaik. In the 1800s, the favoured route from Invercargill to Bluff was via the estuary and Bluff Harbour shorelines including Mokomoko Inlet where there was a hotel. There was a wharf and proposed township at Stanley Town, just east of Mokomoko Inlet. There are many archaeological sites of significance to Maori all around the non-reclaimed shoreline of the estuary, including middens and urupas. There are particular concentrations of such sites in the Sandy Point - West's Point area where the Maori village of Oue was once located, and along the south-west shoreline of Otatara and in the Omaui/Mokomoko Inlet area.
Natural Character and Landscape Values	The natural character values of the estuary are particularly high adjacent to much of the Sandy Point Domain and along the southern Otatara coastline where significant areas of either indigenous salt marsh or indigenous scrub or bush either adjoin or intertwine with the waters edge. The feeling of open space provided by the estuary is enhanced by the low relief of the adjoining land. This open space value is further enhanced by the quality of reflected light from the water areas.
Recreational and Amenity Values	The lower reaches of the Oreti River from Dunns Road to West's Point are frequently used for recreational activities, particularly boating. Trout fishing is undertaken virtually all year round, particularly by the elderly who appreciate the good vehicular access. All areas that adjoin Sandy Point Domain are popular for various recreational activities. The estuary is also very popular for "onlookers" or "get away from it all" people. It provides for such passive scenic recreational users. Given the proximity of the New River Estuary to Invercargill, it has great potential for further recreational use. In recent years, this use has declined in some areas due to water quality

	problems and increasing sedimentation.
Educational Values	The estuary offers a range of educational opportunities, the value of which are enhanced by its proximity to major schools. The study of estuarine ecosystems, rocky and sandy shores, intertidal areas etc, and the contribution of the estuary to the social geography of Invercargill, are frequently included in school curricula. As such, the estuary is the site of many school visits. Its birdlife and cultural history add to the educational experience it can offer. Educational activities are increasingly focusing on the negative aspects of the estuary such as the degree of modification and its water quality.
Marine Mammals and Birds	New River Estuary has a high value as a wading and waterfowl bird habitat. A total of 74 wading and waterfowl species (including migratory species from the northern hemisphere), have been recorded. These species include sandpipers, tattlers and greenshanks. Banded dotterels can migrate to Australia but generally migrate internally, as do South Island pied oyster catchers. South Island fernbirds inhabit coastal wetlands.
Ecosystems, Vegetation and Fauna Habitats	The New River Estuary is part of the Awarua Plains wetland complex, which is the most important habitat for birds in Southland. This has given international recognition to the area. The estuary provides extensive rearing and spawning habitat for marine and freshwater fish species, including native fish such as the giant kokopu, lamprey and the long finned eel. The whole estuary has value as a flounder nursery area, while many other fish species, including migratory species, use the estuary or parts of the estuary as a habitat on either a temporary or permanent basis. Along the shores are extensive maritime marshes including an excellent sequence of marsh to sand dune Totara forest, which is of national significance.

There are six principal issues for the Estuary, listed as:

- The effect of reclamation and impoundments on flushing (sedimentation) and habitat.
- The spread of Spartina and its effect on habitats and recreational values.
- Poor water quality.
- Eroding shoreline in places.
- Inappropriate access.
- The effect of noise on habitats and recreational values.

7.1 Effluent

The potential adverse effects of discharging dairy shed effluent and feed pad onto land include:

- Contamination of groundwater,
- Odour,
- Effects on soil structure and fertility, and
- Contamination of watercourses.

Good management and planning will avoid or mitigate the potential adverse effects detailed above. The discharge will have 20m buffer zones to watercourses and property boundaries. 100m buffers to the bore and 200m buffers to houses and lower application rates as detailed.

Deferred irrigation of effluent is possible because of the storage available which will ensure that there is a soil moisture deficit and this will minimise risk to tile or mole drained areas or ponding and direct runoff.

Scale of activity

There is an increased area of land in this application that will receive effluent discharge. Below is an analysis of the nutrient discharge and the effect on the receiving environment.

No overseer analysis is available with modelled inputs and outputs on the farm so two simple desktop analyses are considered for discharging the collected agricultural effluent:

1. The shed and yards will capture an average of 50l of effluent per cow per day that has an average loading of 0.33 kg TN/m3. It is understood these are the default values used by Environment Southland.
2. The shed and yards will capture an average of 74l of effluent per cow per day that has an average loading of 19.3g TN, 2.5g TP and 0.29kg TS. These values are based on the averages published for a Southland monitoring farm[3].

The purpose of using these two scenarios is to provide a simplistic sensitivity analysis for comparing the current and proposed nutrient load calculations to give an indication of the scale and significance of effects of the effluent discharge to land.

The first two scenarios have been tested against the current consented (i.e. effluent from a maximum of 599 cows with an effluent disposal area of approximately 130 ha) and proposed activities (i.e. 750 cows with an effluent disposal area of approximately 220 ha).

Scenarios A and B show that with the proposed increase in herd size, the aerial load from effluent reduces by 26%. AgResearch (2009)[4] recommends a maximum nitrogen load from effluent of 150 kg N/ha/year for the Southland region and both Scenarios A and B in Table 1 indicate that under the proposal, the disposal of effluent will account for 10 to 12% of this limit and in both cases reducing significantly. Based on these scenarios, the proposal is within recommended loading limits.

Table 1 Estimate of total nitrogen and total phosphorous loads from dairy effluent irrigation

		Scenario A (Environment Southland)		Scenario B (Heubeck)	
		Current	Proposed	Current	Proposed
Effluent load	TN (kg/yr)	2669	3341	3121	3908
	TP (kg/yr)			404	506
Aerial	TN	20.5	15.2	24.0	17.8

[3] Heubeck, S., Nagels, J., and Craggs, R., 2014. *Variability of effluent quality and quantity on dairy farms in New Zealand.* National Institute of Water and Atmospheric Research Ltd, p7

[4] Houlbrooke, D. J., and Monaghan, R. M., 2009. *The influence of soil drainage characteristics on contaminant leakage risk associated with the land application of farm dairy effluent.* Prepared for Environment Southland by AgResearch, Invermay, Dunedin.

load	(kg/ha/yr)				
	TP (kg/ha/yr)			3.11	2.31

For scenarios A and B the aerial loading figures range from 20-24kg N per hectare per year for the current activity, and will reduce to between 15-18 kg N per hectare per year. These new figures are still less than 12% of AgResearch's recommended maximum nitrogen loading from effluent. It is noted that the recommended nitrogen load threshold comprises only FDE discharge.

In terms of the phosphorous lost to land, the second scenario outlines a similar level of reductions per hectare – 26%, however due to the fencing of waterways and limited opportunity for flow to ground-water, the phosphorous is not expected to make its way into the waterways under normal circumstances.

The whole farm is within the Oreti catchment, and we expect E. coli levels to continue to pose a minimal health risk (less than 1%) for wading or boating. Observing good management practices will limit E. coli entering the waterways under normal circumstances.

Scale of effects

To assess the potential effect of the effluent loads on water quality, consideration must be given to the nitrogen that may make its way into the groundwater, or other surface-water bodies, and the impact this will have relative to both existing levels of water quality, and the minimum level of drinking water standards.

Several guides exist to determine the quantity of nitrogen from effluent discharge that permeates through the soil into ground water. Environment Southland have on occasion referred to 0.5 of 1%, previous applications by Civil Tech have referred to technical water assessments of Karen Wilson of 3% for total nitrogen and 35% for phosphorous, and work by David Houlbrooke[5] suggests 7% could be a conservative figure for the attenuated loss of nitrogen that reaches the groundwater. While the specific values of soil leaching may vary, we will use the conservative figure of 7% for total nitrogen, and 35% for total phosphorous in the calculations below.

Average rainfall for Central Plains is 924mm per year, and drainage for this property in the Central Plains groundwater zone equates to 270mm per year.[6] Based on the rainfall value of 924mm, the following concentrations can be calculated.

Table 3 Water quality (nitrate) concentrations with changes to farm activity

	Scenario A (Environment Southland)		Scenario B (Huebeck)	
	Current	Proposed	Current	Proposed

[5] Houlbrooke, D., Longhurst, B., Laurenson, S and Wilson, T. (2014). *Benchmarking N and P loss from dairy effluent derived nutrient sources*. p8

[6] Wilson S., Chanut, P., Rissmann, C., Ledgard G. (2014). *Estimating time lags for nitrate response in shallow Southland groundwater*. Environment Southland publication number 2014-03, Invercargill.

Concentration	TN (g/m3)	0.16	0.12	0.18	0.14
	TP (g/m3)			0.12	0.09

This table suggests that concentrations of total nitrogen and phosphorous could be relatively low at the level of pristine pre-European nitrate levels and well within the DWSNZ maximum acceptable value of 11.3mg/3.

Bore water quality measurements within 2km of the ground water take on this property show nitrate/nitrite levels that exceed the NZDWS between 14 and 20mg/m3, but this is in sharp contrast to readings taken from the bore on the farm in 2014 with TN at 1.3g/m3.

With respect to ecological trigger levels, the first two scenario concentrations are within Australian and New Zealand Environment and Conservation Council (ANZECC) guidelines for freshwater ecosystems based on the respective trigger values of <0.33g/m3 for total phosphorous and <0.614g/m3 for total nitrogen.

Overall the proposed changes in activity reflect a decrease of more than 25% in aerial nutrient loadings.

The water from the property drains eventually into the New River Estuary at Invercargill.

Estimates of the nitrogen loads in the Oreti catchment range between 2,900 and 4,900 tonnes per year – an average load of between 7 and 14.2 kg/ha/year as shown in the following table.

Table 3 Nitrogen loads for Oreti catchment

Oreti Catchment Nitrogen Load			
Total Load (tonnes/year)	Aerial Load (kg/ha/year)	Method	Reference
3,020	7.0	CLUES (total catchment area 4,314km2)	Wriggle (2008)[7]
3,736	10.6	River SoE data (aerial load calculated from total load and ES area of 3,510km2)	Aqualinc and ES (2014a)[8]
4,969	14.2	Land use modelling, and using ES area of 3,510km2)	Aqualinc and ES (2014b)[9]

Assuming a nitrogen attenuation of 97%, the effluent aerial loadings to water from the proposal in Table 1 equate to 0.46-0.53 kg/ha/year.

[7] Wriggle Coastal Management, 2008. *Southland Coast Te Waewae Bay to the Catlins: Habitat mapping, risk assessment and monitoring recommendations.* Prepared for Environment Southland, August 2008

[8] Aqualinc and Environment Southland (2014a). *Regional scale stratification of Southland's water quality – Guidance for water and land management.* Aqualinc report C13055/02 prepared for Environment Southland

[9] Aqualinc and Environment Southland (2014b). *Assessment of farm mitigation options and land use change on catchment nutrient contamination loads in the Southland Region.* Aqualinc report C13055/04 prepared for Environment Southland

It is noted that the disposal of effluent to land will make up only a small component of nitrogen losses from the property – with urine patches expected to comprise the major component.

Effluent pond and infrastructure

All effluent is collected from the shed, yards and any concrete area around the dairy shed. It will flow by gravity to the twin sludge beds, and then the liquid effluent passes through the weeping wall and to a sump. From there it travels by pipe to the pond. Effluent is irrigated from here to the farm as soil moisture levels permit.

The pond will hold 4,489m3 of effluent which is consistent with the Dairy Effluent Storage Calculator. Effluent will be applied to land at low application rates of by 4 different methods. All land is flat to undulating and less than 7 degrees.

The effluent disposal area will be 219ha. It will have 20m buffer zones to boundaries, roadsides and water courses and more than 100m buffer zone to the water intake. The area is more than is needed to meet the minimum requirements or 4ha per 100 cows, and is more than 2 times more than the 8ha per 100 cows as recommended in the Best Practice Guidelines Booklet. This will reduce the risk of flow to groundwater.

There are two soil types in the disposal area. Three are high risk soils but because the farm is mostly flat there is little chance of overland flow.

	Vulnerability Factors		
Soil name	Structural compaction	Nutrient leaching	Waterlogging
Braxton	moderate	severe	slight
Glenelg	slight	very severe	nil

7.2 Water Permit

The applicant requires an increase from the existing permit of 71,880 litres/day to 90,000 litres per day, a rate of 120l per cow. The water take is from one bore: E45/0404 at 1227001E, 4886365N. The property has 100,000 litres of storage in 4 tanks, more than a day's supply. The water storage allows certainty over water supply. A water meter is installed at the bore to measure water abstracted for the farm use.

The catchment is approximately 260ha. Lincoln Environmental estimate mean annual surface recharge in the Central Plains groundwater zone at 470mm/year. The total water use for the dairy farm is 90m3/day. The average recharge from the farm will be 2,593m3/day. The take is therefore 3.5% of the catchment.

The nearest neighbouring bore is 1.3km. The instantaneous is less than 5 litres/sec therefore the average rather than the instantaneous rate of take ultimately determines the magnitude of effects.

The existing bore has been abstracting groundwater under the existing water permit. The nearest permitted bore is 1.3km away and there is no known historic well interference issues. Therefore I consider the potential well interference effects to be less than minor. In terms of potential stream depletion effects, the there is no surface waterbodies within 100m of the existing bore and therefore the potential of stream depletion effects are considered minor or less.

In terms of rates and volumes, the daily volume of 90,000 litres equates to a rate of 120 litres/cow/day and thus is consistent with Council's standard estimate for dairy cows. The groundwater take is therefore

considered to meet the requirements of Policy 21 under the RWP for reasonable use. In terms of aquifer sustainability, the rate of take is the same. We consider the potential effects on aquifer sustainability to be less than minor.

Overall, the take should have a negligible effect on aquifer storage volumes, flow in adjacent water bodies and water availability for other users.

7.3 Dairy Farming – Land Use

There are four changes in land use that are being proposed in this consent. These are depicted in Figure 4 that follows and are outlined below.

1. The previous consent permitted FDE from up to 599 cows to be disposed on the farm over an area of 160ha with an aerial load of between 20 and 24 kg N /ha/year. This area is shaded in purple below. The same area also had a stocking rate of 3.7 cows per hectare. This proposal will lower the aerial load over this part of the farm to between 15 and 18 kg N /ha/year. The stocking rate will reduce to 2.9 cows per hectare.
2. The farm area shaded in yellow below is currently used for dairy and has had cows over the last seven years. It will continue to be used for the same activity, at a lower stocking rate of 2.9 cows per hectare. The proposal also requests the permit allows for FDE to be discharged to this land, with an aerial load between 15 and 18kg N /ha/year.
3. The area shaded in white below has been used in the past six years as a run-off block, winter grazing, raising young stock and cows at various times. The area is 49 hectares and has a long term lease arrangement with the owner's brother. The intensity of land use prior to this proposal has been:
    a. 140 calves on the property mostly leave in December.
    b. 120 to 130 heifers are wintered off the property and return early to calve.
    c. 5.2 ha or 10.8% winter crop (average from last five years).
    d. 100 cows grazed during winter on 10ha of fodder crop.

    This application proposes the land is used for the same purpose as the rest of the farm at the same stocking rate of 2.9 cows, and same low aerial loading of FDE between 15 and 18 kg N/ha/year. The changes to the stock management is a s follows:

    a. 180 calves will leave the property in December and be wintered off the farm.
    b. 150 to 170 heifers are wintered off the property and return early to calve.
    c. 100 cows wintered on the property on 10ha of fodder crop and either springers or late calvers will be grazed on another 10ha of fodder crops in spring.
4. Across the whole farm, 650 cows will be wintered off the farm. This is the main and most significant mitigation that will fully offset all of the nitrogen and phosphorous at the highest risk time during the farming year.

Figure 4 Diagram outlining proposed land-use changes at Miraka farm

In the section that follows, the positive, negative, temporary, permanent, and future effects are discussed as they relate to changes in activity and the values described above.

Table 4 Assessment of proposed changes and impact on values

Proposed change in activity	Scale of effects	Impact on values
Existing 160ha farm: lower stocking rate and reduce aerial effluent disposal	Reduced aerial load over this part of the farm to between 15 and 18 kg N /ha/year and from 3.1 to 2.3 kg P / ha/year. The stocking rate will reduce to 2.9 cows per hectare. Lower discharge rates per area means grass is better able to utilise the nutrients and lower amounts of nitrogen and phosphorous leach to groundwater and risk run-off to surfacewater. The total amount of effluent applied through aerial loading will not change significantly across the Oreti catchments as a result of this proposed change of an increased area. The TN concentration will be between 0.12 and 0.14 g/m3, which is lower than the ANZECC trigger value for aquatic ecosystem health (0.5g/m3). The lower nitrate levels are expected to improve the overall level of dissolved nitrogen which will make the waterways more habitable to insects and fish.	Lower nutrient levels in surface- and ground-water means a positive change for bathing, stock drinking, aquatic life, natural characteristics and improved economic value through more efficient use of (natural) fertiliser. This will also result in lower total amounts of TN and TP that flow down to the New River Estuary. These are positive and permanent impacts.
South dairy block to have FDE applied	The only change to the farming activity will be a low stocking rate of 2.9 cows per hectare and FDE discharge between 15 and 18 kg N /ha/year and 2.3 kg P / ha/year.	Stocking rates across the farm have reduced, which will mean positive and permanent impacts.
Addition of 49ha to dairy	The current total urinary N loss from the calves, heifers and	The effects on the values of the receiving environment

platform.	wintered cows with the current land use is 11,250 kg N over the 49ha. The calculations that support this are attached in Appendix 12. The proposed total urinary N loss under the proposal is 17,290 kg N over the 49ha. This is an increase by 6,040 kg N. This increase will be more than offset by the mitigation to winter the 650 cows off the farm – which will take 15,470 kg N off the whole farm. Considering only the aerial effluent, loading will be 18 kg N /ha/year and 2.3 kg P / ha/year. The TN concentration will be between 0.12 and 0.14 g/m3, which is lower than the ANZECC trigger value for aquatic ecosystem health (0.5g/m3). The new concentration that will leach to groundwater is lower than the current nitrate levels of moderate to high land use impacts (3.5-8.0mg/L) around this block of land.	include: Groundwater on this block will continue to receive nitrogen as it makes it's way through the oxidising physiographic zone during periods when the pasture cannot take up all of the nutrients. The new pond will also allow the effluent to be stored and these potential losses managed. The property is in the Central Plains groundwater zone. The net effect of removing the wintering cows will mean that the water quality improves in the surface water during the winter months, this is a seasonal change, but permanent. Overall the nitrogen load that discharges into the New River Estuary will also reduce, reducing nitrate levels and improving the water quality over time. This will be a permanent change. As nitrate toxicity reduces in the Oreti catchment, phospohorous and faecal contaminants reduce, the vegetation, habitats and ecosystem diversity will also improve.

7.4 Cumulative effects

Regional scale modelling of nitrogen and phosphorous losses from agricultural land use in the Southland region by Aqualinc in 2014[10] showed:

- Adoption of mitigation measures on farms could result in reductions in nutrient loads discharged in Southland;
- Within the agricultural sector, nutrient loss from dairy farms make up a disproportionately large proportion of the nutrient load in most Southland catchments compared to the farm area;
- Adoption of mitigation measures on dairy farms alone significantly reduces catchment scale improvements in nutrient losses because sheep and beef farms make up the greatest area of land use[11]. Overall, contributions from both land uses are significant; and,
- Under the status quo of ongoing conversions and increasing production on dairy farms, water quality will not be maintained or improved in the long term even if very stringent mitigation requirements were to be adopted. Setting limits for catchment nutrient loads and then managing discharges to meet these limits appears to be the most appropriate method of ensuring the goal of maintaining and improving water quality in Southland will be achieved.

While the findings of this study point to dairy as a significant contributor of nutrients across Southland, it does not consider the environment's assimilative capacity. Nitrogen inputs to the New River Estuary are outlined below, from a catchment perspective. Note that this includes both developed and undeveloped areas. It is also relevant that the farm dairy effluent will make up only a small component of the nitrogen losses (with urine patches expected to contribute a much larger component).

Estimates of the nitrogen loads in the Oreti catchment range between 2,900 and 4,900 tonnes per year – an average load of between 7 and 14.2 kg/ha/year as shown in the following table.

Table 5 Nitrogen loads for Oreti catchment

Oreti Catchment Nitrogen Load			
Total Load (tonnes/year)	Aerial Load (kg/ha/year)	Method	Reference
3,020	7.0	CLUES (total catchment area 4,314km2)	Wriggle (2008)[12]
3,736	10.6	River SoE data (aerial load calculated from total load and ES	Aqualinc and ES (2014a)[13]

[10] Aqualinc, 2014. *Assessment of Farm Mitigation Options and Land Use Change on Catchment Nutrient Loads*. Prepared for Environment Southland, report number C13055/04

[11] Adoption of the M1 mitigation package on all farms (i.e. mitigations most easily implemented) reduced agricultural nitrogen loads by 18 – 32% however when only dairy farms adopted M1, nitrogen loads were reduced by only 1 – 6%. Similarly, when all farms adopted M3 (i.e. the most effective but most expensive mitigation measures), nitrogen loads were reduced by 29-37% and phosphorous loads by 40- 80% however when only dairy farms adopted M3, nitrogen and phosphorous loads were reduced by 2-18% and 5-32% respectively.

[12] Wriggle Coastal Management, 2008. *Southland Coast Te Waewae Bay to the Catlins: Habitat mapping, risk assessment and monitoring recommendations*. Prepared for Environment Southland, August 2008

[13] Aqualinc and Environment Southland (2014a). *Regional scale stratification of Southland's water quality – Guidance for water and land management*. Aqualinc report C13055/02 prepared for Environment Southland

		area of 3,510km2)	
4,969	14.2	Land use modelling, and using ES area of 3,510km2)	Aqualinc and ES (2014b)[14]

Good management practices

Good management practices

Table 6 Miraka Farm - Planned good management practices

Activity	Relationship to risks to water quality	Comment
Nutrient management plans	Limit the use of artificial fertiliser to reduce the amount of nutrient leaching to groundwater in porous zones, or surface water where waterlogging is higher risk.	
Optimum soil test P	Information that helps farm manager optimize use of fertilisers and supplements to reduce the amount of nutrient leaching to groundwater or surface water, and maintain health of cows.	
Stock exclusion from streams and wetlands	Ensure there is no nutrient discharge from the herd directly into waterways, so there isn't faecal contamination, or nitrogen or phosphorous directly into the water.	
Tracks and lane site away from water	Limit faecal contamination or phosphorous run-off into the waterways, and limit sediment and erosion effects from stock.	
Improved management of FDE		Using storage and low application rates
Grass buffers	Limit faecal contamination or phosphorous run-off into the waterways, and limit sediment and erosion effects from stock. Grass helps with uptake of any discharge and nutrients in the root zone.	
Pugged soil resown	Ensure high ability of soil to use available nutrients and productive capacity.	

A number of mitigation measures are being actively considered for implementing on-farm. These are outlined below.

Mitigation measures

Table 7 Miraka Farm - Mitigation measures that are appropriate for this farm

Activity	Relationship to water quality risks	Comments
Sediment ponds	Reduces the amount of sediment that leaves the property, retaining the insoluble phosphorous and improving water clarity.	Duck ponds are candidates for conversion
Winter off stock	Reduces the amount of effluent and nutrients lost to ground and surface water during wet periods. Reduces soil pugging so grass and soil condition can take up higher levels of available nutrients from effluent.	

[14] Aqualinc and Environment Southland (2014b). *Assessment of farm mitigation options and land use change on catchment nutrient contamination loads in the Southland Region.* Aqualinc report C13055/04 prepared for Environment Southland

No till pasture where possible (direct drilling)	Reduced sediment loss because soil held together by root system of previous crop or pasture.

Effectiveness of mitigation measures and good management practices

The measure to winter off stock has been calculated to remove a total of 15470kg N from cow effluent being wintered off. The benefits of sediment ponds and no-till pasture have not been quantified.

Effects on Sources of Human Drinking Water

Riverton takes water from the Aparima River more than 60km downstream of the point where the water leaves the property. There will be no discernible effects to the city's water supply resulting from the activity.

Other drinking water sources including local bores will have low risk of impact because the discharge is not directly to water, and buffer zones are imposed to reduce contamination of surface water. With low rates of irrigation over a large discharge area, and there is more than sufficient effluent storage to ensure that irrigation can be deferred until soil moisture conditions are suitable.

7.5 Monitoring of effects

The groundwater bore water quality will continue to be monitored by Environment Southland, as well as the river water quality, macro invertebrate, algae and nutrient levels. The existing arrangement with Environment Southland is that they will undertake a bore water quality test bi-annually and on-charge to South Dairy, however no records of water quality measurement at E46/0942 have been supplied on request for this application.

The activities to monitor the effects on the farm include daily recording of effluent discharge to land, including the paddock and volume. There will be soil testing of each paddock each year to check nutrient levels especially Olsen P test and trace elements to ensure optimum use.

Recording the mitigation measures for the required winter crop and cultivation plans is required as part of the Management Plan detailed in Appendix N.

7.6 Alternatives

The main scenarios are as follows:

1. Status quo: Continue using the dairy farm as per previous permits of 599 cows on 160ha of land. Continue using the 49ha south west block as a run-off and winter-grazing block, and the other southern block for dairy grazing.

2. Increase effluent disposal area to include southern block for dairy grazing, but do not expand farm. Continue to keep 599 cows wintered on the farm.

3. Expand farm to 750 cows and 220ha of land, with an increased discharge area. Heifers and calves removed from 49 ha block. Take 650 cows off the farm over winter.

We are proposing scenario 3. The other options are sub-optimal for environmental, economic or efficiency reasons. The proposed activity meets the existing standards and requirements.

7.7 Additional comments

1. Ground water availability
Water is to be taken from the existing bores E45/0404 and F44/0031. Abstraction rates are low. The water requirements are included in the Application for Water Permit.

2. Slope
The areas of the farm used for effluent disposal are all flat to undulating and all less than 7 degrees.

3. Water quality risks
The water quality will be protected by the ability to store effluent until there is sufficient soil moisture deficit to irrigate with low application rates. The stream and waterways through the property are fenced and vegetated. The application rates are low and spread over a large area.

4. Farm dairy effluent risks
Effluent will be irrigated within the conditions set in the discharge permit. The system will also permit lower application rates than the standard design parameters. The full details of the effluent management are included in the Collected Agricultural Effluent Management Plan.

5. Soil risk/vulnerability factors
The farm has high risk soils but there are no unsuitable soils on the farm. The soils were mapped in the Topoclimate series. There are many dairy farms on these soils around the area.

6. Nutrient management
The key to on-going success is to carry out soil testing regularly and re-run the nutrient budget. 84% of the farm will be used to spread effluent. The aim is to spread a small amount over the discharge area each year to reduce the use of artificial fertilizer.

7. Wintering management
100 cows will be wintered on the farm. Calves will leave in December and winter over away from the farm. They will return as R2 to calve. All replacements will be wintered off the farm as will 650 heifers and cows.

8. Sensitive areas identification
The stream that runs through the property all year has been fenced for a number of years and has riparian planting. There are three ponds on the farm, these will all have buffers from discharged effluent.

The Braxton and Glenelg soils are both prone to nutrient leaching so application rates is an important part of the farm management.

9. Stocking rates
The stocking rate will be 2.9 cows/hectare.

10. Bridges and culverts
All lanes that cross streams and channels have culverts.

11. Farm management plans
A Collected Agricultural Effluent Management Plan is attached.

12. Stock access to water
The streams on the farm are fenced and there is no access to this water for stock. All paddocks have troughs connected to the water scheme.

13. Riparian management

The stream that is adjacent to grazed areas is fenced and vegetated. The stream runs all year has intermittent plantings. The farm has some shelter planting. The shed, yards and effluent storage pond are well away from any stream.

14. Silage management

The farm does not have a silage pad. If one is built, then it will meet the requirements of the Water Plan.

15. Offal disposal

The farm does not have an offal pit. If one is required, it will meet the requirements of the Water Plan. It will not be located closer than 50m to any water course, bore, permanent building or property boundary. It will be constructed so as to not have water run-off into it and be used for offal only.

16. Sludge management

All effluent will flow by gravity to the twin sludge beds. The liquid effluent will flow through the weeping wall to a sump and then to the new storage pond.

17. Sediment management

The waterways are fenced and have vegetation cover and the land is flat leading to the stream. The material used in the pond construction will have little sediment. Any sediment from pond construction would drop out in the pasture buffer.

18. Open drain clearing

Have not need cleaned in the last 10 years and have gravel bases.

19. Soil disturbance/earthworks

There is no need for further soil disturbance works apart from the new pond construction. The work is more than 50m away from the drains. The pond construction will shift some clay, silt, a bit of stone. No issues are expected, and any sediment will settle out across the grass within a few metres.

20 Drainage development

The farm has tiles and the system is complete and only cleaning or upgrading may be required at some stage. Known tiles are shown on the aerial photograph of the farm.

21. Runoff

The drain areas are fenced with good vegetation cover. The land is flat.

22. Shelter removal

There are a number of rows and stands of shelter trees which will be retained.

23. Dairy lane location

There are no lanes that run adjacent to streams or drains.

24. Cultivation

Cultivation will be undertaken as part of the pasture renewal programme by plough or direct drill. There will be up to 20ha of winter crops, and 10ha of grass to grass.

Good Management Practices

The following good management practices are undertaken.

Nutrient Management	Overseer nutrient budgets will be carried out Soil testing carried out and fertiliser levels kept at optimum levels Record all effluent and fertilizer spreading

Riparian Management	All waterways fenced and stock excluded Culverts at all crossings All riparian areas are vegetated and mostly planted
Effluent Management	Best practice levels of water use Using low levels of effluent spreading over most of the farm Optimise the use of N, P and K
Stopping nutrients, sediment and microbes	The vegetated drain will catch sediment when it flows No spreading of effluent on slopes Good buffer zones. Keep cultivation away from drain edges

Physiographic Zones

Central Plains – artificial drainage and overland flow

Protect soil structure, particularly in gullies and near stream areas	Avoid pugging pastures and repair bare areas Using along the contour cultivation 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	Reduce use of N in autumn and use silage or pro-gibb Wintering stock off over winter Use small applications of N as pasture requires 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 effluent at low rates Have sufficient effluent storage
Capture contaminants at drainage outflows, manage critical source areas	Look at possible locations of wetlands Identify critical source areas Review riparian areas and increase if necessary

Central Plains – deep drainage

Reduce the accumulation of surplus nitrogen in the soil particularly during autumn and winter	Reduce use of N in autumn and use silage or pro-gibb Wintering stock off over winter Use small applications of N as pasture requires Re-sow bare or pugged areas of soil

Oxidising – overland flow

Protect soil structure, particularly in gullies	Avoid pugging pastures and repair bare areas Using along the contour cultivation Keep cultivation at correct distances from riparian areas
Reducing phosphorus use and loss	Keep Olsen P levels at optimum or less

	Maintain buffer zones
Capture contaminants at drainage outflows, manage critical source areas	Look at possible locations of wetlands Identify critical source areas Review riparian areas and increase if necessary

8.0 Consultation

The farm is expanding but with reduced intensity compared with the existing permitted activity. The farm will increase stock numbers. No consultation has been undertaken. The changes to the farming activity also include construction of a new effluent pond.

9.0 Conclusion

The farm is an on-going operation, it will increase its cow numbers and lower the stocking rate and aerial effluent loading. With the flat, good vegetation in the riparian areas, collected effluent storage and low application rates there is little risk to water quality. The latest water testing shows a reduction in N levels.

Appendix 1 Collected Agricultural Effluent Management Plan

This plan has been written for all employees, contract milkers and share milkers of Miraka Farms Ltd, and all others associated with managing the farm and dairy effluent system.

A: OBJECTIVE

"As good environmental stewards and responsible citizens, manage the farm dairy effluent system so as to take all practical steps to avoid contamination of ground and surface water, whilst optimizing the of the productive benefits of the effluent asset".

Key strategies to achieve this objective:

- Prepare, implement and monitor a nutrient budget by the Overseer programme to maximize the returns from the resource particularly N, P & K.
- Carry out regular soil tests.
- Subject to soil moisture and weather conditions, irrigate at every practical opportunity to keep the storage pond as empty as possible.
- Ensure that all the staff operating the system are trained and competent, and are aware of the need to continuously monitor the effluent handling system and the farms drainage networks.
- Document system operational details to ensure the system is monitored, to maximize re-use of the nutrient and minimize risk.
- Ensure by regular and programmed checks that the supporting effluent infrastructure is in good condition, is inspected regularly and maintained under a preventative maintenance schedule.
- Ensure by regular inspection that the farms drainage does not contain any obvious signs of dairy effluent contamination.
- Remaining alert to new and emerging technologies that can be incorporated into the system to improve performance or reduce environmental risk.

B: DESCRIPTION OF COLLECTED AGRICULTURAL EFFLUENT DISPOSAL SYSTEM

COLLECTION AND IRRIGATION SYSTEM

I. All effluent from the farm dairy and yard areas will flow to the sludge beds, sump and pond. The effluent will be pumped to the discharge area if the soil moisture levels are suitable. If not it will be pumped to the storage tanks.
II. The effluent will be pumped to the discharge area when the soil moisture level is suitable by traveling irrigator, large pods or picked up by a slurry tanker or umbilical system.

Drainage Monitoring

a: Tile Map

1. Refer to the farm discharge map.
2. There is a tile network.
3. If tiles are installed then the tile location should be added to the map.
4. It is to be updated if paddocks are moled.

b: Tile end marks

I. Any tile outfalls are to be marked on the watercourse banks with a painted stake.

Volumes

a: Generated

I. Total effluent generated per day should be around 37.5m3 per day. 750 cows x 50 l/cow per day. This will be from the dairy shed and yards.
II. The Massey Pond Calculator has been used to calculate total storage required.

III. A report generated from the pond calculator showing input data has been supplied.

b: Pumping

The existing pump will deliver approximately 20m3/hour.

I. The total pumping time per season will be approximately 700 hours per season.
II. Or about 15 hours per week.
III. Each day's accumulated effluent will take approximately 2.0 hours alternate pumping to irrigate.
IV. The slurry tanker and umbilical will operate as required.

c: Pulsing and Automation

The pumping system and irrigators are fitted with a "failsafe" system. The application rate per hour and total depth of application can be set on the irrigator to suit soil moisture conditions.

C: SYSTEM MANAGEMENT

1. PERSON IN CHARGE

The person in charge of the effluent management system will be Peter Dykes who will live on site and will have overall control.

2. SYSTEM TRAINING

A: Training

All staff will be given initial training on the operation of the system and when any new system is commissioned. All the new staff will be trained in the operation of the system as and when employed. Details to be recorded in a staff training log.

B: Resources

Operational sheets and copies are to be held in operational manuals in the cow shed.

3. APPLICATION RATE

The maximum application rate is pre-set by the cam setting. Assuming that the same setting is always used, the application rate will only very slightly according to the pumping pressure based on distance to the irrigator.

The k-line shall be set to operate at no more than 10mm.

The slurry tanker and umbilical system shall be set at a maximum of 5mm per application.

Any extension of the mainline network should be tested in say three places to understand what the delivery is at these points.

4. DEPTH OF APPLICATION

The farm moisture levels will be compared to the Heddon Bush monitoring site in order to determine whether to irrigate and the appropriate application depth of effluent to be applied.

Annual Application Depth and Fertiliser Values

With low depths of application annually to the effluent area the nutrient requirements will be much lower than the total determined by soil analysis. The fertilizer requirements will be determined annually for N, P & K content. A nutrient budget will then be completed (updated) to determine the appropriate solid fertilizer requirements. The aim will be to maximise the use of effluent and minimise the additional solid fertilizer.

Estimate of fertilizer values

Where the composition of the effluent in not known, use the following conservative figures as a guide.

1mm of irrigated effluent depth equals.

3 kg per hectare of N,
3.5 kg per hectare of K,
0.2 kg per hectare of P.

So if 10mm of effluent is irrigated onto one spot, the nutrient application will be:

30.0 kg per hectare of N,
35.0 kg per hectare of K,
2.0 kg per hectare of P.

5. PADDOCK SELECTION

Paddocks will be selected according to their moisture status and grazing management. A sequence of paddocks can be pre-planned for irrigation. Each paddock is grazed and then spelled for the required period before it can then be irrigated. Prior to irrigation a visual assessment of the soil is to be made. If paddocks are pugged or are likely to have very low infiltration rates the irrigation depth will be reduced or the paddock rescheduled for irrigation after the soil conditions have improved.

The **critical factor** is that paddocks should not be irrigated when, or where irrigation will result in the moisture levels exceeding Field Capacity. After this point drainage starts either by passing down through the soil profile or flowing over the ground surface (overland flow).

Tile Lines

If there are any tile ends that are not known then these will be located and marked on the tile map.

Care must be taken when irrigation is done directly over them in every instance. The farm has poorly drained soil and tiles and moles.

6. COVERAGE AREA

There shall not be any discharge of dairy shed effluent onto land within:

20 metres of any surface watercourse;
100 metres of any potable water abstraction point;
20 metres of any property boundary;
20 metres of any residential dwelling.

Dairy shed effluent shall not be discharged onto any land area that has been grazed within the previous 5 days.

Effluent should not be discharged over tiles/lines moles where the soil is at or near field capacity.

7. NUTRIENT BUDGETS

A nutrient budget will be completed annually and will be used in conjunction with soil test data to set the quality of nutrients to be applied per hectare. This will be done in conjunction with the fertiliser supplier.

8. RECORDS

As each paddock is irrigated the application depth will be recorded. This will also provide an annual record of the total depth of effluent applied.
a: Application farm map.

A farm map is to set up each year or log book is to be maintained setting out what paddocks were irrigated when, at what rate (including settings) and to what depth. This map can be used not only in any discussions with compliance authorities, but as data for use in nutrient/fertiliser application planning.

D: MONITORING MAINTENANCE AND OPERATING PROCEDURES

1. Daily

Minimise water use at the cow shed;
Check the storage and irrigation system for operating faults during and following use; evaluate the soil moisture situation and calculate the optimum method and settings for the next application.
Move the irrigator as required to ensure there is sufficient area available for the next discharge and that they are properly sited and ready to operate.
Check and record in log any tile outfalls draining from the irrigator area.
Update the effluent irrigation log with settings, location, depth and method of application.

2. Weekly

a: Storage Facilities
Check tank level.
Check inlet and outlet pipes and clear any blockages;
Check and clean grates and sumps in dairy shed and yard as required.

b: Effluent Pump, Motor and Controls
Check pump and motor, grease if required;
Check mechanical switch gear is operating efficiently;
Note and follow up any unusual noises when the pump is operating.
Check anti siphon devices for blockages.
Note operating pressure during irrigation.

c. Pipelines
Check for leaks and blockages in pipes and joiners.

3. ANNUAL MAINTENANCE

Check pumps and motors and have them serviced by qualified technician;
Assess condition of pipeline, repair and replace parts as necessary;
Update irrigation maps for new fences, tiling etc
Training of new staff.

4. END OF SEASON

Ensure the storage pond is pumped down as far as is practical.
Turn on rainwater diversion.
Drain pumps and/or set frost lamps.

Check pumps and pipes for wear and tear and perform any maintenance required.

5. BEGINNING OF SEASON
Turn off rainwater diversion.
Prime pumps and check their operation.

6. BREAKDOWNS
In the event of power failure, pump or motor breakdown.
Contact repairer immediately to assess problem;
Limit or cease water use in the dairy yard and scrape effluent where possible if the pump pond is full;
Complete repairs or install the back-up pump before the next milking, depending on the storage available.
Where necessary arrange for a back-up petrol/diesel pump.
In the event of pipe blockages:

- For underground pipes: Clear if possible or if too difficult, contact a blocked drain repairer to water blast.
- Drag hoses: open camlock joiners to locate and clear blocks in pipe section;
- If not able to clear blockages, replace the blocked section or move the irrigation lines closer to the pump.

7. GENERAL
Under no circumstances are storage facilities to be allowed to overflow;
There shall be no ponding of effluent in the discharge area;
Maximise full use of the discharge area;
There shall be no discharge of effluent to frozen or snow covered ground;
The discharge will be managed to ensure aerosoling, spray drift and odour do not travel past the property boundary.
The general state of the property is to be monitored particularly areas where environmental contamination with effluent could be a problem. This includes races and silage storage and feeding areas. Remedial action should be taken before problems arise.

8. PLAN REVIEW

Review
Review whole effluent management plan and update by 30 November 2018.
Record irrigation areas due to any new moleing, tiling, etc.
Any developments in infrastructure – ie new/more irrigators, extensions to system, fencing changes.
Developments/targets for coming season verses the effluent plan.

E. Emergency Responses

1. STORAGE OVERFLOW
Where the storage is approaching full, and rain events of continued duration occur that could risk overflow, it is recommended that some low rate spreading with the slurry tanker be started on the lower risk soil areas. Spreading the effluent very thinly over a large area over a longer period of time is preferred to a point source leak from the pond WHICH ON THIS FARM COULD CAUSE ACROSS GROUND FLOW.

2. PONDING – (OVERLAND FLOW)
Should light ponding be detected irrigation will immediately stop. Checks should be made to ensure that there is no overland flow or ponding and any effluent stopped by bunding.

3. DRAINAGE – EFFLUENT ENTERING A WATERWAY
a: Overland flow
See ponding above

b: Discharge via a tile
See c: below

c: Effluent in open drainage
Attempt to immediately contain the contaminants by damming the drain if practical. This can be done by dumping a bale(s) of baleage or hay in the drain and pressing down with either the front end loader or tractor wheel or filling with clay.
Clay and silage wrap can often be used to help seal or form the required plug.
If possible disburse effluent with pod sets over a wide area.

4. EMERGENCY PROCEDURES

Advise person responsible
Seek help
Advise authorities
Mitigate the effect

5. EMERGENCY CONTACTS

Peter Dykes	027 222 4578	
Environment Southland	0800 768 845	

Appendix 2 Effluent System Overview

All effluent is collected from the shed, yards and any concrete area around the dairy shed. It will flow by gravity to the twin sludge beds, and then the liquid effluent passes through the weeping wall and to a sump. From there it travels by pipe to the pond. Effluent is irrigated from here to the farm as soil moisture levels permit.

This aerial photograph is at 10 December 2015.

Appendix 3 Pond Calculation Summary report

Dairy Effluent Storage Calculator
Summary Report

Regional authority:	Environment Southland Regional Council
Authorised agent:	
Client:	Miraka Farms Ltd
Program version:	1.47
Report date:	Wednesday, 31 May 2017
General description:	

Climate

Rainfall site:	Drummond Marson Rd
Mean annual rainfall:	1061 mm/year

Effluent Block

Area of low risk soil:	0.0 hectares
Minimum area of high risk soil:	150.0 hectares
Surplus area of high risk soil:	0.0 hectares

Wash Water

Yard wash:

- Milking season starts: 01 August
- Milking season ends: 15 May

Month	Number of Cows	Hours in Yard	Wash Volume (cubic metres)
January	750	5.0	37.5
February	750	5.0	37.5
March	750	5.0	37.5
April	750	5.0	37.5
May	750	5.0	37.5
June	0	0.0	0.0
July	0	0.0	0.0
August	750	5.0	37.5
September	750	5.0	37.5
October	750	5.0	37.5
November	750	5.0	37.5
December	750	5.0	37.5

Irrigation

Winter-spring depth:	4 mm
Spring-autumn depth:	8 mm
Winter-spring volume:	110 cubic metres
Spring-autumn volume:	150 cubic metres
Irrigate all year?	Yes

Catchments

Yard Area:	964 square metres
Diverted?	No
Shed Roof Area:	175 square metres

Diverted?	Yes
Feedpad Area:	0 square metres
Covered?	No
Diverted?	No
Animal Shelter Area:	0 square metres
Covered?	Yes
Diverted?	No
Other Areas:	14 square metres

Storage

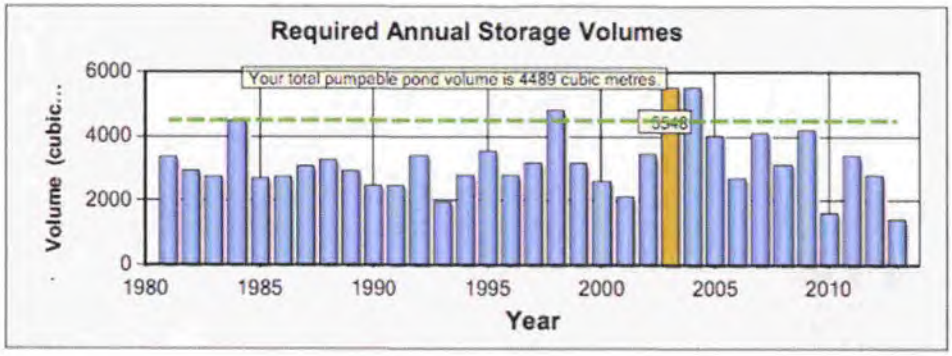
Pond/s present?	Yes
No. of ponds:	1 pond/s
Includes irregular ponds?	No
Pond 1	
- total volume:	5657 cubic metres
- pumpable volume:	4489 cubic metres
- surface area:	2209 square metres
- width:	47.0 metres
- length:	47.0 metres
- batter:	2.0:1
- total height:	3.5 metres
- pumped?	Yes
Tank/s present?	No
Emergency storage period:	1 days

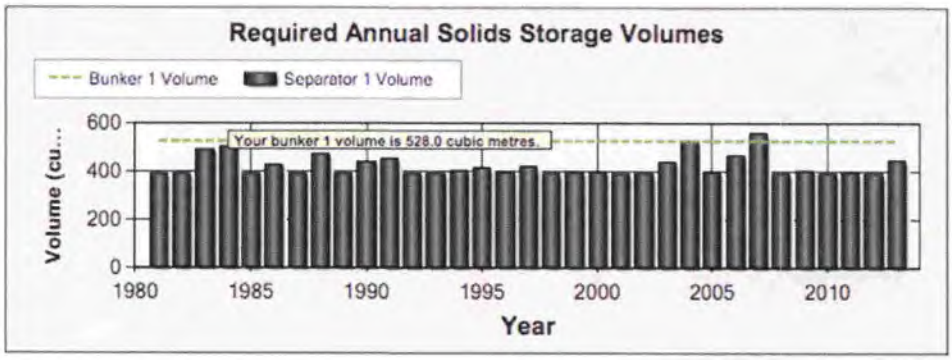
Solids Separation

Solids separator/s present?	Yes
No. of separators:	1 separator/s
Separator 1	
- dry matter:	20 %
- source/s:	Yard
- separation starts:	01 August
- separation ends:	31 May
- bunker length:	48.0 metres
- bunker width:	11.0 metres
- bunker height:	1.0 metres
- minimum SWD:	7 mm
- minimum 4 day SWD excess:	25 mm
- don't empty start:	16 May
- don't empty end:	31 July
- minimum volume before emptying:	75 %

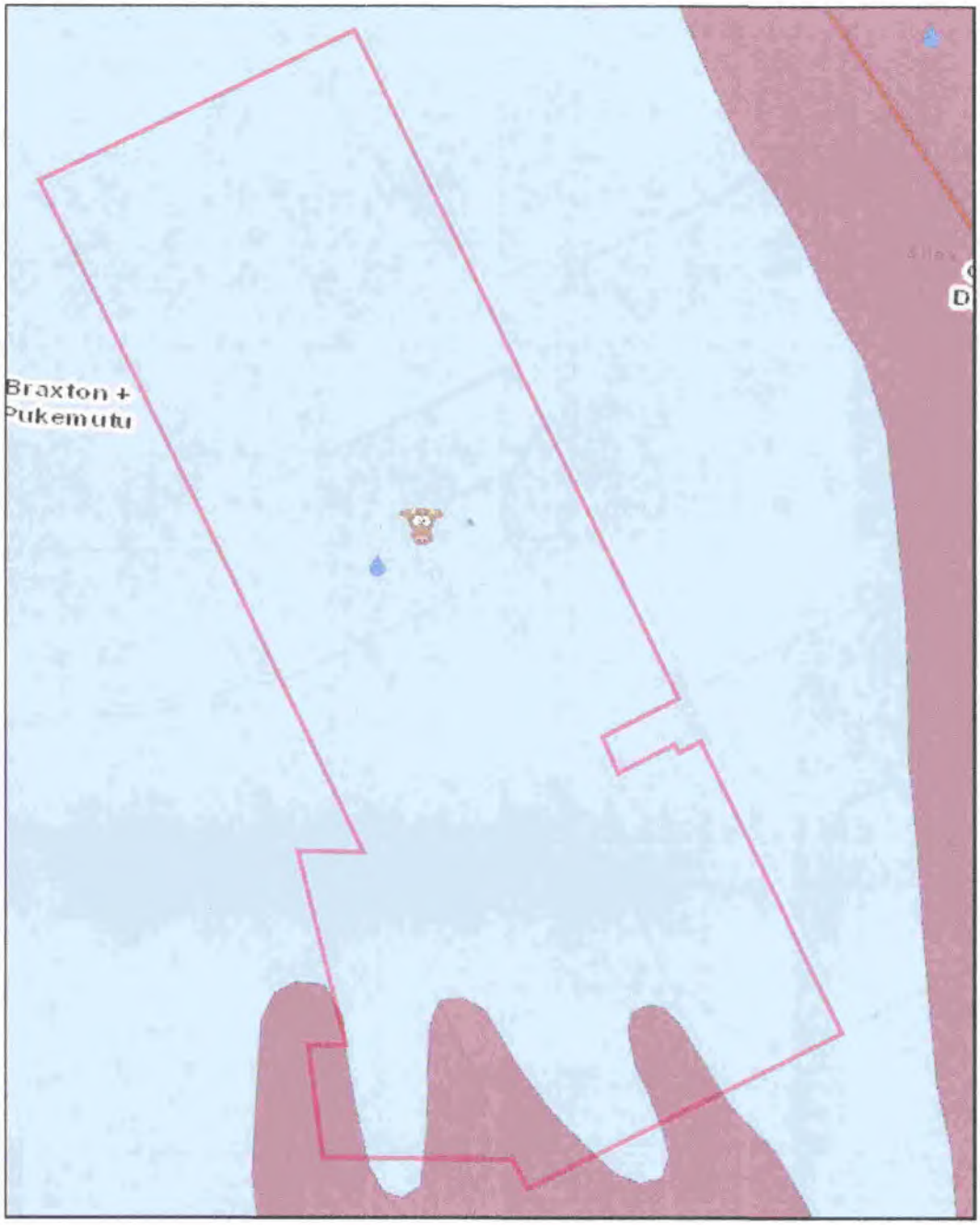
Outputs

Maximum required storage pond volume:	5548 cubic metres
90 % probability storage pond volume:	4427 cubic metres
Maximum required solids bunker volume:	563.4 cubic metres
During the period from:	01 July 1980
To:	30 June 2013


Required Annual Storage Volumes
Your total pumpable pond volume is 4489 cubic metres.
5548
Volume (cubic...
6000
4000
2000
0
1980
1985
1990
1995
2000
2005
2010
Year

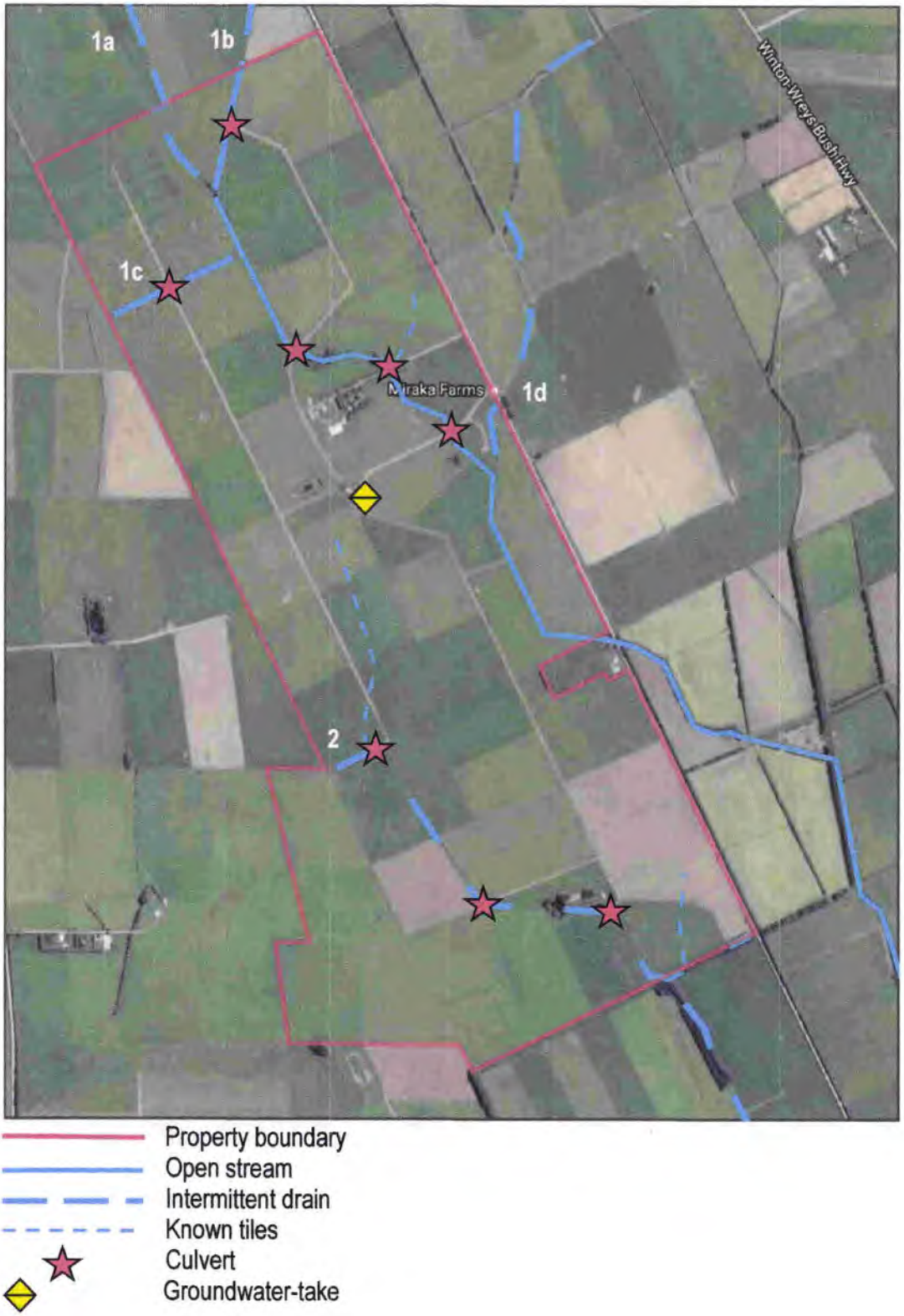

Required Annual Solids Storage Volumes
Bunker 1 Volume
Separator 1 Volume
Your bunker 1 volume is 528.0 cubic metres.
Volume (cu...
600
400
200
0
1980
1985
1990
1995
2000
2005
2010
Year

Appendix 4 Soil Map



Light blue	Braxton
Brown	Glenelg

Appendix 5 Subsurface Drain Map



Appendix 6 Effluent Area Map

Property boundary

Effluent discharge area

Groundwater-take

R

Residential area (200m radius)

B

Other bore (100m radius)

Appendix 7 FARM ENVIRONMENT PLAN

Prepared for: Miraka Farms Ltd
Prepared by: Civil Tech Ltd
Date prepared: October 2017
File no: **Consent No.**

---

1. **Nutrient Management** (from Overseer nutrient budget programme)

• Nutrient budget attached to plan:	Yes	
• Nitrogen (N) leached Kg/ha/yr	Whole Farm - before	21kg/ha/yr
	Whole Farm – after	21kg/ha/yr
• Phosphorus (P) leached Kg/ha/yr	Whole Farm - before	0.7kg/ha/yr
	Whole Farm – after	0.8kg/ha/yr

Nutrient concentration of effluent:

DM%	Total N (g/m3)	Total P (g/m3)	Total K (g/m3)
0.5	250	40	320

(Sources: Longhurst pers.comm.: (1) Longhurst et al., 2011: (2) Pow et al., 2010)

Additional management practices to be put in place. Also refer to Mitigation Measures.

2. **Management of Effluent Disposal**

• Map of effluent area attached	Yes
• Effluent block area (ha)	219ha
• Hectares/100 cows	29ha
• Irrigation type	Low application pods, travelling irrigator or slurry tanker

Effluent system operation
Effluent Collection, Storage, Irrigation, Maintenance and Contingency Plans

All effluent will flow by gravity from the shed and yards to a twin sludge bed and transferred into the storage pond. The effluent will not be treated but long term storage will be provided for the untreated effluent until the weather and ground conditions allow for the irrigation of the designated area by the low application irrigator. The storage pond capacity is based on dairy effluent storage calculator which includes all effluent plus rainfall on the concrete areas and the storage pond surface. The storage pond will hold 4,489m3 of effluent. From the pond the effluent will be sprayed onto an area of 219ha. The aim will be to spread effluent around the entire farm so as to reduce Nitrogen requirements. The farm is flat.

During spring and shoulder periods the low application pods will spread at 5mm but they can also be spread at lower rates if required. From October to April up 15mm may be spread but generally it will be much less than this so that it can be spread around most of the discharge area each year. All effluent will be spread during periods when soil moisture levels will permit. With storage and the ability to wait for sufficient soil moisture the system has good nutrient retention with minimal effect on the environment. Spraying will occur from 2 to 5 days after grazing and then have a minimum period of 15 days until grazed again.

All effluent will fall by gravity to the twin sludge beds and transferred to the storage pond. The storage pond will allow time for the irrigation system to be maintained. The storage pond is close to the shed which will allow close monitoring.

Staff Training
Peter Dykes is an experienced dairy farmer. An experienced manager with additional experienced staff will be employed. Staff training will be provided by Agito and on DairyNZ accredited courses.

All effluent falls by gravity to the two sludge beds and then transferred to the storage pond. The storage volume provides for time to maintain the irrigation system.

Effluent Produced
The application is based on 50 litre/cow/day or a total of 37.5m3/day.

Dairy Effluent Storage Volumes
The farm will have 4,489m3 of storage which is more than 90%ile of the Dairy Effluent Storage Calculator volume. This is at least to 100 days of storage.

Irrigation Practice
The aim will be to keep the pond level low enough during the spring busy period by irrigating on any possible day. During the silage harvesting the pond will be emptied on these paddocks in preference. The pond will be emptied at this time. In March the pond will be empty in preparation for winter and kept that way. If there is a very wet season which does not permit full irrigation then very low rate application can be applied in consultation with Environment Southland. The monitoring site at Heddon Bush will be used as a guide to the soil moisture levels.

Farm Drains
The farm has open drains and not many tile drains but this will be located. There are no plans to install any more drainage.

3. Feedlot/Wintering Pad
They do not intend to build a feed pad at this stage.

4. Monitoring Consent Requirements
1. The maximum application will be 15mm at any application.
2. The maximum depth of 25mm per year.
3. The farm will have a disposal area of 219ha.

- The farm will use soil tests once a year to monitor the nutrient levels and use this to re-run the Overseer nutrient budget to monitor the liquid fertilizer requirements. The low application system proposed will have very high utilisation of nutrient discharge.
- Currently the application rates will be calculated from supplier information but the system will be tested with the water that will be present in the pond prior to permitting effluent to be placed in the pond.
- No measurement can be carried out until the system is installed.

5. Monitoring Required by Consent
The application and management practice will align with best practice identified by Environment Southland.

6. Ancillary Matters
- Soil management in the effluent area. The aim is to spread effluent very thinly over the entire farm. This is to promote good grass growth and reduced levels of nitrogen to be applied. The farm will have 10% of grass renewed each year by pasture renewal of a fodder crop which will be grown for the springer cows when they return to the farm. This permits the animal health regulations to be complied with.

- The well head will be sealed around the pipe.
- All streams and drains within the farm are fenced for the dairy operation.
- There will be no lanes located directly alongside of drains and where lanes cross drains there will be shaping to place nutrients into the riparian areas.
- Any silage pits would be located away from waterways and bores.

All effluent will flow by gravity from shed and yards to the sludge beds and transferred to the storage pond. The effluent will not be treated but long term storage will be provided for the untreated effluent until the weather and ground conditions allow for the irrigation of the designated area by large pod irrigators. The pond storage allows for of 50 days of effluent plus rainfall on the concrete areas and the storage pond surface. The storage pond will hold 4,489m3 of effluent. From the pond the effluent will be spread by slurry tanker onto an area of up to 219ha.

During spring and shoulder periods up to 5mm. But can also be spread at lower rates if required. From October to April up 15mm will be spread. All effluent will be spread during periods when soil moisture levels will permit. With storage and the ability to wait for sufficient soil moisture the system has good nutrient retention with minimal effect on the environment.

Spraying will occur from 2 to 5 days after grazing and then have a minimum period of 15 days until grazed again.

All effluent will fall by gravity to the twin sludge beds and then pumped to the storage pond. The storage pond will allow time for the pump and slurry tanker to be maintained. The storage pond is close to the shed which will allow close monitoring.

Appendix 8 Design and Construction Checklist

162 Boyle Road
Heddon Bush 9783

Pond Volume

Pond volume	4,480m3
Number of days storage	Volume calculated by Massey DESC
Some solids will be removed by stone trap and pump sump	
Freeboard	500mm
Minimum batter slope	2:1
Liquid depth	2.5m

Existing Farm Effluent System

Existing infrastructure – All effluent from the shed and yard flows by gravity to a stone trap and into twin sludge beds, through a weeping wall to a sump. It is then pumped to the storage pond.
There is an existing pond with a capacity of 1,510m3 will be used until the new pond is built. The sludge beds would also have some storage capacity.

When the effluent flows to the pump sump and if soil moisture levels and weather forecast is suitable, effluent will be pumped to the discharge area and irrigated by large pods or a new Cobra rain gun. A slurry tanker or umbilical system will be used to take effluent to the areas that do not currently have underground effluent lines. If ground conditions are not suitable then effluent is stored in a 4,410m3 storage pond which will be constructed. Until it is constructed the existing 1,510m3 storage pond will be used.

Climate data	1061mm/year Drummond
Land application area system	150 hectares – Travelling irrigator, rain gun, slurry tanker or umbilical
Soil types soil	Pukemutu, Waianawa and Northope - high risk soils. Edendale – low risk
Catchment Areas	Yards – 964m2 diverted, shed roof – 175m2 diverted, other areas – 14m2
Water volumes	50 litres/cow/day for wash down
Irrigation	4 – 8mm with 110 - 150m3/irrigation day
Pond details	4,480m3 construct with on site materials and 1.5mm HDPE liner
The FDE system will operate as at present with the new pond providing additional storage.	
Access for construction and maintenance equipment provided	
Freeboard	500mm

Geotechnical Assessment

The material in which the pond will be built is yellow clayey silt. The site is on a flat and the pond will be constructed to the north of the existing pond. The pond will be excavated through the topsoil and into the clayey silt and may require some additional material required to build the walls. The base of the pond will be above the water table as the current pond is. The sludge beds are at a lower level and are not into the water table. The silt in the existing pond is stable with good construction qualities and will be built in thin layers at optimum moisture content. The same contractor will be used. The construction material is competent silt.

Hydrological Assessment

The pond is to be built on a flat plain into deep yellow clayey silt. The existing pond walls show what the construction material is like. The base of the pond is only 1m into the ground and built above the water table. The pond will be constructed of original material. There will be no hydrostatic pressure on the pond when empty. The pond will have a subsoil drain with drainage gravel in the pond base which will run to an inspection chamber. The pond will have a geotextile fabric liner and 1.5mm synthetic liner.

Design

Bank protection	Synthetic liner
Batter slope	2:1
Protection of storage pond at entry from pipe	Synthetic liner – double thickness
Protection of storage pond for stirrer base	Synthetic liner – double thickness

Fence requirement included in plans and specification

Construction

Nightcaps Contracting 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.

Buffer distances

The new pond will be 135m to the milk pick up point and 115m to the cups. Minimum is 45m. The pond will is 260m from an open waterway. Minimum is 50m. The existing smaller storage pond will be checked and may be retained for additional storage.

Monitoring

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

Appendix 9 Farm infrastructure photos

Stone trap

Looking north west at twin sludge beds and existing storage pond in the background

Weeping wall in sludge bed

Existing storage pond

Water storage tanks

Bore in tanker track

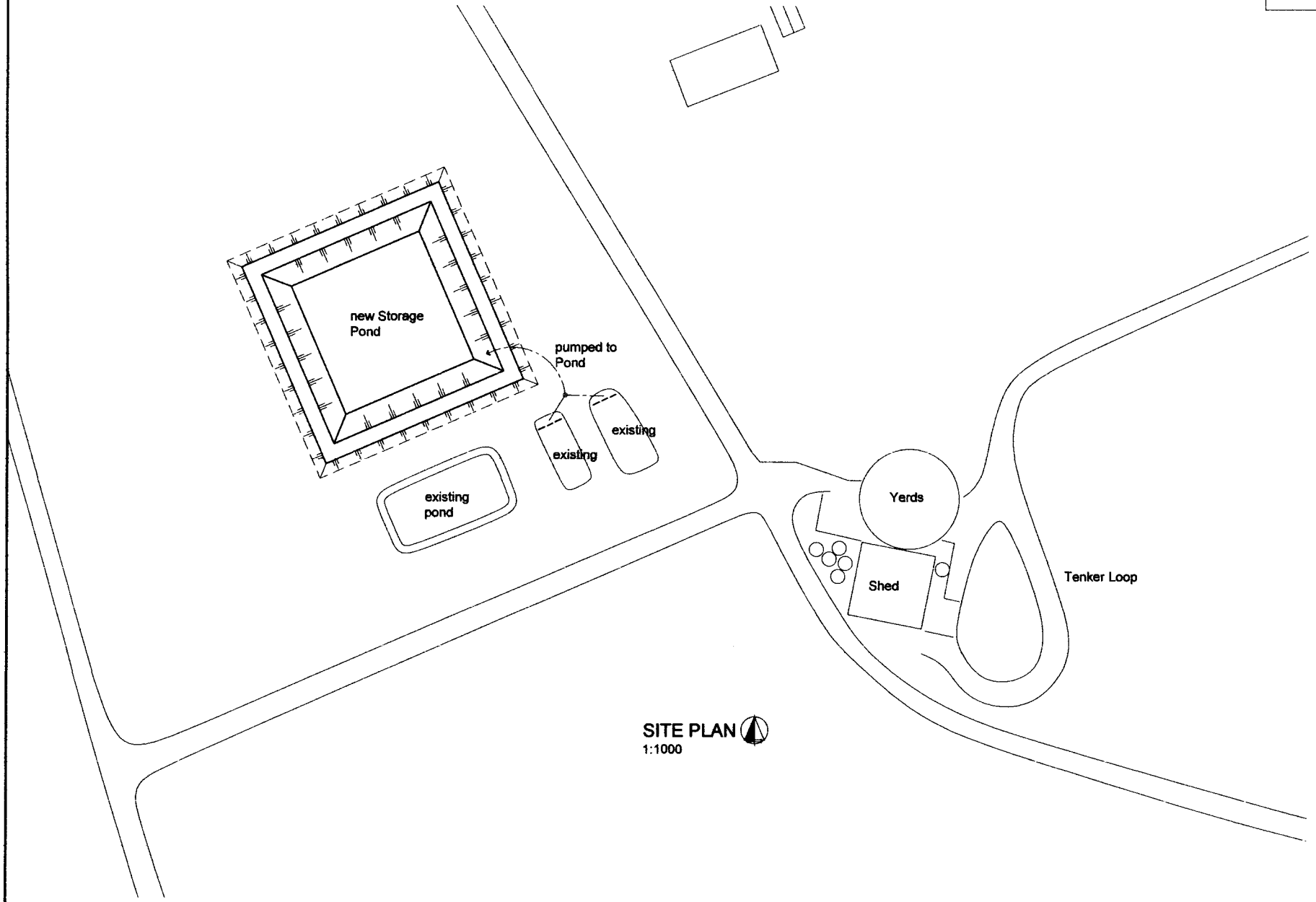
Shed and yards

Appendix 10 Supplementary Information

Also included with this application are the following documents:

- Agricultural Effluent Storage Pond Plans
- Construction Specification
- PS 1 design
- PS 2 design review
- Physiographic Zone - Fact sheets
    - Central Plains
    - Oxidising
- Soil Information Sheets
    - Braxton soil type
    - Glenelg soil type
- Central Plains Groundwater Zone Information sheet

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

Designed for:
750 cows
by pond calculator

DO NOT SCALE – IF IN DOUBT ASK

REV.	DATE	DESCRIPTION
A		issued for approval

DESIGNED: M Gundyns	DATE: 9/17	ORIGINAL SIZE: A3
DRAWN: Hp	DATE: 9/17	
CHECKED: MG	DATE: 9/17	SCALE: as shown @ A3
APPROVED: MG	DATE: 9/17	

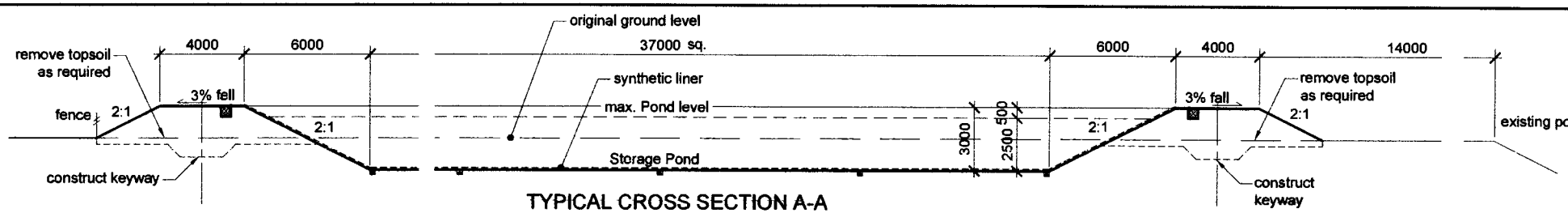
civil tech
PO Box 1558 Invercargill
Phone: 03 216 9745
Mobile Phone: 027 435 7957

CLIENT:
MIRAKA FARMS LTD
HEDDON BUSH

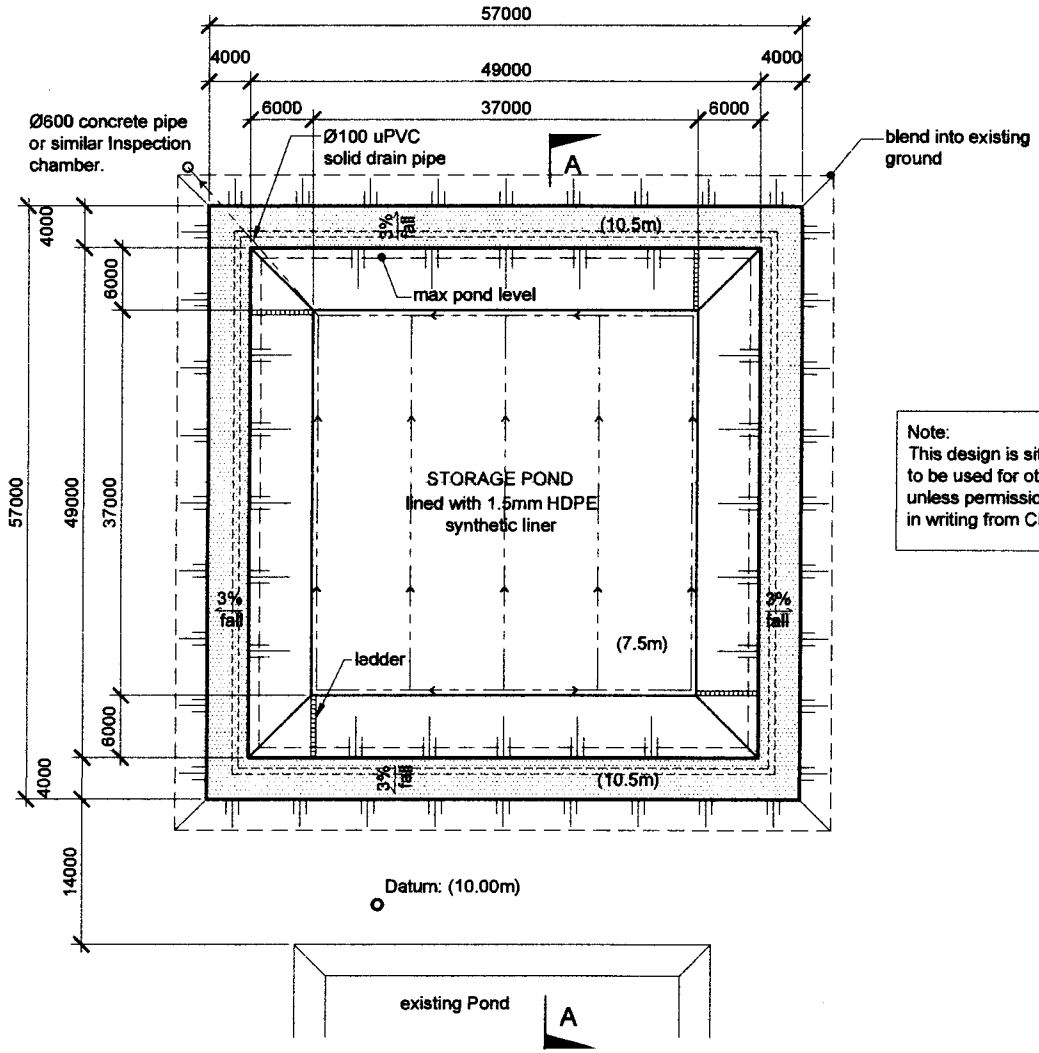
DRAWING TITLE:
COLLECTED AGRICULTURAL EFFLUENT STORAGE POND CIVIL WORKS

DRAWING NUMBER:	REVISION:
1443 C01	A

FILE NO. 1701

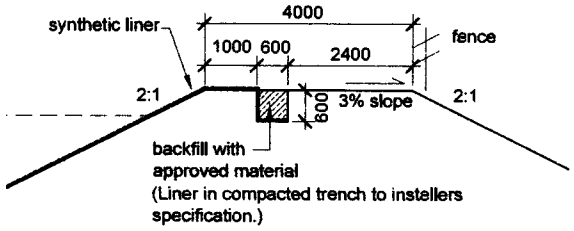


TYPICAL CROSS SECTION A-A
1:200

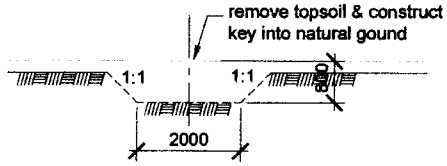


STORAGE POND PLAN
1:500

Allow for safety fence around ponds



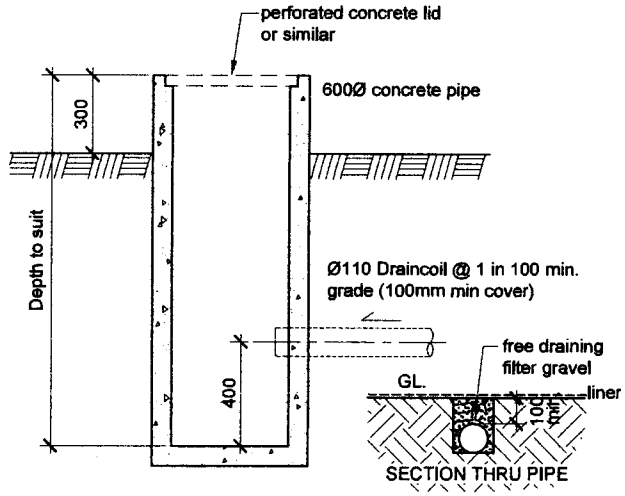
TYPICAL LINER ANCHOR DETAIL
1:100



KEY DETAIL
1:100

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.

Designed for:
750 cows
by pond calculator



INSPECTION CHAMBER DETAIL
1:20

REV.	DATE.	DESCRIPTION:
A	9/17	issued for approval

DESIGNED: M Gandyra	DATE: 9/17	ORIGINAL SIZE: A3
DRAWN: Hp	DATE: 9/17	
CHECKED: MG	DATE: 9/17	SCALE: as shown @ A3
APPROVED: MG	DATE: 9/17	

civil tech
PO Box 1558 Invercargill
Phone 03 216 9745
Mobile Phone: 027 435 7957

CLIENT:

MIRAKA FARMS LTD
HEDDON BUSH

DRAWING TITLE:

COLLECTED AGRICULTURAL EFFLUENT STORAGE POND CIVIL WORKS

DRAWING NUMBER:	REVISION:
1443 C02	A

FILE NO. 1701

DO NOT SCALE – IF IN DOUBT ASK

Specification for Earthworks Construction

for Agricultural Effluent Storage Pond

Client: Miraka Farms Ltd

Location: 162 Boyle Road

Project No.: 1443

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.

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 1.5mm HDPE synthetic lining for the main 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: Miraka Farms Ltd
(Owner/Developer)

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

IN RESPECT OF: Agricultural Effluent Storage Pond
(Description of Building Work)

AT: 162 Boyle Road, Heddon Bush
(Address)

Town/City: ..... **LOT** Pt Lot 5 **DP** 168 **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:

Dairy Effluent Storage Pond - Civil Works and numbered 1443 CO1 & 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 28/09/2017
(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:	Miraka Farms Limited *(Owner/Developer)*
TO BE SUPPLIED TO:	Environment Southland *(Consent Authority)*
IN RESPECT OF:	The design of a Farm Dairy Effluent Storage Pond with a proprietary HDPE liner. *(Description of Work)*
AT:	162 Hoyle Road, Heddon Bush, Southland.
LEGAL DESCRIPTION:	Part Lot 5, DP 168

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 Collected Agricultural Effluent Storage Ponds Civil Works and numbered 1443 – C01 & C02 - Rev A together with the specification, and design and construction checklist according to which the Dairy Effluent 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 Dairy Effluent 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.

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

DATE: 16 October 2017

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.

ENVIRONMENT SOUTHLAND

FACTSHEET

WATER AND LAND 2020 & BEYOND

Physiographic zone: Central Plains

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 'Central Plains' mean?

The Central Plains zone includes areas of clay-rich soils found in the central parts of the Southland Plains.

These soils can crack extensively during summer as they dry out, and swell when wet in winter and early spring, becoming poorly drained.

Key features of the Central Plains zone

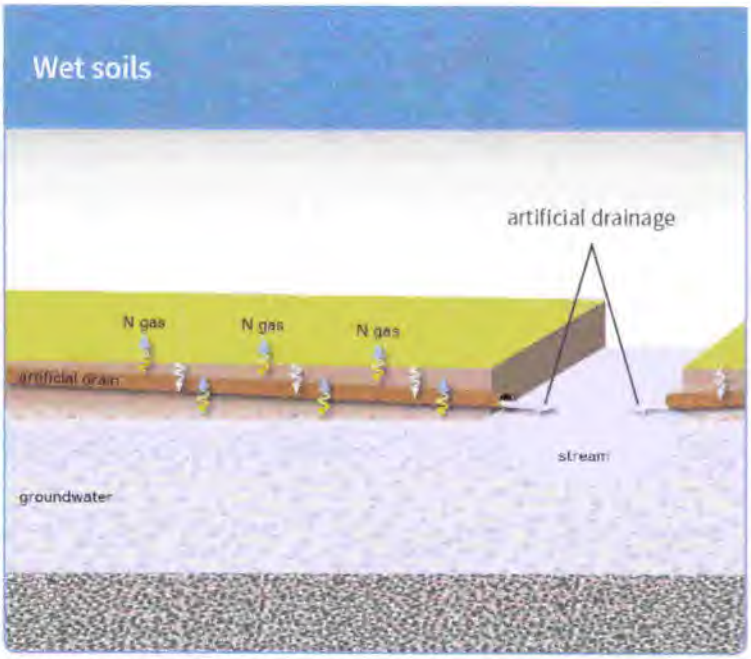
- Clay-rich soils that shrink and crack when dry and swell when wet.
- Wet soils - prone to waterlogging, resulting in an extensive artificial drainage network (mole and tile drains).
- Dry soils - prone to shrinking and cracking, allowing drainage to bypass the soil to the underlying aquifer.
- Central areas of the Southland Plains, including the Heddon Bush, Drummond and Isla Bank areas.
- Dense network of small streams fed by artificial drain network.

Water source and movement

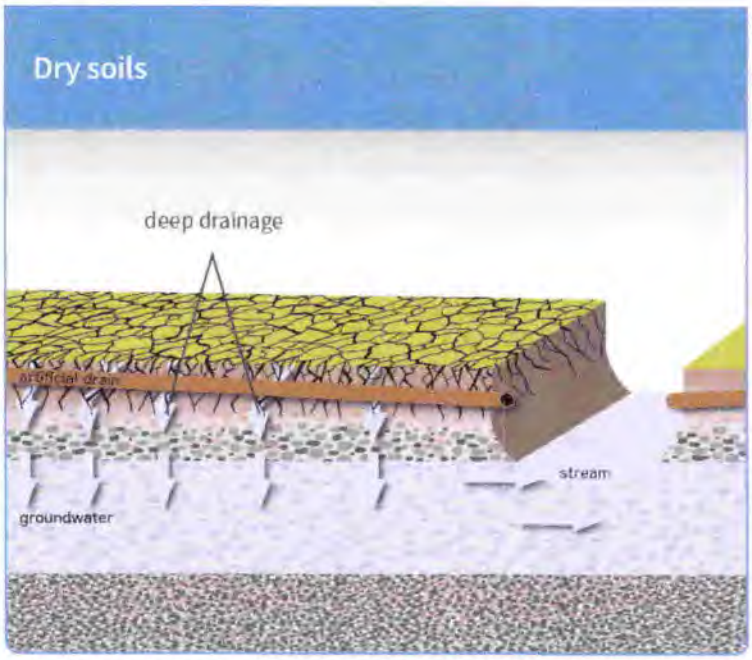
- Underlying gravels host an extensive 'unconfined' aquifer system.
- A dense network of streams flow through this zone.
- Streams and aquifers are not diluted or 'flushed' by a major river.
- Drainage patterns to waterways for this zone vary depending on whether soils are wet or dry:
- Wet soils – water mainly flows via artificial drains into nearby streams.
- Dry soils – rainfall drains rapidly through soil cracks to underlying aquifers.

Contaminant movement

Aquifers and streams in this zone are prone to contaminant build-up as they don't experience dilution by a major river. Patterns for contaminant loss to aquifers and streams vary depending on whether soils are wet or dry.



- Wet soils: This zone has an extensive artificial drainage network to help manage waterlogging. During heavy or prolonged rainfall, contaminants move quickly via artificial drains to streams. Note that some denitrification does occur in the soil but this does not offset the amount of nitrogen lost through drains.



- Dry soils: Clay minerals in the soil shrink as soils dry, resulting in the opening of cracks and fissures. During summer rain, water and contaminants move rapidly from the land surface, through the soil to underlying groundwater. Contaminants in shallow aquifers also make their way to streams, adding to their contamination load.

What does this mean for water quality?

√ Under the right conditions, soils have some ability to remove nitrogen (denitrify).

X When soils are wet, contaminants (including nutrients, sediment and microbes) can potentially be lost rapidly to rivers and streams via artificial drainage.

X When soils are dry, cracks allow nitrogen to move rapidly through the soil to underlying aquifers.

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 Central Plains zone

In addition to the above, good management in the Central Plains zone includes measures for reducing the effects of artificial drainage and deep 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 deep drainage by:

- Reducing the accumulation of surplus nitrogen in the soil, particularly during autumn and winter

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

The Central Plains zone describes clay-rich soils found in the central areas of the Southland Plains.

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: 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.

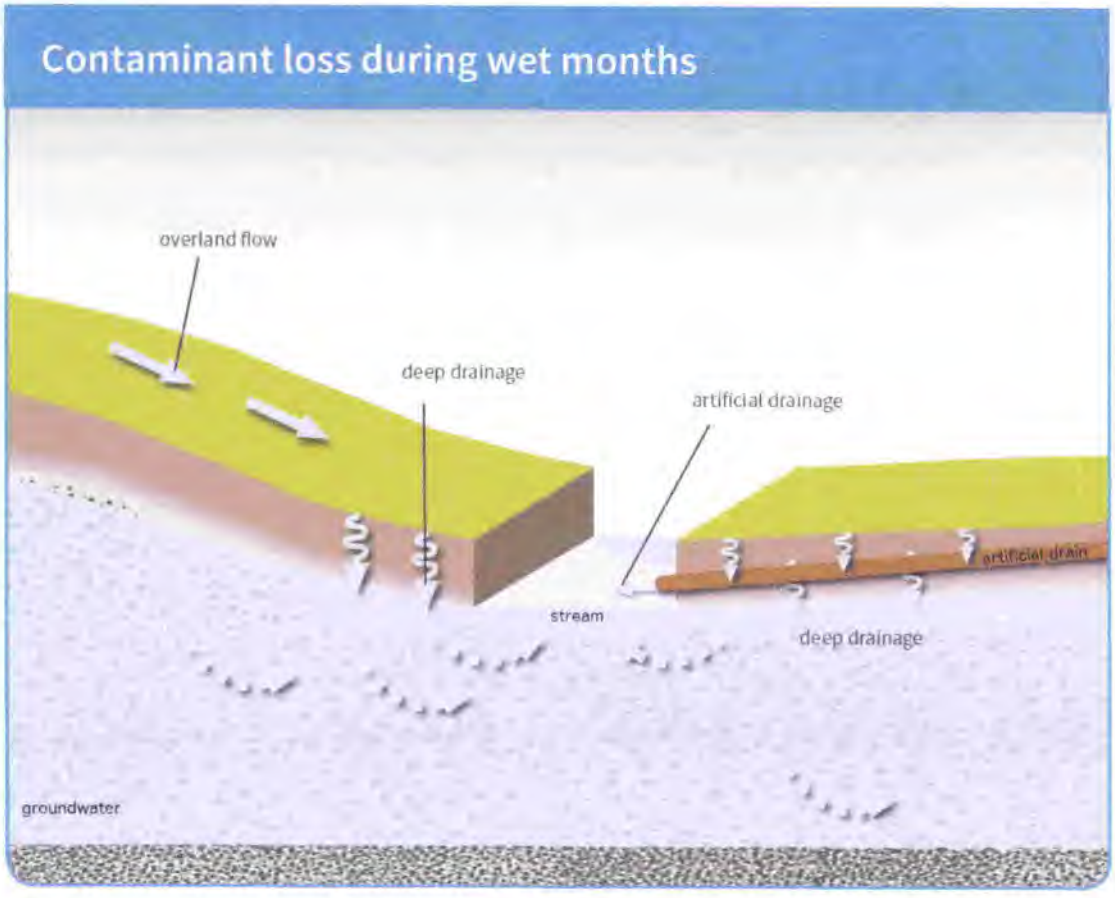
What does this mean for water quality?

√ 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.



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

Soil name: Braxton

Overview

Braxton soils occupy about 19,300 ha on intermediate terraces adjacent to the Aparima River and Waiau Valley. They are formed in a mixture of fine alluvium and loess that is derived from tuffaceous greywacke and volcanic rocks of the Takitimu Mountains. These soils are deep to moderately deep, poorly drained, and have silty clay to heavy silt loam textures. They are used for sheep, deer and dairy production with some cropping. Climate is cool temperate with regular summer rain.

Braxton profile

Physical properties

Braxton soils have a deep rooting depth and high available soil water, although the rooting depth may be limited by poor aeration during wet periods due to the poor drainage and slow subsoil permeability. Mottles occur in all horizons – another indication of poor drainage. Texture varies between heavy silt loam and silty clay in the subsoil, and silt loam topsoil clay content is 22–30%. The soils are typically stone-free, although the moderately deep phase will have gravel between 45 and 90cm depth.

Fertility properties

Topsoil organic matter levels range from7 to 10%; P-retentions 30–60%, with moderate pH values (5.5–6.2) that change little down the profile. Cation exchange values are moderate and base saturation values high. Available magnesium and potassium are low. Reserve phosphorus values are low. Micro-nutrient levels are generally adequate, although boron responses in brassicas and molybdenum responses in legumes are likely.

Associated and similar soils

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

- Glenelg: well drained, shallow stony soil
- Pukemutu: poorly drained soil due to water perching on subsoil fragipan
- Drummond: Well drained, moderately deep to deep soil

Some soils that have similar properties to Braxton soils are:

- Sobig: occur on high terraces; moderately deep to deep soils that are poorly drained due to water perching on clay-bound gravel
- Glenure: occur on terraces and downlands in northern Southland; consistently have silty textures
- Dipton: occur on intermediate terraces, shallow soils that are poorly drained due to water perching on clay bound gravel
- Makarewa: occur on floodplains

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.
Nutrient leaching	slight	These soils have a slight vulnerability to leaching to groundwater. This rating reflects the poor drainage, high water-holding capacity and slow subsoil permeability.
Topsoil erodibility by water	slight	Due to the moderate clay content, the topsoil erodibility of these soils is slight. Erodibility is highly dependent on management, particularly 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 a severe vulnerability to waterlogging during wet periods. This rating reflects the poor drainage and slow subsoil 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.

BxU1 (Braxton undulating deep)
BxU2 (Braxton undulating moderately deep)
BxR1 (Braxton rolling deep)

Versatility evaluation for soil BxU1, BxU2, BxR1		
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 water logging after heavy rainfall.
Intensive pasture	Moderate	Inadequate aeration during wet periods; risk of short-term waterlogging after heavy rainfall.
Forestry	Limited	Inadequate aeration during wet periods; vulnerability to sustained waterlogging.

Management practices that may improve soil versatility

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

Soil name: Glenelg

Overview

Glenelg soils occupy about 14,800 ha on the intermediate terraces of the Waiau and Aparima rivers. They are formed into gravelly alluvium from the tuffaceous greywacke and basic volcanic rocks of the Takitimu mountains. Glenelg soils are well drained, with silt loam topsoil texture. The soils are stony in both the topsoil and subsoil, which limits the rooting depth and water holding capacity. They are used mainly for sheep and beef grazing. Glenelg soils can be seasonally dry, particularly in inland areas.

Glenelg profile

Physical properties

Rooting depth in Glenelg soils is restricted to varying degrees, depending on the gravel content and depth to the cemented pan in the subsoil. Plant available water varies from moderate to low depending on the quantity of gravel present. Textures are loamy silts and silt loams grading to sandy loams and sand. Topsoil clay content is 15–25%. Gravel occurs throughout the profile, with gravel content often above 70% in the subsoil.

Fertility properties

Topsoil organic matter levels are 10–16%; P-retention values 50–75% and pH values moderate. Cation exchange vales are high in the topsoil but decrease down the profile with base saturation values low. Available calcium, magnesium and potassium are low, as is reserve phosphorus and sulphur. Micro-nutrient levels are generally adequate.

Associated and similar soils

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

- Braxton: has poor drainage
- Drummond: deeper soil with with gravel between 45 and 90cm
- Papatotara: similar land surface in the lower Waiau valley, but have gravel between 45 and 90cm depth; have higher P-retention (80%+) than the Drummond soils

Some soils that have similar properties to Glenelg soils are:

- Monowai: formed on glacial outwash terraces; more strongly leached, with P-retention consistently above 85%
- Oreti: formed on intermediate greywacke and schist terraces of the Oreti and Mataura rivers.

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	slight	These soils have a slight vulnerability to structural degradation by long-term cultivation, or compaction by heavy stocking and vehicles. This rating reflects the good drainage, high organic matter and P-retention in the topsoil.
Nutrient leaching	very severe	These soils have a very severe vulnerability to leaching to groundwater. This rating is indicated by the low water holding capacity and rapid permeability of the soil.
Topsoil erodibility by water	minimal	Due to the high organic matter level, the topsoil erodibility of 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 rapid 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.

GIU3 (Glenelg undulating shallow)
GIU3vi (Glenelg undulating shallow imperfectly drained variant)

Versatility evaluation for soil GIU3, GIU3vi		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Limited	shallow soils restricting root penetration
Arable	Limited	shallow soil restricting root penetration; stones
Intensive pasture	Moderate	Shallow soil
Forestry	Limited	Shallow soil restricting root penetration

Central Plains

GROUNDWATER ZONE INFORMATION SHEET

Groundwater zone:	Central Plains
Aquifer type:	Lowland
Size:	26,256 ha
Allocation status:	Low

Extent

The eastern boundary of the Central Plains groundwater zone follows the alluvial terrace that marks the extent of the recent floodplain of the Oreti River. The western boundary follows the boundary of the Middle Creek and Waimatuku Stream catchments. To the north the Central Plains groundwater zone follows the alluvial terrace on the southern flanks of the Taringatura Mountains.

The Central Plains groundwater zone is drained by numerous partially incised first and second-order streams of the Bog Burn and Terrace Creek catchments.

Groundwater Quality

Groundwater quality is generally good in the Central Plains groundwater zone although there are "hotspot" areas where nitrate values are particularly high and are often measured above the drinking water standard.

In order to better understand the causes of the hotspot areas, Environment Southland has installed a nested piezometer at Heddon Bush which allows us to monitor groundwater quality at different depths in the aquifer. The objective of the study is to figure out how much effect historic landuse has on the high nitrate values currently found, and to work out how existing landuse will affect future groundwater quality.

Poor wellhead protection is a significant issue in Southland. Inappropriate location, construction and maintenance of bores and wells can lead to localised groundwater contamination, particularly in regards to bacterial and nutrient concentrations. Contact Environment Southland for more information.

Figure 1: Map of the Central Plains Groundwater Zone (above).

Central Plains

GROUNDWATER ZONE INFORMATION SHEET

Hydrogeology

The subsurface geology of the Central Plains groundwater zone consists largely of moderately weather alluvial gravels in a silt and clay matrix. The southern portion of the Central Plains groundwater zone is recorded by Turnbull *et al* 2004 as a remnant of the Q8 moderately weathered glacial outwash gravel terrace. An excellent exposure of the subsurface gravels, including loess deposits, can be seen on in a cutting adjacent to Valley Road, Spar Bush.

North of Drain Road a marked terrace denotes a lower erosional surface formed by a previous course of the Aparima River which at some point(s) flowed into the Lower Oreti catchment (Turnbull et al 2004). Much of the northern portion of the Central Plains groundwater zone is comprised of surficial gravel deposits reworked to varying degrees by the Aparima River. At depth the gravel deposits retain the characteristic weathered clay silt matrix similar to those underlying the older terrace surface.

The thickness of the gravel deposits appears to vary across the Central Plains groundwater zone from 20 metres near Waianiwa to in excess of 50 metres near Hundred Line Road. The underlying Tertiary sediments are generally recorded as mudstone and sandstone with some lignite which is typical of the Eastern Southland Group. A small exposure of limestone occurs at Dunearn and may be presents at depth elsewhere in the Central Plains groundwater zone.

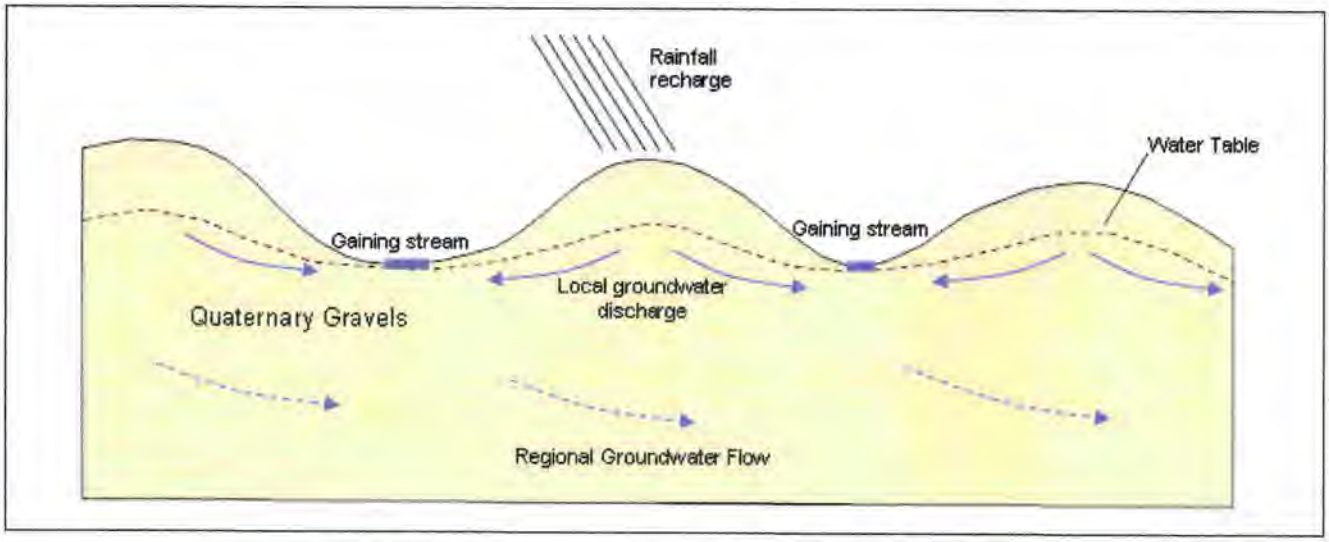


Figure 2: Schematic cross-section of the Central Plains Groundwater Zone.

Recharge and discharge

Recharge to the Central Plains groundwater zone is predominantly from rainfall recharge with some infiltration of runoff along the lower slopes of the Taringatura Hills. Lincoln Environmental (2003) estimated annual land surface recharge in the Central Plains groundwater zone at 470 mm/year.

Groundwater drainage occurs via the numerous small streams which cross the Central Plains groundwater zone. This drainage is aided by extensive mole, tile and artificial drainage networks which act to both intercept soil drainage and control the water table. By this mechanism a large portion of annual recharge is rapidly routed from the catchment with a much small component of deeper groundwater flow following the overall catchment drainage (typical lowland aquifer setting).

Appendix 11 McNeill Water Test Report November 2014

Invercargill

WATER TESTING LABORATORY

Lake Street Invercargill
ph(03) 216 2189 fax (03) 216 2789

21-Nov-14 **Lab Reference Number:** B 18346

McNeill Water Test Report: *Invercargill*

Name:	Dykes	
	Peter	
Address:	180 Boyle Road Centre Bush	
Order No:	P63811	
Date Received:	19/11/2014	13:05
Date Sampled:	19/11/2014	11:00
Sample Description:	Water sample	

Bacteriological Analysis

Test	*Result*	*Units*	*Method*
Total Coliform:	300	Colony Forming Units per 100ml	*(APHA 21ed 9222 B)*
Faecal Coliform:	28	Colony Forming Units per 100ml	*(APHA 21ed 9222 D)*
Enterococci:	27	Colony Forming Units per 100ml	*(APHA 21ed 9230 C)*

Physical and Aggregate Properties

Test	*Result*	*Units*	*Method*
pH:	7.57		*(APHA 21ed 4500-H+ B)*
pH after Aeration:	8.05		*(APHA 21ed 4500-H+ B)*
Turbidity:	48.1	NTU	*(APHA 21ed 2130 B)*
Total Hardness:	74	mg per litre as CaCO3	*(APHA 21ed 2340 C)*
Calcium Hardness:	61	mg per litre as CaCO3	*(APHA 21ed 2340 C)*
Magnesium Hardness:	13	mg per litre as CaCO3	*(APHA 21ed 2340 C)*

Chemical Analysis

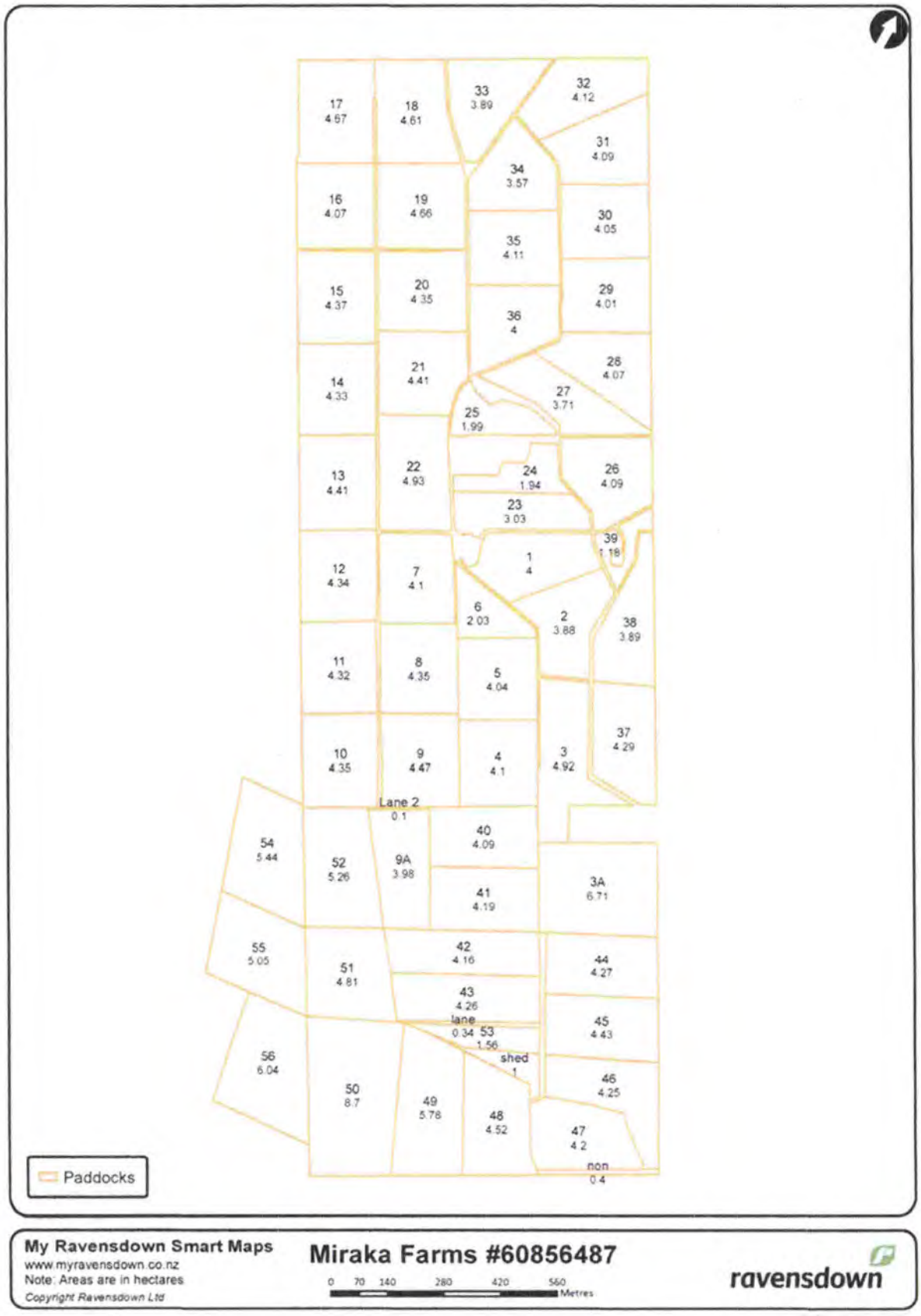
Test	*Result*	*Units*	*Method*
Iron:	3.79	mg per litre	*(APHA 21ed 3500-Fe B)*
Nitrate Nitrogen:	1.21	mg per litre as N	*(NWASCO 38)*
Ammoniacal Nitrogen:	0.10	mg per litre as N	*(NWASCO 38)*
Chloride:	25	mg per litre	*(APHA 21ed 4500-Cl-B)*
Manganese:	0.45	mg per litre	*(APHA 21ed 3500-Mn B)*

Bacteriologically this water sample showed faecal contamination. A soft water sample. The iron and manganese may cause taste and staining.

A. Cocker
Lab Manager

Civic Administration Building • 101 Esk Street • Private Bag 90104 • Invercargill 9840 • New Zealand • DX No. YA90023 • TEL 03 211 1777

Appendix 12 Farm Map



Appendix 13 Scale of effects of urinary N from Heifers, Calves and Cows

The scale of effects, particularly urinary N from the heifers, calves and cows is estimated below. The amount of estimated urinary N per calf and hectare of 90g N per day has been based on the meta analysis that follows. It is considered conservative given the current research is limited to measurements for heifers aged 6-11 months in age and 150-200kg in weight. It is expected the urinary N per heifer will be higher than this value, particularly as they approach full live weight of 400-500kg.

Two values have been compared for average N loss for a mature dairy cow. A mid point of 350g / cow / day has been used as a working number for the calculations below.

Current scenario

	Urinary N (g / day / head)	Number	Days	total N (kg/day)	total N / year (kg)
Calves	90	140	365	12.6	4,599
Heifers	90	130	365	11.7	4,271
Cows (wintered 68d)	350	100	68	35	2,380
Totals				59.3	11,250

Proposed scenario

	Urinary N (g / day / head)	Number	Days	total N (kg/day)	total N / year (kg)
Dairy cows (150 for 300 days)	350	142	300	49.7	14,910
Wintered cows (200 for 23 days)	350	100	68	35	2,380
Totals				49.7	17,290

Mitigations

	Urinary N (g / day / head)	Number	Days	total N (kg/day)	total N / year (kg)
Dairy cows (wintered off)	350			227.5	15,470

Meta-analysis of heifer and calf total urinary N loss

Only a handful of studies have been undertaken that measure or estimate the urinary concentration, volume and total N loss of immature dairy cows to land. The following literature review has been undertaken to support the estimation of total urinary N loss on the South Dairy farm, and includes the recent published research projects undertaken on farms in New Zealand.

The range of measured and estimated N loss for a calves was from 42-106 g per heifer per day, for samples that ranged in age from 6-11 months, and average weights between 144 and 210kg.

No research on N loss has been located for heifers between the ages 12 to 24 months.

Study	Heifer age (months)	Weight (kg)	Urinary N loss (g / day)
Edwards (2014)	6	144	42
Judson & Edwards (2016)	8	180	106*
Cheng et al (2015)	9-10	210	70
Cheng et al (2016)	9-11	184	99
Carr (2015)	8-9	176	

* calculated based on a measured on an average urine concentration of 0.53%.

Measured and estimated mature dairy cow urinary loss

Study	Urinary N loss (g / day)	Notes
Christensen et al (2012)	383	Measured 340-425
MfE (2009) as cited in de Klein et al (2010)	329	120kg / year

References

Carr, H. (2015). *Live weight gain and urinary nitrogen excretion of dairy heifers grazing pasture, chicory and plantain* (Doctoral dissertation, Lincoln University).

Cheng, L., McCormick, J., Hussein, A. N., Fraslin, C., Moonsan, Y., Logan, C., Grabot J. & Edwards, G. R. (2015). Urinary nitrogen excretion, grazing and urination behaviour of dairy heifers grazing pasture, chicory and plantain in autumn. In *Proceedings of New Zealand Society of Animal Production* (Vol. 75, pp. 70-73).

Cheng L., McCormick J., Logan C., Hague H., Hodge M. C., Edwards G. R. (2016) Liveweight gain and urinary nitrogen excretion of dairy heifers grazing perennial ryegrass-white clover pasture, canola, and wheat. *Animal Production Science*.

Christensen, C. L., Hedley, M. J., Hanly, J. A., & Horne, D. J. (2012). Nitrogen loss mitigation using duration-controlled grazing: Field observations compared to modelled outputs. In *Proceedings of the New Zealand Grassland Association* (Vol. 74, pp. 115-120).

De Klein, C. A. M., et al. "A system's perspective on the effectiveness of measures to mitigate the environmental impacts of nitrogen losses from pastoral dairy farming." *Proceedings of the Australasian Dairy Science Symposium*. Vol. 4. 2010.

EDWARDS, G. (2014). Liveweight gain and urinary nitrogen excretion of dairy heifers grazing perennial ryegrass/white clover pasture, wheat and canola. In *Proceedings of the 5th Australasian Dairy Science Symposium* (p. 309).

JUDSON, H., & EDWARDS, G. (2016). Urinary nitrogen concentration from dairy heifers grazing kale supplemented with either plantain or perennial ryegrass baleage in winter. *Journal of New Zealand Grasslands, 78*, 99-102.

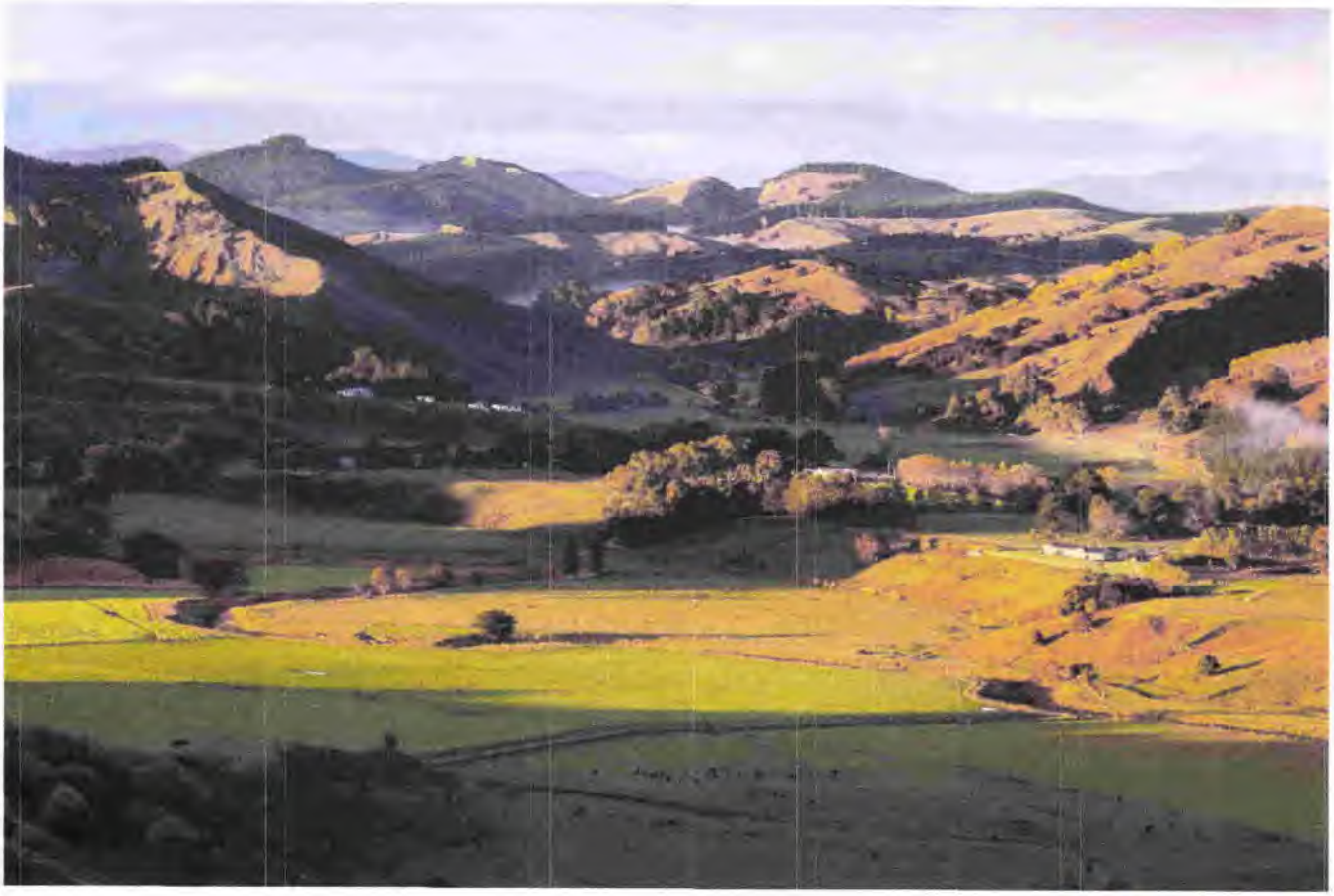
ravensdown

Farm Scenario Plan

Current and Proposed System Nutrient Budgets for Effluent consent

Prepared by Mark Crawford
Farm Environmental Consultant
CNMA
Certified Nutrient Management Adviser

60856487
MIRAKA FARMS LTD
C/- P J DYKES & M F WITSEY
162 BOYLE ROAD; RD 3 WINTON 9783
04/07/17
Reviewed by Tim Lissaman (CNMA)



optimiser
Environmental analysis and planning

Executive Summary

Miraka farms Ltd, have requested an OVERSEER® Nutrient Budgets to reflect the current and proposed estimated nutrient losses from their dairy farm as part of a renewal of their effluent discharge consent and an expansion of the cow herd. The farm is located at 162 Boyle Road, Heddon Bush, 14 km North West of Winton Township and 39 km west North West of Invercargill city and 43 km from the south west coast. The property is a dryland dairy farm, calving and peak milking 600 cows (consented number 599, modelled 600 for ease of calculations).

Average Nitrogen lost from the root zone, calculated from the current farm system modelled, using OVERSEER® Nutrient Budgets (OVERSEER) 6.2.3 was **5,493 kg N/year** or **21 kg N/ha/year.**

Average Phosphorus lost from the current farm system modelled using OVERSEER® Nutrient Budgets (OVERSEER) 6.2.3 was **180 kg P /year** or **0.7 kg P/ha/year**.

Average Nitrogen lost from the root zone, calculated from the proposed farm system modelled, using OVERSEER® Nutrient Budgets (OVERSEER) 6.2.3 was **5,391 kg N/year** or **21 kg N/ha/year.**

Average Phosphorus lost from the proposed farm system modelled using OVERSEER® Nutrient Budgets (OVERSEER) 6.2.3 was **195 kg P /year** or **0.8 kg P/ha/year.**

The productivity and urine patch deposition on gley soils with a high buffering capacity to leaching (high PAW and deep topsoil's) and crops are key risk reducing and increasing factors respectively.

The reduction of winter stocking, plus the associated increased effluent area enables the property to increase the cow herd, with a resulting slight reduction in the overall risk of N losses.

The farm is in a zone with a mostly moderate to high risk to nitrate levels and the physiographic zones point to high nitrates in ground water, nitrate accumulation and artificial drains as being risk factors. The proposed farm system, as modelled by OVERSEER®, has a number of strategies to reduce these risks of Nitrogen loss to water. These include an effluent system with its low application depths and greater storage to allow for deferred applications during periods of wet weather, a reduced winter stocking and continued use of crop to minimise soil damage over the spring period. Riparian strip planting, capture of sediment from crops and laneways through adequate buffer zones plus optimal phosphate levels are all practices which will reduce the risk of P losses. Future practices such as deferred grazing over autumn, plus ensuring the lowest volume applications and depths are applied to the well-drained and low PAW soils (Glenelg), with none applied at the highest risk times are further mitigations that may be used in the future.

The associated parameter reports are available in a separate document.

Overseer Nutrient Budget Version 6.2.3 have been used to create the nutrient budgets presented in this report.

Contents

Important Points to Note

1. Ravensdown grants permission for this document to be used for purposes such as land sale and purchase, land lease, or for territorial authority consenting purposes.

2. This document, together with the services provided by Ravensdown in connection with this document, is subject to the Ravensdown Environmental standard Terms of Engagement.

3. This Plan complies with the industry standard "Code of Practice for Nutrient Management (with emphasis on Fertiliser Use)" (hereafter referred to as 'the code'). The Code can be found on-line in full at: http://www.fertiliser.org.nz/Site/code_of_practice

Disclaimer

Ravensdown is not liable for any loss, damage or other disadvantage of any form suffered by the Customer or any third party arising in any way from this document or the services provided by Ravensdown in connection with this document, whether in contract, tort or otherwise.

Copyright

Use of this document

- Ravensdown has granted to its customer a limited licence to use this document. This licence enables the customer to possess, use, copy and distribute this document for the specific purposes for which the document was prepared by Ravensdown. This licence does not permit any alteration of this document in any way, or the document to be copied, distributed or disseminated other than in its entirety.
- If you are not the customer, to be able to lawfully use or rely on this document you must have been authorised to do so by Ravensdown or its customer. Your use of this document is subject to the same limitations as apply to the customer, as set out above.

.....

Mark Crawford

Farm Environmental Consultant

Dated 4th July 2017

General

Aim and Purpose of Farm Scenario Plan

Miraka Farms Ltd, has requested current and proposed OVERSEER® Nutrient Budgets to reflect the current and proposed estimated nutrient losses from their dairy farm as a part of a renewal of their effluent discharge consent and an expansion of the cow herd. The farm is at 162 Boyle Road, Heddon Bush, 14 km north west from Winton Township and 39 km west-north west from Invercargill city and 43 km from the south west coast (Te Wae Wae bay). The property is a dryland dairy farm, milking approximately 599 cows (consented numbers; modelled 600 for ease of calculations. Note it is not the intent to promote non-compliance, with reporting of a single cow over consent numbers).

The total titled area of the property is 255.0 ha as stated by the owner, and the GIS map with paddock areas calculates to 259.2 ha. This excludes a calculated area of 62.9 ha of additional land not part of the leased area (title Part Lot 2 Deposited Plan 471006 and Section 144 Oreti Hundred, 57 ha included in 259.2 ha) which is included in a 97.1 ha support block, which joins the 162.1 ha dairy platform. As well there is 2.39 ha of additional area due to road side and riparian edges. The effective area is calculated at 248.8 ha, close to the owner stated 246 ha of paddocks. In addition there is an estimated 7.0 ha of non-effective area, comprising of sheds, lanes, feed pads and yards, 1.0 ha of trees and 2.4 ha riparian areas. It is of flat to gently rolling topography (modelled flat).

Soil types on the farm are mostly homogenous and include; mostly Braxton_4a.1, , Silt Loam over clay, 246.0 ha (Orthic Gley soil, Poorly drained, PAW (plant available water) to 60 cm of 147.0 mm); and a Glenelg_4a.1 Silt Loam, 13.2 ha (Firm Brown, well drained, PAW of 78.0 mm). The Braxton soil is a deep to moderately deep soil and being a heavier silty loam texture means a lower risk of nitrogen leaching.

Overseer modelling of the system has been undertaken in accordance with the Overseer 6.2.3 "best practice data input standards" and has been reviewed by a certified nutrient management advisor.
The following report summarises the respective Overseer 6.2.3 nutrient budgets and key assumptions made.

Property Details

Location/address	162 Boyle Road, Heddon Bush 9783 RD 3, Winton
Legal Description	Lot 1 Deposited Plan 4967 & 6647; Lot 1 Deposited Plan 471006 Part Lot 5 Block I Deposited Plan 168; Lot 3 Block I Deposited Plan 168 Part Lot 2 Deposited Plan 471006 and Section 144 Oreti Hundred
Total area (ha)	202.24 ha titled plus part area of 119.97 land calculated at 57 ha. Total 259.24 ha
Owners	P J DYKES & M F WITSEY
Contact details	
Phone	(03) 2361121 mobile (027) 2224578
Email	mirakafarms@gmail.com

Farm Type	Seasonal supply Dairy farm

Current Farm System Analysis

Climate

Climate data for the property has been sourced from Overseer's Climate Station Tool data and has been entered as rainfall –984 mm/year, PET – 711 mm/year and average temperature – 9.9 °C, based on location close to latitude/longitude -46.073200, 168.17700 (Silo co-ordinates). Climate data has been modelled as per Overseer BPDIS.

Description of Current Farm System

The 259.2 ha property is operated as a dryland dairy farm, calving 600 cows rounded for ease of calculations (599 consented) and peak milking 600 (430 kg LW) smaller crossbred cows. Milk production aimed for is 260,000 kg MS/year (433 kg MS/cow). Cow numbers are shown in the table below. Most cows are wintered off-farm for June and July with a small number of lighter cows remaining (100) plus the first calving heifers, with all cows brought back in mobs over the month of August. Mean calving date is the 24th August.

The dry-off date is the 31st of May for the cows and first calving heifers. All replacements (160) are grazed off-the platform until they return as in calf R2 heifers in August. Cows are never milked once a day over drying off (modelled never) and all calves are fed colostrum and waste milk.

The 97.1 ha support block is used to winter the 100 dairy cows, as well as the heifer replacements and cuts silage to be used on the dairy platform. In addition it is used over the drying off period by the milking herd.

Supplements

Supplementary feed imported onto the property and to be fed during the season is as follows:

- 60 T DM Barley grain imported and used over the season through the milking shed.
- 55 T DM of Molasses imported and fed through the shed.
- 106 T DM of Palm Kernel Expeller (PKE); fed across pastoral areas for dairy cows (25 % over Sept/Oct and Jan/Feb)

Supplementary feed made and fed during the season is as follows;

- Approximately 290 T DM of grass baleage; made the support blocks and fed evenly across pastoral blocks to dairy cows.

Farm System - Dairy			
Herd Type/Breed	Fr X J	**Total Milk Solids (kg/year)**	260,000
Seasonal Supply	Seasonal	**Winter milk**	No
Number of cows	600	**Milk Solids (kg/cow)**	433
Stocking rate (cows/ha)	3.7 (3.9/ha grazed)*	**Milk Solids (kg/ha)**	1604/ha (1713/ ha grazed)*
Other information			
Winter off milking platform		Yes, 100 lighter cows and heifers on support block	
Stock grazed off (%)		57 % (including first calvers) in June and July, returning August	
Young stock reared off milking platform		Yes from weaning until before calving on support area	
Imported Feeds	60 T DM Barley grain, fed through shed to milking cows, 55 T DM of Molasses to dairy cows through shed; 106 T DM of PKE fed evenly on pastoral areas to dairy cows. Total 221 T DM		

		Proposed			
Cows	Av weight kg LW	430 kg LW			
	Median calving Date	24th August for Herd			
	Dry-Off date	31st May			
	Peak Milk (1 Dec)	600 cows			
	Cow Numbers		**No cows Dairy Herd**	**Dry cows & Heifers**	**In shed feeding (Y/N)**
		Jul	0	100 & 160 & 160	N
		Aug	395	50 & 160	Y
		Sept	600	160	Y
		Oct	600	160	Y
		Nov	600	160	Y
		Dec	600	160 & 160	Y
		Jan	600	160 & 160	Y
		Feb	600	160 & 160	Y
		Mar	580	160 & 160	Y
		Apr	550	160 & 160	Y
		May	500	160 & 160	Y
		Jun	0	100 & 160 & 160	N
	Production kg/MS	260,000			
	Lactation length	280 days used			
	Once a day Milking (e.g half season, dry off, never)	Never			
	Calves fed milk powder (Y/N)	No			
Supplements Imported		**Amount(T/DM)**	**Fed (e.g. paddock, shed, trough, crop)**		
	Barley grain and Molasses	60 & 55	Fed to dairy milking cows through shed		
	Other PKE	106	Fed to dairy cows on pastoral blocks		
Supplements Made		**Amount (T/DM)**	**Ha**	**Fed or stored?**	
	Baleage	290	@ 3.6 & 3.8 T DM/ha	Made and fed out evenly across dairy milking cow pastoral blocks	
	Swedes	13	20	Fed to replacements and dry cows in June July and milking cows over August	
Effluent	Type/system	Holding Pond system after weeping walls and applied via K Line pods			
	Application Depth mm	Application depth at < 10 mm per application (modelled < 12 mm) from August to May (stir and spray regularly			
Replacements	On/off farm when & what age	On support block from weaning, back as First calvers in August			

* Calculated on milking platform area only excluding the support area.

Fertiliser

Fertiliser applications have been modelled from Ravensdown sales records and farmer information, and are based on average monthly rates. Ammo 31 is applied to the whole farm in August at rates of 100 kg/ha. Urea is then applied in October, December, February and March behind the cows at rates of 45 kg/ha. Records point to 4 applications of Nitrogen over the season. Both effluent and non-effluent blocks receive the same nitrogen and also the same maintenance application of 100 kg/ha of Cropmaster DAP and 30kg/ha Sulphur 90 in November as well as 100 kg/ha of Cropmaster 13 in February plus potassium chloride in December at 80 kg/ha in December. In April Urea is applied in liquid form with Express a gibberellic acid The total fertiliser nitrogen applied is 161 kg N/ha/year for farm blocks and 149 kg N/ha across all blocks (whole property) on average.

Non Effluent and Effluent blocks:

Month	Fertiliser	NPKS nutrient rating (kg/ha)
August	Ammo 31	31-0-0-14
October	Urea	21-0-0-0
November	Crop DAP & Sulphur 90	18-20-0-28
December	Urea	21-0-0-0
February	Urea	21-0-0-0
February	Crop 13	12-14-15-1
March	Urea	21-0-0-0
April	Urea	18-0-0-0
December	Potassium Chloride	0-0-40-0

Soil Test Results

Taken from 2015 and 2016 soil tests for the various areas in table below;

Soil tests	Olsen P	QTK	QT Ca	QT Mg	QT Na	Org S
Non Effluent blocks	30	10	13	33	11	16
Effluent blocks	36	10	13	33	11	16
Support Block	20	10	13	31	11	16

Pasture Production

The predominant pasture species on the dairy farm is ryegrass/white clover. Annual pasture production has been weighted by relative productivity as no differences between blocks:

Block	Relative productivity	T DM/ha/year
Dairy pastoral areas	No differences	15.3 to 15.8

It should be noted that this estimated pasture production is based on default South Island pasture ME values and may be different to actual ME values and utilisation values on this farm which in turn would influence estimated pasture production.

Structures

There are no structures on the property, with swedes used as the stand-off paddock over the August period.

Fodder Cropping

A fodder cropping cycle of Pasture to Swedes before being re sown into pasture in October is practiced for approximately 20 ha or 20 % of the support platform. Crops are modelled as Fodder crops and information entered is;

- Swedes are sown in December after direct drilling, 20 ha in total, with dry cows and replacements grazed over June and July, however in August it is grazed by dairy cows before calving.
- Sown with Cropmaster DAP plus boron at 250 kg/ha, NPKS rating (41-47-0-2) and one further application of Urea made at 100 kg/ha in February.
- Yields are averaged at 13 T DM/ha.

Effluent

Effluent has been modelled as using Overseer default values, and calculated as applying 32 kg N/ha/year (liquid) over the 112 ha (120 ha total area less riparian and non-effective areas calculated to 112 ha) effluent area, plus 10 kg N/ha/year (solids) applied as well from pond sludge and weeping wall pond solids. The non-effluent blocks that receive pond sludge and solids only have the 10 kg N/ha/year applied. Currently, the effluent system has effluent gravity fed into a stone trap and sump then into a weeping wall followed by a holding pond, from which the effluent is pumped through K Line pods applying liquids at depths of 10 mm per application or less (modelled < 12 mm). The current holding pond is estimated to hold 7 to 14 days of effluent (owner stated). Liquid effluent is sprayed during the months of August to May inclusive (modelled stir and spray). Sludge from the pond is modelled to be spread on all areas in January every 5 years by a muck spreader, given there has been little need to de sludge the pond; with all solids (separated solids from weeping wall pond) has been modelled to be spread over effluent and non-effluent blocks in December.

Management Unit details and Soil Information: Table 1

Block Name	Stock	Block Type	Soil Order	Drainage Class	Effluent	PAW (0-60cm)	Effective Area (ha)
Brax_4a.1 Non Eff	Dairy	Pastoral	Orthic Gley	Poorly drained	Pond Sludge and solid	147	39.7
Brax_4a.1 Effluent	Dairy	Pastoral	Orthic Gley	Poorly drained	Liquid and pond sludge and solid	147	112.0
Brax_4a.1 Support*	Dairy	Pastoral	Orthic Gley	Poorly drained	Pond Sludge and solid	147	83.9
Glene_4a.1 Support*	Dairy	Pastoral	Firm Brown	Well drained	Pond Sludge and solid	78	13.2
Riparian	Dairy	Pastoral	Orthic Gley	Poorly drained			2.4
Trees and Scrub	Dairy	Crop	Orthic Gley	Poorly drained			1.0
Swedes	Dairy	Fodder Crop	Various	Various			(20)
Non-Productive area							7.0
Total							259.2

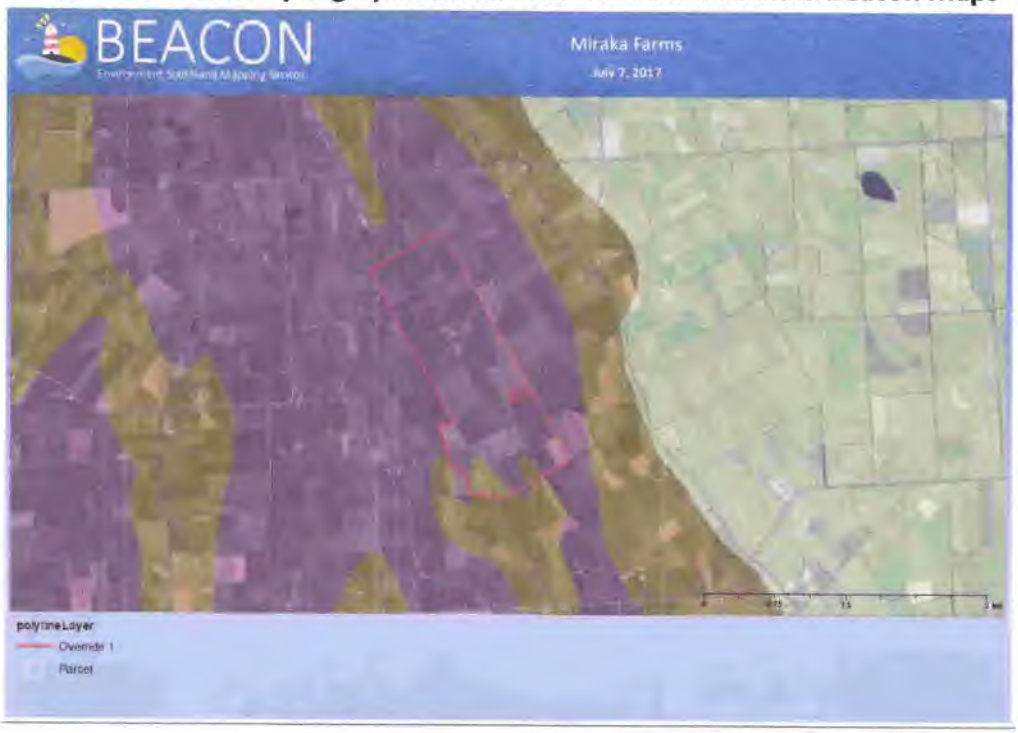
* Fodder crop rotates through these blocks; PAW Overseer calculated

Land Management Unit Map and Farm Map

Farm map with Effluent block outlined, 123.6 ha in total less riparian areas and non-productive areas,. Plus areas around houses, estimated pastoral area of 112 ha.

Title area and soils, however part title is leased and the rest is not under lease or title, this area calculated to be 62.97 or 63 ha, leaving 57 ha leased. (53 ha stated by owner)

Nitrate Levels and Physiographic Zonal Environment Southland Beacon Maps



Physiographic zones are brown oxidising and gley soils, with the blue line denotes the three different stream catchments of Terrace, Middle and Oreti River, all which contribute to the Oreti catchment. Green, Yellow and Red shades depict minor to moderate (green) and moderate to high (orange) and at drinking water threshold (red) nitrate levels.

Regional Council Nutrient Management Regulations-

Environment Southland (Regional Council) has specified the following rules and policies.

Effluent(c) The discharge of farm dairy effluent to land, lawfully being undertaken up to and including 17 July 2010, in any of the following situations is a restricted discretionary activity:
(i) high rate irrigation to soil/landscape categories A, B, D and E as identified on Map 1 of Appendix N http://www.es.govt.nz/media/16996/water_classification_maps.pdfor determined by farm-scale soils mapping undertaken by a suitably qualified person; or
(ii) low rate irrigation to soil/landscape category C as identified on Map 1 of Appendix N or determined by farm-scale soils mapping undertaken by a suitably qualified person; or
(iii) where the discharge falls within the situations listed in Rule 50(b) but cannot meet the conditions contained in Rule (50)(b).
The Council will restrict the exercise of its control to the following matters:
(a) application depth and rate, storage requirements, nitrogen loading and contingency plans;
(b) the separation distance of the discharge from surface water bodies, artificial watercourses, subsurface drains, the coastal marine area, residential dwellings, places of assembly, urban areas, property boundaries, water abstraction points and registered drinking-water supplies;
(c) inspection and audit requirements;
(d) water quality monitoring directly relating to the possible effects of the authorised discharge. *(NB: This does not include general state of the environment water quality monitoring.)*
~~**Effluent: (d) The discharge of farm dairy effluent to land, that was not being lawfully undertaken as at 17 July 2010 (including an increase in the scale of an activity) in any of the following situations is a restricted discretionary activity:**~~
~~(i) low rate irrigation to soil/landscape categories A and B, and D and E as identified on Map 1 of Appendix N or determined by farm-scale soils mapping undertaken by a suitably qualified person; or~~
~~(ii) low or high rate irrigation by slurry tanker to soil/landscape categories A, B, D and E as identified on Map 1 of Appendix N http://www.es.govt.nz/media/16996/water_classification_maps.pdf, or determined by farm-scale soils mapping undertaken by a suitably qualified person, does not exceed 5 mm in depth. provided the following conditions are met:~~
~~1. the discharge is not within 20 metres of any surface water body, artificial watercourse or the coastal marine area;~~
~~2. the discharge is not within 200 metres of any place of assembly or dwelling not on the same property, or 20 metres of the boundary of any other property; and~~
~~3. the discharge is not within 100 metres of any water abstraction point.~~
~~The Council will restrict the exercise of its discretion to the following matters:~~
~~(a) Application depth and rate, storage requirements, nutrient loading (in particular nitrogen) and contingency plans.~~
~~(b) The separation distance (beyond that required under conditions 1, 2 and 3 above) of the discharge from surface water bodies, artificial watercourses, subsurface drains, the coastal marine area, residential dwellings, places of assembly, urban areas, property boundaries, water abstraction points and registered drinking water supplies.~~
~~(c) Other measures to avoid, remedy or mitigate adverse effects (including cumulative effects directly related to the discharge of farm dairy effluent) on water quality taking into account the nature and sensitivity of the receiving environment.~~
~~(g) Where the discharge of farm dairy effluent is to a mix of the soil/landscape categories identified on Map 1 of Appendix N, the status of the activity under Rules 50(a) to (e) will be determined by the soil/landscape category that has the highest consent test.~~
~~(h) Where the discharge of farm dairy effluent to land will occur using both high rate and low rate irrigation, the status of the activity under Rules 50(a) to (d) will be based on the low rate irrigation.~~
~~(i) An application for resource consent under clause (c) or (d) does not need to be notified and does not need to be served on persons who may be adversely affected by the activity unless the applicant requests notification or the Council considers special circumstances exist that warrant notification of the application~~
Fertiliser: The discharge of fertiliser onto or into land is a permitted activity, providing it is not directly discharged into surface water, water bodies or ground water and is applied at levels which ensure minimal leaching of nutrients to ground water. The practice of application needs to ensure all practicable steps are taken to minimise fertiliser drift beyond target area and run off to surface water.

Nutrient related resource Consents held by the Landowner

Resource Consent No.	Condition No.	Condition Text	Resource consent expiry date
		Not discussed	

Proposed Farm System Analysis

Description of Proposed Farm System

The farm dairy platform will be increased to the entire property including the leased area and the effluent area will also be extended to 219 ha. There will no longer be a support block, with most cows wintered off the platform, except the 100 lighter cows, as well as the dairy heifers. There will still be 20 ha of swedes grown, but rotating through the entire property.

The 259.2 ha property will be operated as a dryland dairy farm, calving 750 cows and peak milking 750 (430 kg LW) smaller crossbred cows. Milk production aimed for is 322,000 kg MS/year (430 kg MS/cow). Cow numbers are shown in the table below. Most cows are wintered off-farm for June and July with a small number of lighter cows remaining (100) plus the first calving heifers, with all cows brought back in mobs over the month of August. Mean calving date is still the 24th August.

The dry-off date is the 31st of May for the cows and first calving heifers. All replacements (170) are grazed off-the platform until they return as in calf R2 heifers in May to be wintered. Cows are never milked once a day over drying off (modelled never) and all calves are fed colostrum and waste milk.

Mob name	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June
Dairy cows		465	750	750	750	750	750	725	725	685	625	
Dairy grazers (milking cows)	100	50										100
Dairy grazers (replacements)	170										170	170

Supplements

Supplementary feed imported onto the property and to be fed during the season is as follows:

- 75 T DM Barley grain imported and used over the season through the milking shed.
- 70 T DM of Molasses imported and fed through the shed.
- 130 T DM of Palm Kernel Expeller (PKE); fed across pastoral areas for dairy cows

- 130 T DM of baleage is imported and fed out to dairy cows on blocks mostly (110 T DM) with 20 T DM to crops

Supplementary feed made and fed during the season on farm is now not included as to reconcile the pastoral productivity, baleage was imported at 130 T DM, indicating that without any means of increasing pastoral productivity on farm, there is reduced opportunity to make supplementary feed on farm on average, in comparison to the current system.

Fodder Cropping

A fodder cropping cycle of Pasture to Swedes before being re sown into pasture in October is still practiced for approximately 20 ha or 8 % of the dairy farm. Crops are modelled as Fodder crops and information entered is still the same, however the crops have been broken into two 10 ha blocks, one is grazed by cows and heifers over the June to July period while one is grazed by milking cows over the August September period.

Effluent

Effluent has been modelled as using Overseer default values, and calculated as applying 14 to 16 kg N/ha/year (liquid) over the proposed 219 ha effluent area (201 ha less fodder crop area), plus 31 kg N/ha/year (solids) applied as well from pond sludge and weeping wall pond solids. The non-effluent blocks that receive pond sludge and solids only have the 31 kg N/ha/year applied. The effluent system is largely the same, however the proposed holding pond is estimated to hold 90 days of effluent (owner stated). Liquid effluent is sprayed during the months of September to May inclusive (modelled spray infrequently). Sludge from the pond is modelled to be spread on all areas in January every 5 years by a muck spreader, given there has been little need to de sludge the pond; with all solids (separated solids from weeping wall pond) has been modelled to be spread over effluent and non-effluent blocks in December.

Pasture Production

The predominant pasture species on the dairy farm is ryegrass/white clover. Annual pasture production has been weighted by relative productivity as no differences between blocks:

Block	Relative productivity	T DM/ha/year
Dairy pastoral areas	No differences	15.8

It should be noted that this estimated pasture production is based on default South Island pasture ME values and may be different to actual ME values and utilisation values on this farm which in turn would influence estimated pasture production.

All other factors have remained the same.

Summary of Current and Proposed Farm System Scenario: Table 2

	Current scenario	Proposed scenario
System Type	Seasonal dairy supply and support block	Seasonal dairy supply
Total Area (ha)	259.2	259.2
Effluent area (ha)	112 ha receiving liquids from dairy shed with this area plus 39.7 ha non effluent and 97.1 ha support block having pond sludge from the holding pond and weeping wall solids applied as well.	219 ha receiving liquids and pond sludge plus weeping wall solids, with the remaining non effluent areas receiving sludge and solids
Stocking rate (s.u/ha)	6142 s.u* or 24.7 s.u/ha effective or 3.9 cows/ha platform (3.7 cows/ha total)	6637 s.u or 26.7 s.u/ha effective or 3.0 cows/ha platform (2.9 cows/ha total)
N use (kg N/ha/year)	149 across the whole farm	149 across the whole farm
Production (kg MS/ha grazed)	1714/ha effective platform (1045/ha total grazed)	1295/ha effective platform
Supplements Imported (kg DM/ha/year)	221 T DM in total or 1456 effective platform. Note also 290 T DM baleage is made on support blocks and fed out on dairy pastoral blocks and 10 ha of swedes is fed over June and July with dry cows and heifers and dairy cows graze crop in August.	405 T DM in total or 1628 effective platform.
Wintering system	Off farm mostly, with 100 dairy cows and heifers wintered on support block	Off farm mainly, with 100 dairy cows plus replacements wintered on.
Pasture production(kg DM/ha/year) - Platform Pastures - Support paddocks	 15804** 15335	 15752** 15752

*As calculated by OVERSEER and including and dry cows**As calculated by OVERSEER with standard default and ME values likely to be lower than Southland values.

Summary of Current Whole Farm Nutrient Loss Indicators: Table 3

	Current scenario	Proposed scenario
Nitrogen leaching loss to water (Total kg N) Dairy platform* Support block	5493 2147 3347	5,392
Nitrogen leaching loss to water (kg N/ha) Dairy platform Support block	21 14 34	21
Phosphorus runoff to water (Total kg P) Dairy platform Support block	180 148 32	195
Phosphorus runoff to water (kg P/ha) Dairy platform Support block	0.7 1.0 0.3	0.8

* Losses split pro rata with riparian, trees and other losses

Discussion on Whole Farm Nutrient Loss Indicators

From the information provided by Miraka Farms, farm records, and the assumptions listed above, the N loss from the root zone and P loss to second order streams for the farm system is outlined below.

Current Farm System

- The N loss from the root zone from the farm system modelled was calculated using OVERSEER® (v6.2.3) to be **21 kg N/ha/year or 5,493 kg N/year.**
- The P loss risk from the farm system modelled was calculated using OVERSEER® (v6.2.3) to be **0.7 kg P/ha/year or 180 kg P/year.**

Proposed Farm System

- The N loss from the root zone from the farm system modelled was calculated using OVERSEER® (v6.2.3) to be **21 kg N/ha/year or 5,392 kg N/year.**
- The P loss risk from the farm system modelled was calculated using OVERSEER® (v6.2.3) to be **0.8 kg P/ha/year or 195 kg P/year.**

Key factors influencing Nutrient Loss include:

- Soil type and Profile Available Water (PAW) plus drainage.

  The soil type has a large impact on N leached. The soils on the property are mainly poorly drained silt loams over clay. Plant Available Water (PAW) values would be considered 'moderate to high' ranging between 78 mm and 147 mm (0-60cm), with the main soil type being 147 mm. The Plant Available Water is described as "the amount of water potentially available to plant growth that can be stored in the soil to specific soil depths". It therefore makes sense that the soils with high PAW will have lower N leaching as there will be less drainage from these soils. Soils with lower PAW are less able to buffer against changes in nitrogen losses to the bottom of the root zone (from stocking rates, crop yields, irrigation volumes) as the soils have larger pores and are flushed frequently as compared to a poorer draining soil with a higher PAW (see N report in Appendix where the Glenelg soils lose 74 kg N/ha/year compared to the Braxton soils, losing 21 kg N/ha/year respectively on the Support pastoral blocks under the current system).

  These heavier soils are often tile drained (artificially drained, but not so here) to remove water from the profile and enable higher productivity. The risk is that these drains also provide a conduit to nutrient flows and effluent discharges direct to water ways. Ensuring the nutrients are captured by plant growth and minimising effluent applications when soil PAW are near capacity will reduce this.

- Pastoral productivity

  The higher the pastoral productivity from dairy land and the associated higher stocking, the higher the risk of N losses on dairy farms, especially under the climatic, rainfall and evapotranspiration rates for Southland. The current system has a high production per ha (1714 kg MS/ha) at a high stocking rate of 3.9 cows/ha platform grazed; (cf. to 2.73 cows/ha & 1056 kg MS/ha, NZ Southland Dairy statistics 2015-16) with a moderate amount (1456 kg DM/ha) of supplement imported (but not including the supplement from the support block), which supports the stocking and consequently the pasture production required at 15804 kg DM/ha/year as seen in table 2, page 18. This leads to the high amount of urine deposition on pastures from the resulting cow intakes, resulting in increased risk from N leaching. The results point to a reduced influence from urinary deposition in the proposal, with the amount of N loss attributed to urine decreasing as a percentage from 57 % to 52 %, the rest due to N losses from cropping and effluent applications (other sources)

- Cropping

  The crop blocks for the current system contribute 1197 kg N/ha or 60 kg N/ha/year on average (21.8 % of total N losses and yet accounts for 7.7 % of the total land area). (Figures as in Block Nitrogen reports, pages 24 & 27). It is the higher concentration of stock in a smaller area and thus the greater urine deposition which leads to this increased risk of losses. This is also exacerbated by these crops being grazed at a time when drainage events are most likely to occur. The losses are similar between the current and proposed scenarios.

The non-productive areas offset these N losses to an extent.

The other environmental risk indices are the current P losses to surface water at 0.7 kg P/ha/year as seen in the Phosphate reports pages 23 & 26, which are low risk in their impact. The P risk is mostly influenced by losses from other sources (95 kg or 52.8 % of total of 180 kg, refer Phosphorous block reports, pages 23 & 26) which is run off from tracks and yards into drains and ditches from the farm. Riparian strip planting and vegetation buffer zones for crops and lane ways can reduce this and have been implemented on this farm. Olsen P levels are within or below the optimum agronomic ranges, and the topography where the majority of the fertiliser is applied is flat, which also helps to minimise P losses. The new Effluent storage plus the low volume applications will help to mitigate this risk also. The proposed P losses are only 15 kg P/year higher and due entirely to the increase in other losses, mitigated by the above.

The current scenario is rated 10.0, the upper side of category 1 under the Soil versatility rating system (Landcare Research, 2002), as calculated in the table 4 below (page 20). The farm already uses a number of effective

Nitrogen mitigation strategies to minimise losses for the proposal culminating in the results above. As modelled, the farm uses and/or has;

- All water ways are fenced and adequate Riparian strips in place.
- The proposed effluent system is a holding pond, with adequate storage. The area is more than adequate when compared to effluent nutrients supplied, with 69 ha required for the standard effluent application of 150 kg/ha for this number of cows including solids, compared to the current 211 ha liquid plus sludge and pond solids and the rest of the farm area made available to spread pond sludge and solids (Effluent reports pages 25 & 28.).
- The farm proposes to winter most cows off farm and the replacements are grazed off farm, until coming home for their second winter. In comparing this to the current state, the winter stocking is reduced, with a slight increase in overall annual stocking rate, but a reduced milking cow stocking on the platform over the lactation. The farm uses a crop as a stand-off area when it is wet over late winter early spring. The soil type being Braxton is relatively forgiving to nutrient losses, and so this does help in minimising losses to a small area and the overall effect would be reduced treading and pugging damage. Further use of deferred grazing over the autumn period would help further in lowering N losses.

Soil Vulnerability Land Management Rating: Table 4

Soil Type/Farm blocks	Soil Vulnerability	Vulnerability rating	% Farm	Rating score
Braxt_4a.1	Moderate	10	94.9	9.49
Glene_4a.1	Moderate	10	5.1	0.51
Total			**100.0**	**10.0**

The property is situated in the Terrace and Middle creek and Oreti River sub catchments, and the Oreti catchment of the proposed Environment Southland Regional Water and Land Plan. It is 94.9 % on a gley soil physiographic zone, and 5.1 % on an oxidising physiographic zone, with no variants in overland flow (see map, page 14 and table above), meaning the farm must attach significance to both zones in its environmental management. The farm is within zones having influence in the high nitrate levels in ground water. Water quality is characterised by lowland hard bed, with either quaternary gravel or Waimatuku groundwater management zones, sub surfaces. Implications of this information are unknown at present but some catchment areas will be required to reduce their impacts. The zonal information would point to the presence of nitrate leaching; and nitrogen accumulation as key risk factors for the zone. With the key risk factors for the gley soils being overland flow and losses of nitrogen through tiles if any and not the case here, however this is being mitigated by the use of increased

effluent storage and low volume applications, with a reduction in winter stocking. Further targeting of deferred grazing over at risk times would help further mitigate these risks. No effluent applications to the highest risk soil during the highest risk periods would be helpful. This and the created Riparian strips and wetlands would be the activities which would be required to mitigate any overland flows.

Please see information contained in the Appendices for detail relating to nutrient budgets, nitrogen block reports, phosphorus block reports and estimated pasture production for the current situation and scenario modelled.

OVERSEER v6.2.3 onwards has a new irrigation module to better reflect the management practices of irrigators. The Best Practice Data Input Standards give some guidance on what is now required. The model requires more information from users about their irrigation system and how water application decisions are made on farm. The extra data needed includes depth of water per application; return time and depending on how soil water is monitored what are the trigger points and targets (mm deficit). Ideally, this data needs to be actual long term average data as OVERSEER uses 30 year average climate data. Best estimates of these data will generally generate more drainage, and hence N loss to water, than has been the case with previous OVERSEER versions.

OVERSEER is a continually developing model with several aspects currently being investigated. In particular there are on-going issues in relation to the modelled nitrogen leaching from grazed crop blocks (and possibly forage blocks also) being less than expected. (Please see www.overseer.org.nz/OVERSEERModel/bugs.aspx for more detail).

When future versions of OVERSEER are stipulated for use associated with Regional Council rules both the current and the proposed farm systems will need to be re-modelled for consistency as the base N lost from the root zone may alter with updated OVERSEER versions.

Appendices

Current farm System Whole Farm Nutrient Budget

Nutrient Budget OVERSEER

	N	P	K	S	Ca	Mg	Na
	(kg/ha/yr)						
Nutrients added in							
Fertiliser, lime & other	149	34	49	38	0	0	1
Rain/clover N fixation	128	0	2	4	1	4	17
Irrigation	0	0	0	0	0	0	0
Supplements imported	16	3	14	3	2	2	1
Nutrients removed							
As products	76	14	17	5	19	2	5
Exported effluent	0	0	0	0	0	0	0
As Supplements	0	0	0	0	0	0	0
To atmosphere	134	0	0	0	0	0	0
To water	21	0.7	17	57	63	3	12
Change in internal pools							
Plant material	-7	-1	-9	1	-1	-1	0
Organic pool	58	12	4	-18	1	0	0
Inorganic mineral	0	3	-15	0	-3	-4	-5
Inorganic soil pool	10	8	51	0	-75	6	7

Current Farm System Nutrient Loss Indicators

P report

Block P

Block Phosphorus OVERSEER

Block name	Total P (kg P/yr)	P lost (kg P/ha/yr)	P loss categories		
			Soil	Fertiliser	Effluent
Brax_4a.1 Non Eff	12	0.3	Low	Low	Low
Brax_4a.1 Effluent	41	0.4	Low	Low	Low
Brax_4a.1 Support ##	16	0.2	Low	Low	Low
Glene_4a.1 Support ##	1	0.1	Low	Low	Low
Riparian 1	0	0.1	N/A	N/A	N/A
Trees and Scrub 1	0	0.1	N/A	N/A	N/A
Swedes	15	0.7	N/A	N/A	N/A
Other Sources	95				
Whole farm	180	0.7			

Has a fodder crop rotating though, results for pastoral block component only

N report

Farm N

Farm Nitrogen

OVERSEER

	Units	Benchmark farm	Current farm
Inputs (farm average)			
Clover N	kg N/ha/yr		126
Fertiliser N	kg N/ha/yr		149
Other N added	kg N/ha/yr		18
Indices			
Average N loss to water includes N lost as effluent	kg N/ha/yr	24-42	21
N2O emissions	kg N/ha/yr		79.5
For pastoral area of farm:			
Farm N surplus	kg N/ha/yr	123-191	216
N conversion efficiency	%	27-35	26

Block N

Block Nitrogen

OVERSEER

Block name	Total N lost (kg N/yr)	N lost to water (kg N/ha/yr)	N in drainage * (ppm)	N surplus (kg N/ha/yr)	Added N ** (kg N/ha/yr)
Brax_4a.1 Non Eff	458	12	3.5	217	171
Brax_4a.1 Effluent	1374	12	3.7	238	203
Brax_4a.1 Support ##	1377	21	6.3	181	171
Glene_4a.1 Support	773	74	18.4	189	171
Riparian 1	7	3	NaN	0	0
Trees and Scrub 1	2	1	NaN	0	0
Swedes	1197	60	14.9	55	87
Other farm sources	306				
Whole farm	5493	21			
Less N removed in wetland	0				
Farm output	5493	21			

* Estimated N concentration in drainage water at the bottom of the root zone. Maximum recommeded level for drinking water is 11.3 ppm (note that this is not an environmental water quality standard).

** Sum of fertiliser and external factory effluent inputs.

N/A: N in drainage not calculated for easy and steep pastoral blocks, or for tree and shrubs, riparian, wetland or house blocks.

* Estimated N concentration in drainage water at the bottom of the root zone. Maximum recommeded level for drinking water is 11.3 ppm (note that this is not an environmental water quality standard).

** Sum of fertiliser and external factory effluent inputs.

N/A: N in drainage not calculated for easy and steep pastoral blocks, or for tree and shrubs, riparian, wetland or house blocks.

Current System Pasture Production, Other Values and Effluent Report

Block Pasture

OVERSEER

Block name	On-farm fresh pasture intake (kg DM/ha/yr)	Estimated utilisation (%)	Supplements removed (kg DM/ha/yr)	Pasture growth (kg DM/ha/yr)
Brax_4a.1 Non Eff	13434	85	0	15804
Brax_4a.1 Effluent	13434	85	0	15804
Brax_4a.1 Support	8627	75	3784	15332
Glene_4a.1 Support	8751	75	3619	15335
Riparian 1	0	0	0	0
Trees and Scrub 1	0	0	0	0
Swedes	2360	75	0	3159

This report gives an estimated animal intake for each block based on animal production and supplements brought on to farm information supplied. Estimated annual pasture growth is shown for the animal utilisation value shown. Note: the model is not sensitive to changes in utilisation.

It is recommended that a consultant or software such StockPol is used to estimate farm pasture production.

Other values for farm - Ovr-Ovr-Miraka

OVERSEER

Milking herd size (peak cows/ha grazed)	2.4
Milk solids (kg/ha grazed)	1045
Milk production per cow (kg milk solids /	433.3
Default calving data	06 August
Total liveweight brought (kg/ha grazed)	70
Total liveweight reared (kg/ha grazed)	170
Total liveweight sold (kg/ha grazed)	562
No fertiliser costs entered	
GHG: Allocation to milk	0.84
Dairy stock rate (RSU)	5212
Dairy replacements stock rate (RSU)	851
Beef / dairy grazing stock rate (RSU)	79

Effluent Report

OVERSEER

Based on pastoral farm area only	Units	Current farm	
Current area receiving liquid effluent			
Total area including crops	ha	112	
Pastoral area receiving liquid	ha	112	
% of farm pastoral area	%	49	
Average liquid effluent	kg N/ha/yr	32.0	
Average fertiliser N	kg N/ha/yr	161.0	
Average other N inputs	kg N/ha/yr	10.0	
Area of farm to apply all effluent to achieve rate:			
150 kg N/ha/yr	ha	89.0	#
Maintenance K	ha	215	
100 kg K/ha/yr	ha	64.0	
Source of N in effluent block(s)			
Effluent from farm dairy	%	100	
Effluent from feed pad	%	0	
Effluent from wintering pad	%	0	
Effluent from standoff	%	0	

based on the total of liquid and solid effluents generated on farm and imported effluents applied.

The report shows rates and target areas for farm liquid effluent only, assuming it is all applied to pastoral blocks. It excludes any farm solid effluent or imported effluent that may be added to effluent blocks. If this occurs, then target areas may need to be increased.

Current System Parameter Report

Presented as a separate document.

Proposed farm System Whole Farm Nutrient Budget

Nutrient Budget

OVERSEER

	N	P	K	S	Ca	Mg	Na
				(kg/ha/yr)			
Nutrients added in							
Fertiliser, lime & other	149	34	49	38	0	0	1
Rain/clover N fixation	130	0	2	4	2	4	17
Irrigation	0	0	0	0	0	0	0
Supplements imported	26	5	26	5	5	4	2
Nutrients removed							
As products	89	15	21	5	21	2	6
Exported effluent	0	0	0	0	0	0	0
As Supplements	0	0	0	0	0	0	0
To atmosphere	150	0	0	0	0	0	0
To water	21	0.8	18	62	69	3	12
Change in internal pools							
Plant material	-6	0	-9	1	0	-1	0
Organic pool	41	11	-8	-21	-1	-1	-1
Inorganic mineral	0	3	-10	0	-3	-4	-5
Inorganic soil pool	11	9	64	0	-72	8	7

Proposed Farm System Nutrient Loss Indicators

P report

Block P

Block Phosphorus

OVERSEER

Block name	Total P (kg P/yr)	P lost (kg P/ha/yr)	P loss categories		
			Soil	Fertiliser	Effluent
Brax_4a.1 Non Eff ##	3	0.3	Low	Low	Low
Brax_4a.1 Effluent ##	47	0.4	Low	Low	Low
Brax_4a.1 Non Eff S ##	3	0.2	Low	Low	Low
Glene_4a.1 Non Eff S ##	0	0.1	Low	Low	Low
Riparian 1	0	0.1	N/A	N/A	N/A
Trees and Scrub 1	0	0.1	N/A	N/A	N/A
Swedes	7	0.7	N/A	N/A	N/A
Brax_4a.1 Eff S ##	15	0.2	Low	Low	Low
Glene_4a.1 Eff S ##	1	0.1	Low	Low	Low
Swedes 2	7	0.7	N/A	N/A	N/A
Other Sources	110				
Whole farm	195	0.8			

Has a fodder crop rotating though, results for pastoral block component only

N report

Farm N

Farm Nitrogen

OVERSEER

	Units	Benchmark farm	Current farm
Inputs (farm average)			
Clover N	kg N/ha/yr		128
Fertiliser N	kg N/ha/yr		149
Other N added	kg N/ha/yr		28
Indices			
Average N loss to water includes N lost as effluent	kg N/ha/yr	24-42	21
N2O emissions	kg N/ha/yr		85
For pastoral area of farm:			
Farm N surplus	kg N/ha/yr	128-191	217
N conversion efficiency	%	27-35	29

Block N

Block Nitrogen

OVERSEER

Block name	Total N lost (kg N/yr)	N lost to water (kg N/ha/yr)	N in drainage * (ppm)	N surplus (kg N/ha/yr)	Added N ** (kg N/ha/yr)
Brax_4a.1 Non Eff ##	128	14	4.2	226	192
Brax_4a.1 Effluent	1848	14	4.3	237	208
Brax_4a.1 Non Eff S	199	14	4.1	223	192
Glene_4a.1 Non Eff S	212	62	15.7	213	192
Riparian 1	7	3	NaN	0	0
Trees and Scrub 1	2	2	NaN	0	0
Swedes	693	69	17.1	-55	87
Brax_4a.1 Eff S	869	14	4.2	234	208
Glene_4a.1 Eff S	558	64	16.1	224	208
Swedes 2	508	51	13	-15	87
Other farm sources	366				
Whole farm	5392	21			
Less N removed in wetland	0				
Farm output	5392	21			

* Estimated N concentration in drainage water at the bottom of the root zone. Maximum recommeded level for drinking water is 11.3 ppm (note that this is not an environmental water quality standard).

** Sum of fertiliser and external factory effluent inputs.

N/A: N in drainage not calculated for easy and steep pastoral blocks, or for tree and shrubs, riparian, wetland or house blocks.

Proposed System Pasture Production, Other Values and Effluent Report

Block Pasture

OVERSEER

Block name	On-farm fresh pasture intake (kg DM/ha/yr)	Estimated utilisation (%)	Supplements removed (kg DM/ha/yr)	Pasture growth (kg DM/ha/yr)
Brav_4a.1 Non Eff	13309	85	0	15752
Brav_4a.1 Effluent	13309	85	0	15752
Brav_4a.1 Non Eff 5	13153	84	0	15752
Glene_4a.1 Non Eff 5	13153	84	0	15752
Riparian 1	0	0	0	0
Trees and Scrub 1	0	0	0	0
Swedes	2734	84	0	3239
Brav_4a.1 Eff 5	13153	84	0	15752
Glene_4a.1 Eff 5	13153	84	0	15752
Swedes 2	2734	84	0	3239

This report gives an estimated animal intake for each block based on animal production and supplements brought on to farm information supplied. Estimated annual pasture growth is shown for the animal utilisation value shown. Note: the model is not sensitive to changes in utilisation

It is recommended that a consultant or software such StockPol is used to estimate farm pasture production

Other values for farm - Ovr-Ovr-Miraka

OVERSEER

Milking herd size (peak cows/ha grazed)	3.0
Milk solids (kg/ha grazed)	1295
Milk production per cow (kg milk solids /	429.3
Default calving data	06 August
Total liveweight brought (kg/ha grazed)	771
Total liveweight reared (kg/ha grazed)	54
Total liveweight sold (kg/ha grazed)	982
No fertiliser costs entered	
GHG: Allocation to milk	0.90
Dairy stock rate (RSU)	6406
Dairy replacements stock rate (RSU)	0
Beef / dairy grazing stock rate (RSU)	229

Effluent Report

OVERSEER

Based on pastoral farm area only	Units	Current farm	
Current area receiving liquid effluent			
Total area including crops	ha	201	
Pastoral area receiving liquid	ha	201	
% of farm pastoral area	%	88	
Average liquid effluent	kg N/ha/yr	16.0	
Average fertiliser N	kg N/ha/yr	161.0	
Average other N inputs	kg N/ha/yr	51.0	
Area of farm to apply all effluent to achieve rate:			
150 kg N/ha/yr	ha	69.0	#
Maintenance K	ha	3010	
100 kg K/ha/yr	ha	105.0	
Source of N in effluent block(s)			
Effluent from farm dairy	%	100	
Effluent from feed pad	%	0	
Effluent from wintering pad	%	0	
Effluent from standoff	%	0	

based on the total of liquid and solid effluents generated on farm and imported effluents applied.

* Average K maintenance rates were less than 20 kg K/ha/yr - use with caution.

The report shows rates and target areas for farm liquid effluent only, assuming it is all applied to pastoral blocks. It excludes any farm solid effluent or imported effluent that may be added to effluent blocks. If this occurs, then target areas may need to be increased.

Proposed System Parameter Report

Presented as a separate document

Nutrient Budget

Ovr-Ovr-Miraka Consent Current 2016_17 - copy 1

for MIRAKA FARMS LTD

Prepared by Farm Environmental Consultant

Mark Crawford

24/07/2017

OVERSEER

This Overseer report is at all times subject to the disclaimers set out on page 2 of this report. Please read these disclaimers carefully.

OVERSEER

OVERSEER® Disclaimer

The contents of this document are provided "AS IS" and without warranties of any kind either express or implied. To the fullest extent permissible and subject and pursuant to applicable law, the owners of the OVERSEER® Nutrient Budgets disclaim all warranties, express or implied, including, but not limited to, implied warranties of merchantability and fitness for a particular purpose. The owners of the OVERSEER® Nutrient Budgets do not warrant or make any representations regarding the correctness, accuracy, reliability, or otherwise of the contents of this document or the results of its use nor do they make any warranty or representation that this document or the information in this document is complete, accurate or not misleading.

Ravensdown Disclaimer

Ravensdown is not liable for any loss, damage or other disadvantage of any form suffered by the Customer or any third party arising in any way from this document or the services provided by Ravensdown in connection with this document, whether in contract, tort or otherwise.

Use of this document

Ravensdown has granted to its customer a limited licence to use this document. This licence enables the customer to possess, use, copy and distribute this document for the specific purposes for which the document was prepared by Ravensdown. This licence does not permit any alteration of this document in any way, or the document to be copied, distributed or disseminated other than in its entirety.

If you are not the customer, to be able to lawfully use or rely on this document you must have been authorised to do so by Ravensdown or its customer. Your use of this document is subject to the same limitations as apply to the customer, as set out above.

The rights associated with this document do not include the right to possess, alter, use, copy or distribute the Xml file used to create a nutrient budget. The Xml file remains the exclusive property of Ravensdown, and may only be disseminated with Ravensdown's prior written consent.

No reliance can be placed on this document for the purposes of farm sale, purchase or lease, or territorial authority resource consent without written consent from Ravensdown.

Nutrient Budget

OVERSEER

	N	P	K	S	Ca	Mg	Na
	(kg/ha/yr)						
Nutrients added in							
Fertiliser, lime & other	149	34	49	38	0	0	1
Rain/clover N fixation	128	0	2	4	2	4	17
Irrigation	0	0	0	0	0	0	0
Supplements imported	16	3	14	3	2	2	1
Nutrients removed							
As products	76	14	17	5	19	2	5
Exported effluent	0	0	0	0	0	0	0
As Supplements	0	0	0	0	0	0	0
To atmosphere	134	0	0	0	0	0	0
To water	21	0.7	17	57	63	3	12
Change in internal pools							
Plant material	-7	-1	-9	1	-1	-1	0
Organic pool	58	12	4	-18	1	0	0
Inorganic mineral	0	3	-15	0	-3	-4	-5
Inorganic soil pool	10	8	51	0	-75	6	7

Farm Nitrogen

OVERSEER

	Units	Benchmark farm	Current farm
Inputs (farm average)			
Clover N	kg N/ha/yr		126
Fertiliser N	kg N/ha/yr		149
Other N added	kg N/ha/yr		18
Indices			
Average N loss to water includes N lost as effluent	kg N/ha/yr	24-42	21
N2O emissions	kg N/ha/yr		79.5
For pastoral area of farm:			
Farm N surplus	kg N/ha/yr	123-191	216
N conversion efficiency	%	27-35	26

Farm Phosphorus

OVERSEER

	Units	Benchmark farm	Current farm
Inputs (farm average)			
P added as fertiliser	kg P/ha/yr		34
P imported as supplements	kg P/ha/yr		3
Other P added	kg P/ha/yr		0
Indices			
Average P loss to water	kg P/ha/yr		0.7
P lost from effluent pond	kg P/ha/yr		0
P surplus	kg P/ha/yr		-14
For pastoral block % of area with high or extreme:			
Soil P loss risk category	%		0
Fertiliser P loss risk category	%		0
Effluent P loss risk category	%		0

Block Nitrogen

OVERSEER

Block name	Total N lost (kg N/yr)	N lost to water (kg N/ha/yr)	N in drainage * (ppm)	N surplus (kg N/ha/yr)	Added N ** (kg N/ha/yr)
Brax_4a.1 Non Eff	458	12	3.5	217	171
Brax_4a.1 Effluent	1374	12	3.7	238	203
Brax_4a.1 Support ##	1377	21	6.3	181	171
Glene_4a.1 Support	773	74	18.4	189	171
Riparian 1	7	3	NaN	0	0
Trees and Scrub 1	2	2	NaN	0	0
Swedes	1197	60	14.9	55	87
Other farm sources	306				
Whole farm	5493	21			
Less N removed in wetland	0				
Farm output	5493	21			

* Estimated N concentration in drainage water at the bottom of the root zone. Maximum recommeded level for drinking water is 11.3 ppm (note that this is not an environmental water quality standard).

** Sum of fertiliser and external factory effluent inputs.

N/A: N in drainage not calculated for easy and steep pastoral blocks, or for tree and shrubs, riparian, wetland or house blocks.

Block Phosphorus

Block name	Total P (kg P/yr)	P lost (kg P/ha/yr)	P loss categories		
			Soil	Fertiliser	Effluent
Brax_4a.1 Non Eff	12	0.3	Low	Low	Low
Brax_4a.1 Effluent	41	0.4	Low	Low	Low
Brax_4a.1 Support ##	16	0.2	Low	Low	Low
Glene_4a.1 Support ##	1	0.1	Low	Low	Low
Riparian 1	0	0.1	N/A	N/A	N/A
Trees and Scrub 1	0	0.1	N/A	N/A	N/A
Swedes	15	0.7	N/A	N/A	N/A
Other Sources	95				
Whole farm	180	0.7			

Has a fodder crop rotating though, results for pastoral block component only

Block Pasture

Block name	On-farm fresh pasture intake (kg DM/ha/yr)	Estimated utilisation (%)	Supplements removed (kg DM/ha/yr)	Pasture growth (kg DM/ha/yr)
Brax_4a.1 Non Eff	13434	85	0	15804
Brax_4a.1 Effluent	13434	85	0	15804
Brax_4a.1 Support	8627	75	3784	15332
Glene_4a.1 Support	8752	75	3619	15335
Riparian 1	0	0	0	0
Trees and Scrub 1	0	0	0	0
Swedes	2360	75	0	3159

This report gives an estimated animal intake for each block based on animal production and supplements brought on to farm information supplied. Estimated annual pasture growth is shown for the animal utilisation value shown. Note: the model is not sensitive to changes in utilisation.

It is recommended that a consultant or software such StockPol is used to estimate farm pasture production.

Other values for farm - Ovr-Ovr-Miraka

Milking herd size (peak cows/ha grazed)	2.4
Milk solids (kg/ha grazed)	1045
Milk production per cow (kg milk solids /	433.3
Default calving data	06 August
Total liveweight brought (kg/ha grazed)	70
Total liveweight reared (kg/ha grazed)	170
Total liveweight sold (kg/ha grazed)	552
No fertiliser costs entered	
GHG: Allocation to milk	0.84
Dairy stock rate (RSU)	5212
Dairy replacements stock rate (RSU)	851
Beef / dairy grazing stock rate (RSU)	79

Nutrient Budget

OVERSEER

Brax_4a.1 Non Eff	N	P	K	S	Ca	Mg	Na	H+*
	(kg/ha/yr)							
Nutrients added in								
Fertiliser, lime & other	161	34	55	43	0	0	1	0.6
Rain/clover N fixation	162	0	2	4	2	4	17	0.1
Irrigation	0	0	0	0	0	0	0	0
Effluent added	10	3	4	1	5	2	0	-0.5
Supplements fed on block	40	6	39	6	9	3	2	1
Nutrients removed								
As animal products	106	19	24	6	25	2	7	0
As supplements	0	0	0	0	0	0	0	0
Net transfer by animals	50	4	38	3	7	2	1	-1
To atmosphere	155	0	0	0	0	0	0	0
To water	12	0.3	20	64	60	2	11	-0.6
Change in internal pools								
Organic pool	50	13	0	-19	0	0	0	-0.2
Inorganic mineral	0	3	-13	0	-3	-4	-5	0
Inorganic soil pool	0	4	30	0	-73	7	7	3

Brax_4a.1 Effluent	N	P	K	S	Ca	Mg	Na	H+*
	(kg/ha/yr)							
Nutrients added in								
Fertiliser, lime & other	161	34	55	43	0	0	1	0.6
Rain/clover N fixation	151	0	2	4	2	4	17	0.1
Irrigation	0	0	0	0	0	0	0	0
Effluent added	42	3	53	4	6	2	1	-1
Supplements fed on block	40	6	39	6	9	3	2	1
Nutrients removed								
As animal products	106	19	24	6	25	2	7	0
As supplements	0	0	0	0	0	0	0	0
Net transfer by animals	50	4	38	3	7	2	1	-1
To atmosphere	156	0	0	0	0	0	0	0
To water	12	0.4	20	66	61	2	11	-0.6

This Overseer report is at all times subject to the disclaimers set out on page 2 of this report. Please read these disclaimers carefully.

Change in internal pools								
Organic pool	70	14	0	-19	0	0	0	-0.3
Inorganic mineral	0	4	-9	0	-3	-4	-5	0
Inorganic soil pool	0	2	7S	0	-73	7	8	2.6

Brax_4a.1 Support	N	P	K	S	Ca	Mg	Na	H+*
				(kg/ha/yr)				
Nutrients added In								
Fertiliser, lime & other	161	34	55	43	0	0	1	0.6
Rain/clover N fixation	123	0	2	4	2	4	17	0.1
Irrigation	0	0	0	0	0	0	0	0
Effluent added	10	3	4	1	5	2	0	-0.5
Supplements fed on block	10	2	6	2	0	1	0	0.1
Nutrients removed								
As animal products	36	7	7	2	10	1	2	0
As supplements	70	10	79	10	20	5	4	-2
Net transfer by animals	16	1	14	1	3	1	0	-0.3
To atmosphere	103	0	0	0	0	0	0	0
To water	21	0.2	16	54	68	3	12	-1.2
Change in internal pools								
Organic pool	58	11	0	-18	0	0	0	-0.1
Inorganic mineral	0	2	-29	0	-3	-4	-5	0
Inorganic soil pool	0	8	-20	0	-90	2	6	4.1

Glene_4a.1 Support	N	P	K	S	Ca	Mg	Na	H+*
				(kg/ha/yr)				
Nutrients added in								
Fertiliser, lime & other	161	34	55	43	0	0	1	0.6
Rain/clover N fixation	128	0	2	4	2	4	17	0.2
Irrigation	0	0	0	0	0	0	0	0
Effluent added	10	3	4	1	5	2	0	-0.5
Supplements fed on block	10	2	6	2	0	1	0	0.1
Nutrients removed								
As animal products	37	7	7	3	10	1	2	0
As supplements	67	9	76	9	19	5	4	-2
Net transfer by animals	16	1	14	1	3	1	0	-0.3
To atmosphere	60	0	0	0	0	0	0	0
To water	74	0.1	16	55	110	4	16	-4.9

Change in internal pools								
Organic pool	S5	10	0	-18	0	0	0	-0.1
Inorganic mineral	0	3	-29	0	-3	-4	-5	0
Inorganic soil pool	0	9	-18	0	-131	1	2	7.8

Riparian 1	N	P	K	S	Ca	Mg	Na	H+*
	(kg/ha/yr)							
Nutrients added in								
Fertiliser, lime & other	0	0	0	0	0	0	0	0
Rain/clover N fixation	3	0	2	4	2	4	17	0
Irrigation	0	0	0	0	0	0	0	0
Supplements fed on block	0	0	0	0	0	0	0	0
Nutrients removed								
As animal products	0	0	0	0	0	0	0	0
As supplements	0	0	0	0	0	0	0	0
Net transfer by animals	0	0	0	0	0	0	0	0
To atmosphere	0	0	0	0	0	0	0	0
To water	3	0.1	2	4	2	4	17	0
Change in internal pools								
Organic pool	0	0	0	0	0	0	0	0
Inorganic mineral	0	0	0	0	0	0	0	0
Inorganic soil pool	0	0	0	0	0	0	0	0

Trees and Scrub 1	N	P	K	S	Ca	Mg	Na	H+*
	(kg/ha/yr)							
Nutrients added in								
Fertiliser, lime & other	0	0	0	0	0	0	0	0
Rain/clover N fixation	2	0	2	4	2	4	17	0
Irrigation	0	0	0	0	0	0	0	0
Supplements fed on block	0	0	0	0	0	0	0	0
Nutrients removed								
As animal products	0	0	0	0	0	0	0	0
As supplements	0	0	0	0	0	0	0	0
Net transfer by animals	0	0	0	0	0	0	0	0
To atmosphere	0	0	0	0	0	0	0	0
To water	2	0.1	2	4	2	4	17	0
Change in internal pools								
Organic pool	0	0	0	0	0	0	0	0
Inorganic mineral	0	0	0	0	0	0	0	0
Inorganic soil pool	0	0	0	0	0	0	0	0

Swedes	N	P	K	S	Ca	Mg	Na	H+*
	(kg/ha/yr)							
Nutrients added in								
Fertiliser, lime & other	87	46	0	2	0	1	0	-1.5
Rain/clover N fixation	14	0	2	4	2	4	17	0
Irrigation	0	0	0	0	0	0	0	0
Supplements fed on block	8	2	4	2	0	1	0	0.1
Nutrients removed								
As product	46	9	9	3	13	1	3	0
As supplements and crop	0	0	0	0	0	0	0	0
Net transfer by animals	8	1	7	1	4	1	1	0.4
To atmosphere	103	0	0	0	0	0	0	0
To water	60	0.7	5	27	68	6	19	0
Change in internal pools								
Standing plant material	-197	-18	-134	-9	-14	-10	-6	-0.4
Root and stover residuals	111	11	15	17	8	2	2	0.4
Organic pool	-149	-14	0	-32	0	0	0	0
Inorganic mineral	0	4	-12	0	-3	-4	-5	0
Inorganic soil pool	127	55	116	0	-73	11	4	-1.8

Other values for block

Brax_4a.1 Non Eff

Relative yield (from soil tests &	98
Pasture utilisation (%)	85
Annual average temperature (C)	9.9
Annual rainfall (mm/yr)	984
Annual irrigation supplied (mm/yr)	0
Added to pasture (mm/yr)	0
Annual AET (mm/yr)	657
Annual drainage (mm/yr)	327
Annual runoff (mm/yr)	0
Field capacity (mm to 60 cm)	318
Wilting point (mm to 60 cm)	171
Saturation (mm to 60 cm)	369
Profile available water (PAW) (mm to 60	147
No fertiliser costs entered	
Urine N risk index	3.6
Average N2O EF3 factor	0.131

Brax_4a.1 Effluent

Relative yield (from soil tests &	99
Pasture utilisation (%)	85
Annual average temperature (C)	9.9
Annual rainfall (mm/yr)	984
Annual irrigation supplied (mm/yr)	0
Added to pasture (mm/yr)	0
Annual AET (mm/yr)	657
Annual drainage (mm/yr)	327
Annual runoff (mm/yr)	0
Field capacity (mm to 60 cm)	318
Wilting point (mm to 60 cm)	171
Saturation (mm to 60 cm)	369
Profile available water (PAW) (mm to 60	147
No fertiliser costs entered	
Urine N risk index	3.8

Average N2O EF3 factor	0.131

Brax_4a.1 Support

Relative yield (from soil tests &	97
Pasture utilisation (%)	75
Annual average temperature (C)	9.9
Annual rainfall (mm/yr)	984
Annual irrigation supplied (mm/yr)	0
Added to pasture (mm/yr)	0
Annual AET (mm/yr)	657
Annual drainage (mm/yr)	327
Annual runoff (mm/yr)	0
Field capacity (mm to 60 cm)	318
Wilting point (mm to 60 cm)	171
Saturation (mm to 60 cm)	369
Profile available water (PAW) (mm to 60	147
No fertiliser costs entered	
Urine N risk index	3.6
Average N2O EF3 factor	0.131

Glene_4a.1 Support

Relative yield (from soil tests &	97
Pasture utilisation (%)	75
Annual average temperature (C)	9.9
Annual rainfall (mm/yr)	984
Annual irrigation supplied (mm/yr)	0
Added to pasture (mm/yr)	0
Annual AET (mm/yr)	585
Annual drainage (mm/yr)	399
Annual runoff (mm/yr)	0
Field capacity (mm to 60 cm)	171
Wilting point (mm to 60 cm)	93
Saturation (mm to 60 cm)	228
Profile available water (PAW) (mm to 60	78
No fertiliser costs entered	
Urine N risk index	23.5
Average N2O EF3 factor	0.071

Riparian 1

P remove by riparian blocks (kg P)	0

Swedes

Annual average temperature (C)	9.7
Annual rainfall (mm/yr)	985
Annual irrigation supplied (mm/yr)	0
Added to crop (mm/yr)	0
Annual AET (mm/yr)	584
Annual drainage (mm/yr)	401
Annual runoff (mm/yr)	0
Field capacity (mm to 60 cm)	300
Wilting point (mm to 60 cm)	159
Saturation (mm to 60 cm)	351
Profile available water (PAW) (mm to 60	141
Field capacity (mm to 150 cm)	723
Wilting point (mm to 150 cm)	429
Saturation (mm to 150 cm)	810
Profile available water (PAW) (mm to	294

No fertiliser costs entered

Effluent Report

Based on pastoral farm area only	Units	Current farm	
Current area receiving liquid effluent			
Total area including crops	ha	112	
Pastoral area receiving liquid	ha	112	
% of farm pastoral area	%	49	
Average liquid effluent	kg N/ha/yr	32.0	
Average fertiliser N	kg N/ha/yr	161.0	
Average other N inputs	kg N/ha/yr	10.0	
Area of farm to apply all effluent to achieve rate:			
150 kg N/ha/yr	ha	39.0	#
Maintenance K	ha	213	
100 kg K/ha/yr	ha	64.0	
Source of N in effluent block(s)			
Effluent from farm dairy	%	100	
Effluent from feed pad	%	0	
Effluent from wintering pad	%	0	
Effluent from standoff	%	0	

based on the total of liquid and solid effluents generated on farm and imported effluents applied.

The report shows rates and target areas for farm liquid effluent only, assuming it is all applied to pastoral blocks. It excludes any farm solid effluent or imported effluent that may be added to effluent blocks. If this occurs, then target areas may need to be increased.

This Overseer report is at all times subject to the disclaimers set out on page 2 of this report. Please read these disclaimers carefully.

Nutrient Budget

Ovr-Ovr-Miraka Consent Proposed 2016_17 - copy

for MIRAKA FARMS LTD

Prepared by Farm Environmental Consultant

Mark Crawford

24/07/2017

OVERSEER

This Overseer report is at all times subject to the disclaimers set out on page 2 of this report. Please read these disclaimers carefully.

OVERSEER

OVERSEER® Disclaimer

The contents of this document are provided "AS IS" and without warranties of any kind either express or implied. To the fullest extent permissible and subject and pursuant to applicable law, the owners of the OVERSEER® Nutrient Budgets disclaim all warranties, express or implied, including, but not limited to, implied warranties of merchantability and fitness for a particular purpose. The owners of the OVERSEER® Nutrient Budgets do not warrant or make any representations regarding the correctness, accuracy, reliability, or otherwise of the contents of this document or the results of its use nor do they make any warranty or representation that this document or the information in this document is complete, accurate or not misleading.

Ravensdown Disclaimer

Ravensdown is not liable for any loss, damage or other disadvantage of any form suffered by the Customer or any third party arising in any way from this document or the services provided by Ravensdown in connection with this document, whether in contract, tort or otherwise.

Use of this document

Ravensdown has granted to its customer a limited licence to use this document. This licence enables the customer to possess, use, copy and distribute this document for the specific purposes for which the document was prepared by Ravensdown. This licence does not permit any alteration of this document in any way, or the document to be copied, distributed or disseminated other than in its entirety.

If you are not the customer, to be able to lawfully use or rely on this document you must have been authorised to do so by Ravensdown or its customer. Your use of this document is subject to the same limitations as apply to the customer, as set out above.

The rights associated with this document do not include the right to possess, alter, use, copy or distribute the Xml file used to create a nutrient budget. The Xml file remains the exclusive property of Ravensdown, and may only be disseminated with Ravensdown's prior written consent.

No reliance can be placed on this document for the purposes of farm sale, purchase or lease, or territorial authority resource consent without written consent from Ravensdown.

Nutrient Budget

OVERSEER

	N	P	K	S	Ca	Mg	Na
	(kg/ha/yr)						
Nutrients added in							
Fertiliser, lime & other	149	34	49	38	0	0	1
Rain/clover N fixation	130	0	2	4	2	4	17
Irrigation	0	0	0	0	0	0	0
Supplements imported	26	5	26	5	5	4	2
Nutrients removed							
As products	89	15	21	5	21	2	6
Exported effluent	0	0	0	0	0	0	0
As Supplements	0	0	0	0	0	0	0
To atmosphere	150	0	0	0	0	0	0
To water	21	0.8	18	62	63	3	12
Change in internal pools							
Plant material	-6	0	-9	1	0	-1	0
Organic pool	41	11	-8	-21	-1	-1	-1
Inorganic mineral	0	3	-10	0	-3	-4	-5
Inorganic soil pool	11	9	64	0	-72	8	7

Farm Nitrogen

	Units	Benchmark farm	Current farm
Inputs (farm average)			
Clover N	kg N/ha/yr		128
Fertiliser N	kg N/ha/yr		149
Other N added	kg N/ha/yr		28
Indices			
Average N loss to water includes N lost as effluent	kg N/ha/yr	24-42	21
N2O emissions	kg N/ha/yr		85
For pastoral area of farm:			
Farm N surplus	kg N/ha/yr	123-191	217
N conversion efficiency	%	27-35	29

Farm Phosphorus

OVERSEER

	Units	Benchmark farm	Current farm
Inputs (farm average)			
P added as fertiliser	kg P/ha/yr		34
P imported as supplements	kg P/ha/yr		5
Other P added	kg P/ha/yr		0
Indices			
Average P loss to water	kg P/ha/yr		0.8
P lost from effluent pond	kg P/ha/yr		0
P surplus	kg P/ha/yr		-15
For pastoral block % of area with high or extreme:			
Soil P loss risk category	%		0
Fertiliser P loss risk category	%		0
Effluent P loss risk category	%		0

Block Nitrogen

OVERSEER

Block name	Total N lost (kg N/yr)	N lost to water (kg N/ha/yr)	N in drainage * (ppm)	N surplus (kg N/ha/yr)	Added N ** (kg N/ha/yr)
Brax_4a.1 Non Eff ##	128	14	4.2	226	192
Brax_4a.1 Effluent	1848	14	4.3	237	208
Brax_4a.1 Non Eff S	199	14	4.1	223	192
Glene_4a.1 Non Eff S	212	62	15.7	213	192
Riparian 1	7	3	NaN	0	0
Trees and Scrub 1	2	2	NaN	0	0
Swedes	693	69	17.1	-55	87
Brax_4a.1 Eff S	869	14	4.2	234	208
Glene_4a.1 Eff S	558	64	16.1	224	208
Swedes 2	508	51	13	-15	87
Other farm sources	366				
Whole farm	5392	21			
Less N removed in wetland	0				
Farm output	5392	21			

* Estimated N concentration in drainage water at the bottom of the root zone. Maximum recommeded level for drinking water is 11.3 ppm (note that this is not an environmental water quality standard).

** Sum of fertiliser and external factory effluent inputs.

N/A: N in drainage not calculated for easy and steep pastoral blocks, or for tree and shrubs, riparian, wetland or house blocks.

Block Phosphorus

Block name	Total P (kg P/yr)	P lost (kg P/ha/yr)	P loss categories		
			Soil	Fertiliser	Effluent
Brax_4a.1 Non Eff ##	3	0.3	Low	Low	Low
Brax_4a.1 Effluent ##	47	0.4	Low	Low	Low
Brax_4a.1 Non Eff S ##	3	0.2	Low	Low	Low
Glene_4a.1 Non Eff S ##	0	0.1	Low	Low	Low
Riparian 1	0	0.1	N/A	N/A	N/A
Trees and Scrub 1	0	0.1	N/A	N/A	N/A
Swedes	7	0.7	N/A	N/A	N/A
Brax_4a.1 Eff S ##	15	0.2	Low	Low	Low
Glene_4a.1 Eff S ##	1	0.1	Low	Low	Low
Swedes 2	7	0.7	N/A	N/A	N/A
Other Sources	110				
Whole farm	195	0.8			

Has a fodder crop rotating though, results for pastoral block component only

Block Pasture

OVERSEER

Block name	On-farm fresh pasture intake (kg DM/ha/yr)	Estimated utilisation (%)	Supplements removed (kg DM/ha/yr)	Pasture growth (kg DM/ha/yr)
Brax_4a.1 Non Eff	13389	85	0	15752
Brax_4a.1 Effluent	13389	85	0	15752
Brax_4a.1 Non Eff S	13153	84	0	15752
Glene_4a.1 Non Eff S	13153	84	0	15752
Riparian 1	0	0	0	0
Trees and Scrub 1	0	0	0	0
Swedes	2734	84	0	3239
Brax_4a.1 Eff S	13153	84	0	15752
Glene_4a.1 Eff S	13153	84	0	15752
Swedes 2	2734	84	0	3239

This report gives an estimated animal intake for each block based on animal production and supplements brought on to farm information supplied. Estimated annual pasture growth is shown for the animal utilisation value shown. Note: the model is not sensitive to changes in utilisation.

It is recommended that a consultant or software such StockPol is used to estimate farm pasture production.

Other values for farm - Ovr-Ovr-Miraka

Milking herd size (peak cows/ha grazed)	3.0
Milk solids (kg/ha grazed)	1295
Milk production per cow (kg milk solids /	429.3
Default calving data	06 August
Total liveweight brought (kg/ha grazed)	771
Total liveweight reared (kg/ha grazed)	54
Total liveweight sold (kg/ha grazed)	982
No fertiliser costs entered	
GHG: Allocation to milk	0.90
Dairy stock rate (RSU)	6408
Dairy replacements stock rate (RSU)	0
Beef / dairy grazing stock rate (RSU)	229

Nutrient Budget

OVERSEER

Brax_4a.1 Non Eff	N	P	K	S	Ca	Mg	Na	H+*
	(kg/ha/yr)							
Nutrients added in								
Fertiliser, lime & other	161	34	55	43	0	0	1	0.6
Rain/clover N fixation	154	0	2	4	2	4	17	0.1
Irrigation	0	0	0	0	0	0	0	0
Effluent added	31	4	19	6	8	4	2	-1.4
Supplements fed on block	19	4	14	3	2	2	1	0.4
Nutrients removed								
As animal products	91	15	22	5	20	2	6	0
As supplements	0	0	0	0	0	0	0	0
Net transfer by animals	47	4	36	3	6	2	1	-0.9
To atmosphere	153	0	0	0	0	0	0	0
To water	14	0.3	19	66	62	2	11	-0.7
Change in internal pools								
Organic pool	60	13	0	-18	0	0	0	-0.2
Inorganic mineral	0	3	-14	0	-3	-4	-5	0
Inorganic soil pool	0	6	26	0	-73	8	8	1.6

Brax_4a.1 Effluent	N	P	K	S	Ca	Mg	Na	H+*
	(kg/ha/yr)							
Nutrients added in								
Fertiliser, lime & other	161	34	55	43	0	0	1	0.6
Rain/clover N fixation	148	0	2	4	2	4	17	0.1
Irrigation	0	0	0	0	0	0	0	0
Effluent added	47	4	50	7	8	4	2	-1.6
Supplements fed on block	19	4	14	3	2	2	1	0.4
Nutrients removed								
As animal products	91	15	22	5	20	2	6	0
As supplements	0	0	0	0	0	0	0	0
Net transfer by animals	47	4	36	3	6	2	1	-0.9
To atmosphere	153	0	0	0	0	0	0	0
To water	14	0.4	20	67	62	2	11	-0.8

Change in internal pools								
Organic pool	70	14	0	-18	0	0	0	-0.3
Inorganic mineral	0	4	-10	0	-3	-4	-5	0
Inorganic soil pool	0	4	53	0	-73	8	9	1.5

Brax_4a.1 Non Eff S	N	P	K	S	Ca	Mg	Na	H+*
				(kg/ha/yr)				
Nutrients added in								
Fertiliser, lime & other	161	34	55	43	0	0	1	0.6
Rain/clover N fixation	149	0	2	4	2	4	17	0.1
Irrigation	0	0	0	0	0	0	0	0
Effluent added	31	4	19	6	8	4	2	-1.4
Supplements fed on block	17	4	13	3	2	2	1	0.4
Nutrients removed								
As animal products	90	15	22	5	20	2	6	0
As supplements	0	0	0	0	0	0	0	0
Net transfer by animals	45	4	34	3	6	2	1	-0.9
To atmosphere	149	0	0	0	0	0	0	0
To water	14	0.2	19	66	62	3	12	-0.7

Change in internal pools								
Organic pool	61	11	0	-18	0	0	0	-0.2
Inorganic mineral	0	2	-13	0	-3	-4	-5	0
Inorganic soil pool	0	10	27	0	-74	7	7	1.5

Glene_4a.1 Non Eff S	N	P	K	S	Ca	Mg	Na	H+*
				(kg/ha/yr)				
Nutrients added in								
Fertiliser, lime & other	161	34	55	43	0	0	1	0.6
Rain/clover N fixation	139	0	2	4	2	4	17	0.1
Irrigation	0	0	0	0	0	0	0	0
Effluent added	31	4	19	6	8	4	2	-1.4
Supplements fed on block	17	4	13	3	2	2	1	0.4
Nutrients removed								
As animal products	90	15	22	5	20	2	6	0
As supplements	0	0	0	0	0	0	0	0
Net transfer by animals	45	4	34	3	6	2	1	-0.9
To atmosphere	78	0	0	0	0	0	0	0
To water	62	0.1	19	66	101	4	16	-4.1

Change in internal pools								
Organic pool	72	10	0	-18	0	0	0	-0.2
Inorganic mineral	0	3	-13	0	-3	-4	-5	0
Inorganic soil pool	0	10	27	0	-112	6	3	4.9

Riparian 1	N	P	K	S	Ca	Mg	Na	H+*
				(kg/ha/yr)				
Nutrients added in								
Fertiliser, lime & other	0	0	0	0	0	0	0	0
Rain/clover N fixation	3	0	2	4	2	4	17	0
Irrigation	0	0	0	0	0	0	0	0
Supplements fed on block	0	0	0	0	0	0	0	0
Nutrients removed								
As animal products	0	0	0	0	0	0	0	0
As supplements	0	0	0	0	0	0	0	0
Net transfer by animals	0	0	0	0	0	0	0	0
To atmosphere	0	0	0	0	0	0	0	0
To water	3	0.1	2	4	2	4	17	0
Change in internal pools								
Organic pool	0	0	0	0	0	0	0	0
Inorganic mineral	0	0	0	0	0	0	0	0
Inorganic soil pool	0	0	0	0	0	0	0	0

Trees and Scrub 1	N	P	K	S	Ca	Mg	Na	H+*
				(kg/ha/yr)				
Nutrients added in								
Fertiliser, lime & other	0	0	0	0	0	0	0	0
Rain/clover N fixation	2	0	2	4	2	4	17	0
Irrigation	0	0	0	0	0	0	0	0
Supplements fed on block	0	0	0	0	0	0	0	0
Nutrients removed								
As animal products	0	0	0	0	0	0	0	0
As supplements	0	0	0	0	0	0	0	0
Net transfer by animals	0	0	0	0	0	0	0	0
To atmosphere	0	0	0	0	0	0	0	0
To water	2	0.1	2	4	2	4	17	0
Change in internal pools								
Organic pool	0	0	0	0	0	0	0	0
Inorganic mineral	0	0	0	0	0	0	0	0
Inorganic soil pool	0	0	0	0	0	0	0	0

Swedes	N	P	K	S	Ca	Mg	Na	H+*
	(kg/ha/yr)							
Nutrients added in								
Fertiliser, lime & other	87	46	0	2	0	1	0	-1.5
Rain/clover N fixation	14	0	2	4	2	4	17	0
Irrigation	0	0	0	0	0	0	0	0
Supplements fed on block	4	1	5	1	1	0	0	0.2
Nutrients removed								
As product	147	35	13	16	69	2	5	0
As supplements and crop	0	0	0	0	0	0	0	0
Net transfer by animals	13	1	10	1	3	1	0	0.3
To atmosphere	117	0	0	0	0	0	0	0
To water	69	0.7	5	16	76	6	19	0
Change in internal pools								
Standing plant material	-202	-18	-134	-9	-14	-10	-6	-0.4
Root and stover residuals	123	12	7	17	3	1	1	0.2
Organic pool	-302	-17	0	-35	0	0	0	0
Inorganic mineral	0	4	-12	0	-3	-4	-5	0
Inorganic soil pool	140	29	119	0	-130	10	3	-1.4

Brax_4a.1 Eff S	N	P	K	S	Ca	Mg	Na	H+*
	(kg/ha/yr)							
Nutrients added in								
Fertiliser, lime & other	161	34	55	43	0	0	1	0.6
Rain/clover N fixation	144	0	2	4	2	4	17	0.1
Irrigation	0	0	0	0	0	0	0	0
Effluent added	47	4	50	7	8	4	2	-1.6
Supplements fed on block	17	4	13	3	2	2	1	0.4
Nutrients removed								
As animal products	90	15	22	5	20	2	6	0
As supplements	0	0	0	0	0	0	0	0
Net transfer by animals	45	4	34	3	6	2	1	-0.9
To atmosphere	149	0	0	0	0	0	0	0
To water	14	0.2	19	67	63	3	12	-0.8
Change in internal pools								
Organic pool	71	11	0	-18	0	0	0	-0.3
Inorganic mineral	0	2	-10	0	-3	-4	-5	0
Inorganic soil pool	0	10	54	0	-74	7	8	1.4

Glene_4a.1 Eff S	N	P	K	S	Ca	Mg	Na	H+*
	(kg/ha/yr)							

Nutrients added in								
Fertiliser, lime & other	161	34	55	43	0	0	1	0.6
Rain/clover N fixation	134	0	2	4	2	4	17	0.1
Irrigation	0	0	0	0	0	0	0	0
Effluent added	47	4	50	7	8	4	2	-1.6
Supplements fed on block	17	4	13	3	2	2	1	0.4
Nutrients removed								
As animal products	90	15	22	5	20	2	6	0
As supplements	0	0	0	0	0	0	0	0
Net transfer by animals	45	4	34	3	6	2	1	-0.9
To atmosphere	78	0	0	0	0	0	0	0
To water	64	0.1	19	67	102	4	16	-4.2
Change in internal pools								
Organic pool	82	10	0	-18	0	0	0	-0.3
Inorganic mineral	0	3	-10	0	-3	-4	-5	0
Inorganic soil pool	0	10	54	0	-113	6	4	4.9

Swedes 2	N	P	K	S	Ca	Mg	Na	H+*
	(kg/ha/yr)							
Nutrients added in								
Fertiliser, lime & other	87	46	0	2	0	1	0	-1.5
Rain/clover N fixation	14	0	2	4	2	4	17	0
Irrigation	0	0	0	0	0	0	0	0
Supplements fed on block	21	4	26	3	6	2	2	1
Nutrients removed								
As product	94	16	23	5	20	2	7	0
As supplements and crop	0	0	0	0	0	0	0	0
Net transfer by animals	42	3	31	3	7	2	1	0.9
To atmosphere	167	0	0	0	0	0	0	0
To water	51	0.7	5	27	61	6	18	0
Change in internal pools								
Standing plant material	-202	-18	-134	-9	-14	-10	-6	-0.4
Root and stover residuals	127	13	35	18	17	4	4	1.2
Organic pool	-292	-17	0	-35	0	0	0	0
Inorganic mineral	0	4	-13	0	-3	-4	-5	0
Inorganic soil pool	135	49	82	0	-81	8	0	-2.3

Other values for block

Brax_4a.1 Non Eff

Relative yield (from soil tests &	98
Pasture utilisation (%)	85
Annual average temperature (C)	9.9
Annual rainfall (mm/yr)	984
Annual irrigation supplied (mm/yr)	0
Added to pasture (mm/yr)	0
Annual AET (mm/yr)	657
Annual drainage (mm/yr)	327
Annual runoff (mm/yr)	0
Field capacity (mm to 60 cm)	318
Wilting point (mm to 60 cm)	171
Saturation (mm to 60 cm)	369
Profile available water (PAW) (mm to 60	147
No fertiliser costs entered	
Urine N risk index	3.7
Average N2O EF3 factor	0.131

Brax_4a.1 Effluent

Relative yield (from soil tests &	99
Pasture utilisation (%)	85
Annual average temperature (C)	9.9
Annual rainfall (mm/yr)	984
Annual irrigation supplied (mm/yr)	0
Added to pasture (mm/yr)	0
Annual AET (mm/yr)	657
Annual drainage (mm/yr)	327
Annual runoff (mm/yr)	0
Field capacity (mm to 60 cm)	318
Wilting point (mm to 60 cm)	171
Saturation (mm to 60 cm)	369
Profile available water (PAW) (mm to 60	147
No fertiliser costs entered	
Urine N risk index	3.8

Average N2O EF3 factor	0.131

Brax_4a.1 Non Eff S

Relative yield (from soil tests &	97
Pasture utilisation (%)	84
Annual average temperature (C)	9.9
Annual rainfall (mm/yr)	984
Annual irrigation supplied (mm/yr)	0
Added to pasture (mm/yr)	0
Annual AET (mm/yr)	657
Annual drainage (mm/yr)	327
Annual runoff (mm/yr)	0
Field capacity (mm to 60 cm)	318
Wilting point (mm to 60 cm)	171
Saturation (mm to 60 cm)	369
Profile available water (PAW) (mm to 60	147
No fertiliser costs entered	
Urine N risk index	3.7
Average N2O EF3 factor	0.131

Glene_4a.1 Non Eff S

Relative yield (from soil tests &	97
Pasture utilisation (%)	84
Annual average temperature (C)	9.9
Annual rainfall (mm/yr)	984
Annual irrigation supplied (mm/yr)	0
Added to pasture (mm/yr)	0
Annual AET (mm/yr)	585
Annual drainage (mm/yr)	399
Annual runoff (mm/yr)	0
Field capacity (mm to 60 cm)	171
Wilting point (mm to 60 cm)	93
Saturation (mm to 60 cm)	228
Profile available water (PAW) (mm to 60	78
No fertiliser costs entered	
Urine N risk index	23.9
Average N2O EF3 factor	0.071

Riparian 1

P remove by riparian blocks (kg P)	0

Swedes

Annual average temperature (C)	9.7
Annual rainfall (mm/yr)	985
Annual irrigation supplied (mm/yr)	0
Added to crop (mm/yr)	0
Annual AET (mm/yr)	579
Annual drainage (mm/yr)	406
Annual runoff (mm/yr)	0
Field capacity (mm to 60 cm)	309
Wilting point (mm to 60 cm)	168
Saturation (mm to 60 cm)	360
Profile available water (PAW) (mm to 60	141
Field capacity (mm to 150 cm)	768
Wilting point (mm to 150 cm)	456
Saturation (mm to 150 cm)	855
Profile available water (PAW) (mm to	312
No fertiliser costs entered	

Brax_4a.1 Eff S

Relative yield (from soil tests &	97
Pasture utilisation (%)	84
Annual average temperature (C)	9.9
Annual rainfall (mm/yr)	984
Annual irrigation supplied (mm/yr)	0
Added to pasture (mm/yr)	0
Annual AET (mm/yr)	657
Annual drainage (mm/yr)	327
Annual runoff (mm/yr)	0
Field capacity (mm to 60 cm)	318
Wilting point (mm to 60 cm)	171
Saturation (mm to 60 cm)	369
Profile available water (PAW) (mm to 60	147
No fertiliser costs entered	
Urine N risk index	3.8

Average N2O EF3 factor	0.131

Glene_4a.1 Eff S

Relative yield (from soil tests &	97
Pasture utilisation (%)	84
Annual average temperature (C)	9.9
Annual rainfall (mm/yr)	984
Annual irrigation supplied (mm/yr)	0
Added to pasture (mm/yr)	0
Annual AET (mm/yr)	585
Annual drainage (mm/yr)	399
Annual runoff (mm/yr)	0
Field capacity (mm to 60 cm)	171
Wilting point (mm to 60 cm)	93
Saturation (mm to 60 cm)	228
Profile available water (PAW) (mm to 60	78
No fertiliser costs entered	
Urine N risk index	24.3
Average N2O EF3 factor	0.071

Swedes 2

Annual average temperature (C)	9.7
Annual rainfall (mm/yr)	985
Annual irrigation supplied (mm/yr)	0
Added to crop (mm/yr)	0
Annual AET (mm/yr)	594
Annual drainage (mm/yr)	391
Annual runoff (mm/yr)	0
Field capacity (mm to 60 cm)	309
Wilting point (mm to 60 cm)	168
Saturation (mm to 60 cm)	360
Profile available water (PAW) (mm to 60	141
Field capacity (mm to 150 cm)	768
Wilting point (mm to 150 cm)	456
Saturation (mm to 150 cm)	855
Profile available water (PAW) (mm to	312
No fertiliser costs entered	

Effluent Report

Based on pastoral farm area only	Units	Current farm
Current area receiving liquid effluent		
Total area including crops	ha	201
Pastoral area receiving liquid	ha	201
% of farm pastoral area	%	88
Average liquid effluent	kg N/ha/yr	16.0
Average fertiliser N	kg N/ha/yr	161.0
Average other N inputs	kg N/ha/yr	31.0
Area of farm to apply all effluent to achieve rate:		
150 kg N/ha/yr	ha	69.0 #
Maintenance K	ha	3010
100 kg K/ha/yr	ha	105.0
Source of N in effluent block(s)		
Effluent from farm dairy	%	100
Effluent from feed pad	%	0
Effluent from wintering pad	%	0
Effluent from standoff	%	0

based on the total of liquid and solid effluents generated on farm and imported effluents applied.

* Average K maintenance rates were less than 20 kg K/ha/yr - use with caution.

The report shows rates and target areas for farm liquid effluent only, assuming it is all applied to pastoral blocks. It excludes any farm solid effluent or imported effluent that may be added to effluent blocks. If this occurs, then target areas may need to be increased.

civil tech ltd

MANAGEMANT PLAN

MIRAKA FARMS LTD

162 BOYLE ROAD

Civil Tech Ltd
P O Box 1558
INVERCARGILL 9840
T: (03) 216 9745
F: (03) 216 9735
M: 0274 357 957
E: murray@civiltech.co.nz

2. 373 O'SHANNESSY ROAD

MIRAKA FARMS LTD Contact: Mr P Dykes

Legal description of land owned by Mirkaka Farms Ltd:

Lot 3 and Part Lot 5 DP 168, Lot 1 DP 4967, Sec 234 Blk 15 Oreti HD, Lot 1 and 2 DP 471006 and Sec 144 Oreti HD

Consents Held:

204990	Discharge Permit + Appendix 1
204991	Water Permit

3. Attachments

Physiographic Zones Map
Aerial Photograph
Soil Type Map

There are no recorded archeological sites in the Southland District Council Proposed District Plan.

There is no indigenous vegetation on the property. There are no outstanding natural features or landscapes or visual amenity landscapes within the farm or on neigbouring farms.

4. Nutrient Budget

5. Good Management Practices

6. Riparian Management Plan

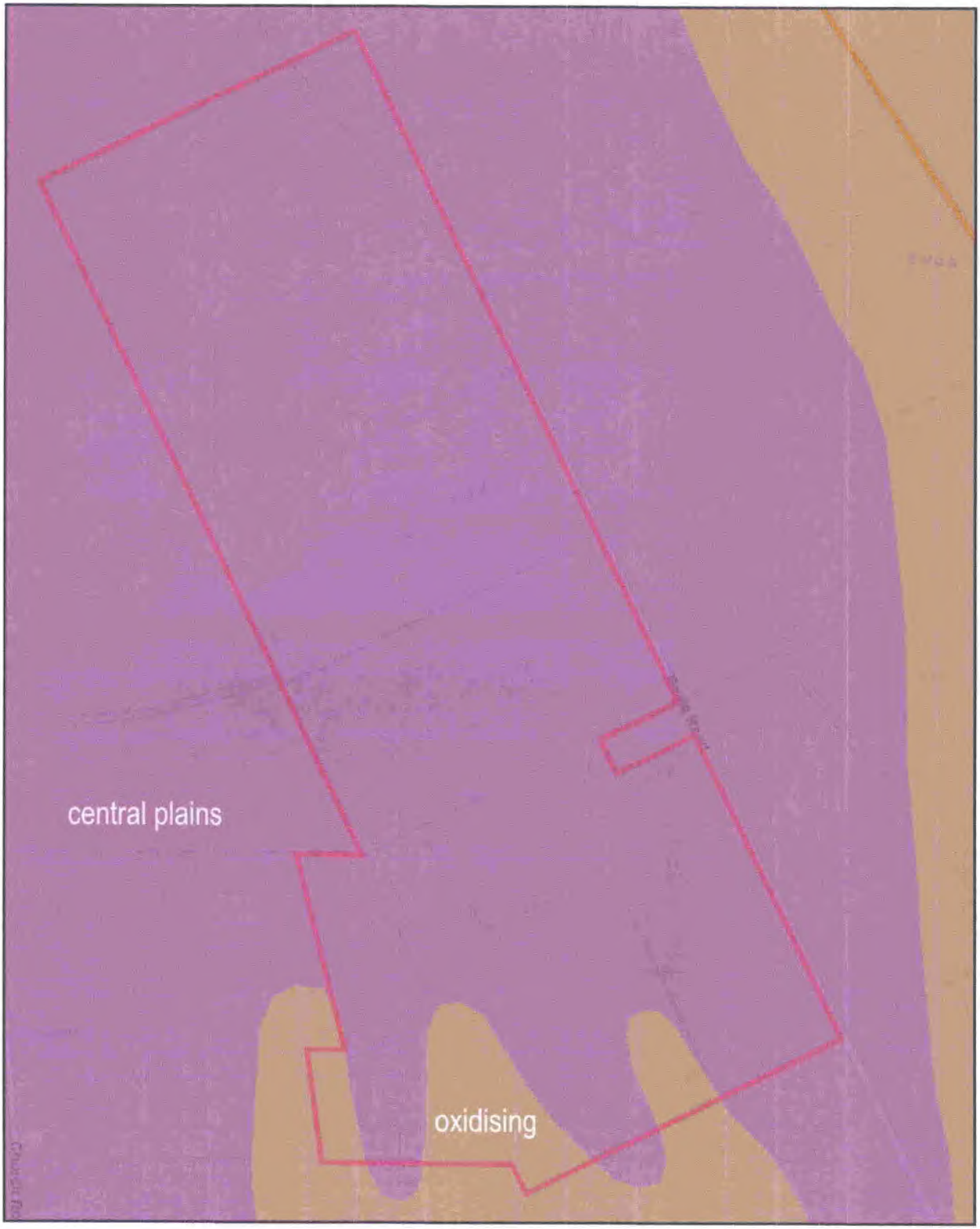
7. Cultivation

8. Intensive Winter Grazing

9. Collected Agricultural Effluent

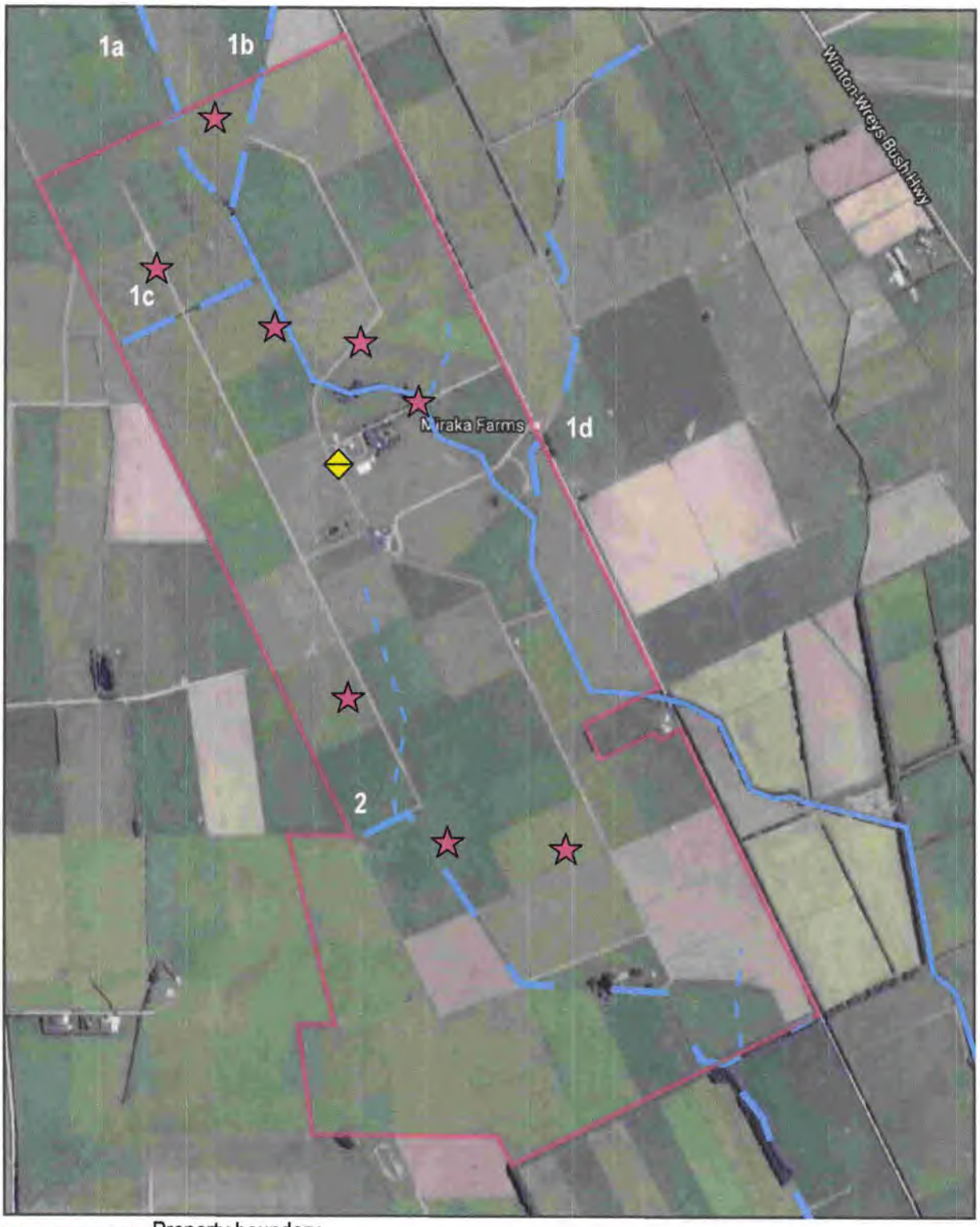
Collected Agricultural Effluent Management Plan

PHYSIOGRAPHIC MAP



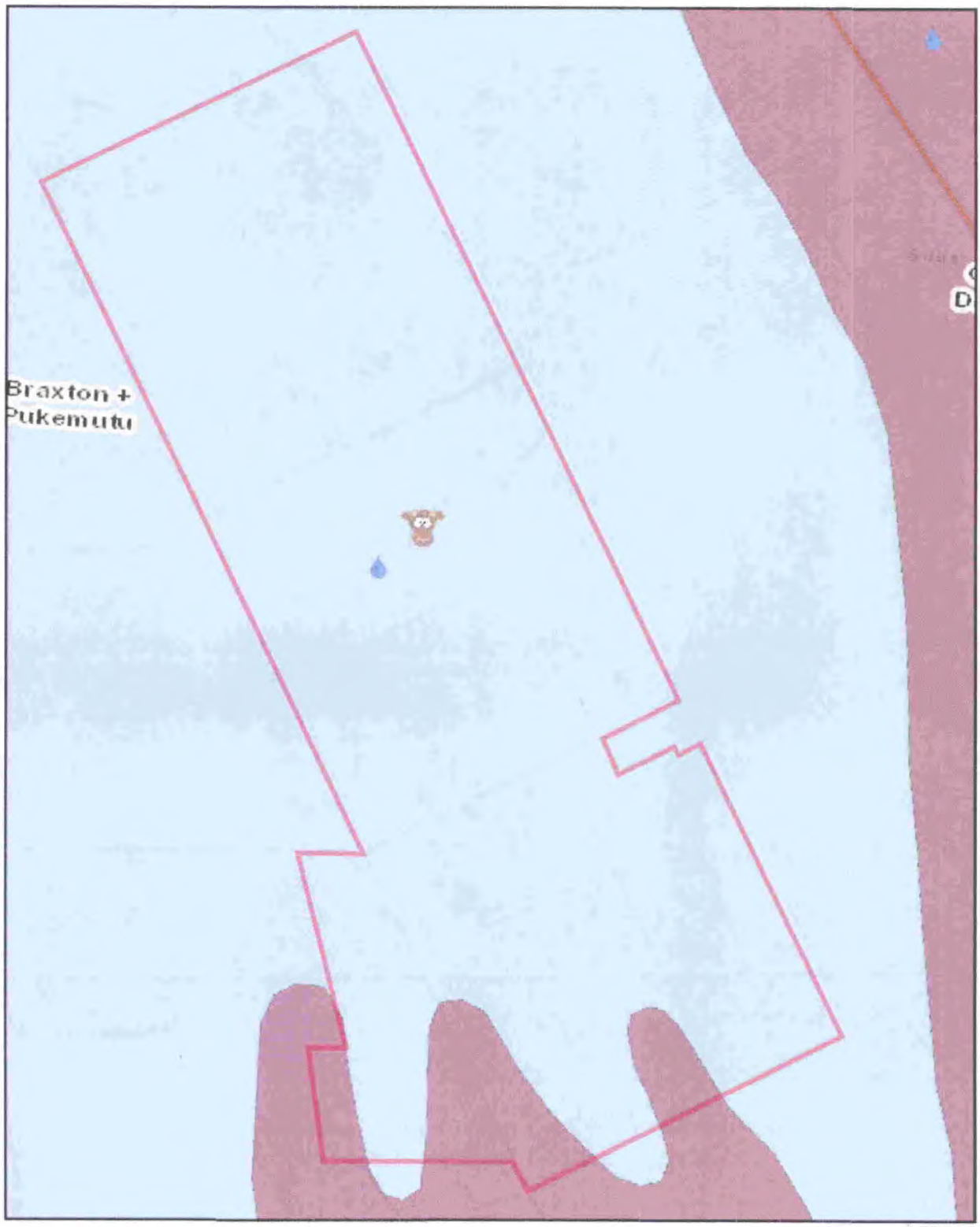
Purple	Central Plains
Copper	Oxidising

AERIAL MAP



Property boundary
Open stream
Intermittent drain
Known tiles
Culvert
Groundwater-take

SOIL MAP



Light blue	Braxton
Brown	Glenelg

4 NUTRIENT BUDGET

Included with full application

5 GOOD MANAGEMENT PRACTISES

Central Plains – artificial drainage and overland flow

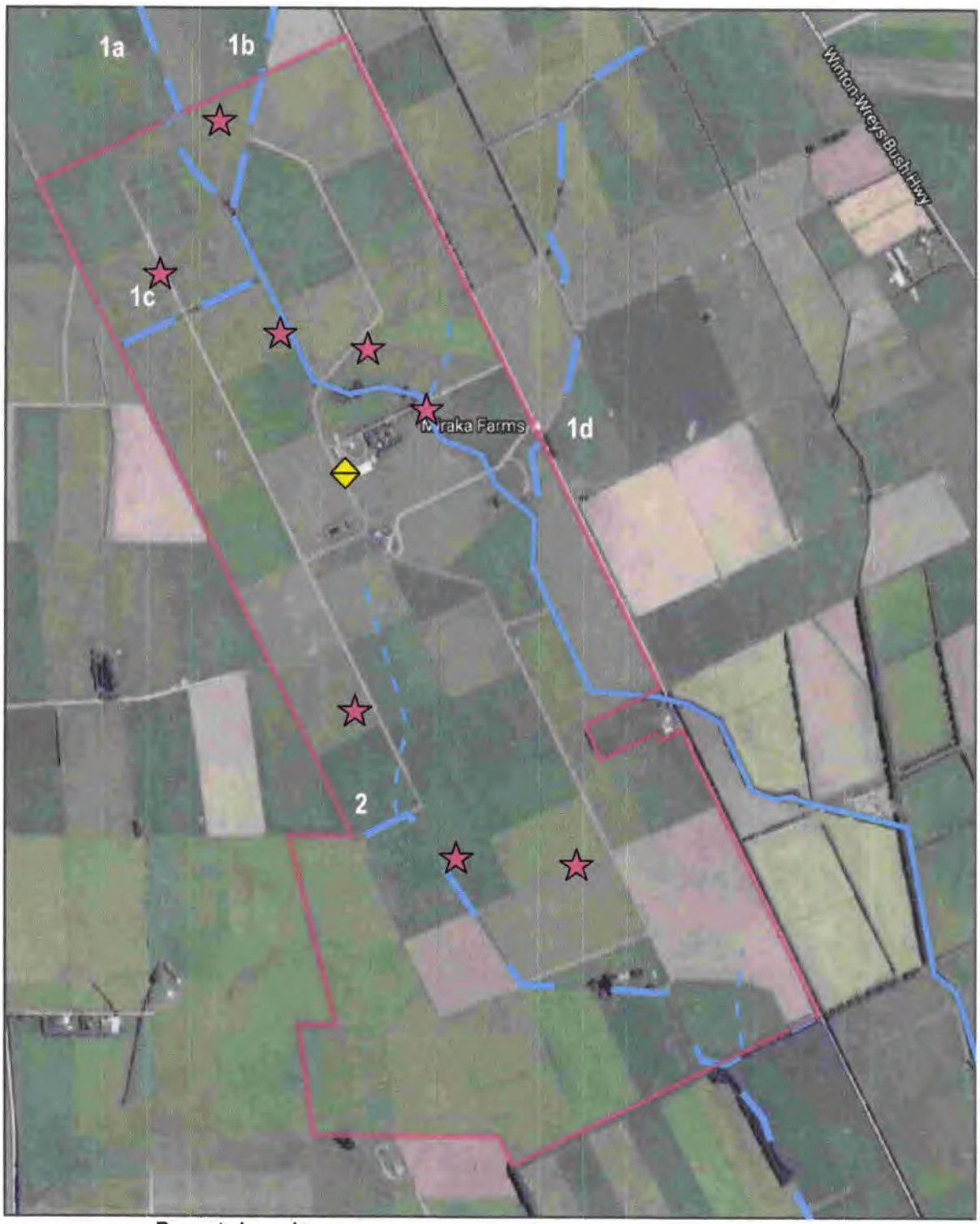
Protect soil structure, particularly in gullies and near stream areas	Avoid pugging pastures and repair bare areas Using along the contour cultivation Keep cultivation at correct distances from riparian areas
Reducing phosphorus use and loss	Keep Olsen P levels at optimum or less Maintain buffer zones
Reduce the accumulation of surplus nitrogen in the soil particularly during autumn and winter	Reduce use of N in autumn and use silage or pro-gibb Wintering stock off over winter Use small applications of N as pasture requires 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 effluent at low rates Have sufficient effluent storage
Capture contaminants at drainage outflows, manage critical source areas	Look at possible locations of wetlands Identify critical source areas Review riparian areas and increase if necessary

Central Plains – deep drainage

Reduce the accumulation of surplus nitrogen in the soil particularly during autumn and winter	Reduce use of N in autumn and use silage or pro-gibb Wintering stock off over winter Use small applications of N as pasture requires Re-sow bare or pugged areas of soil

Oxidising – overland flow

Protect soil structure, particularly in gullies	Avoid pugging pastures and repair bare areas Using along the contour cultivation Keep cultivation at correct distances from riparian areas
Reducing phosphorus use and loss	Keep Olsen P levels at optimum or less Maintain buffer zones
Capture contaminants at drainage outflows, manage critical source areas	Look at possible locations of wetlands Identify critical source areas Review riparian areas and increase if necessary

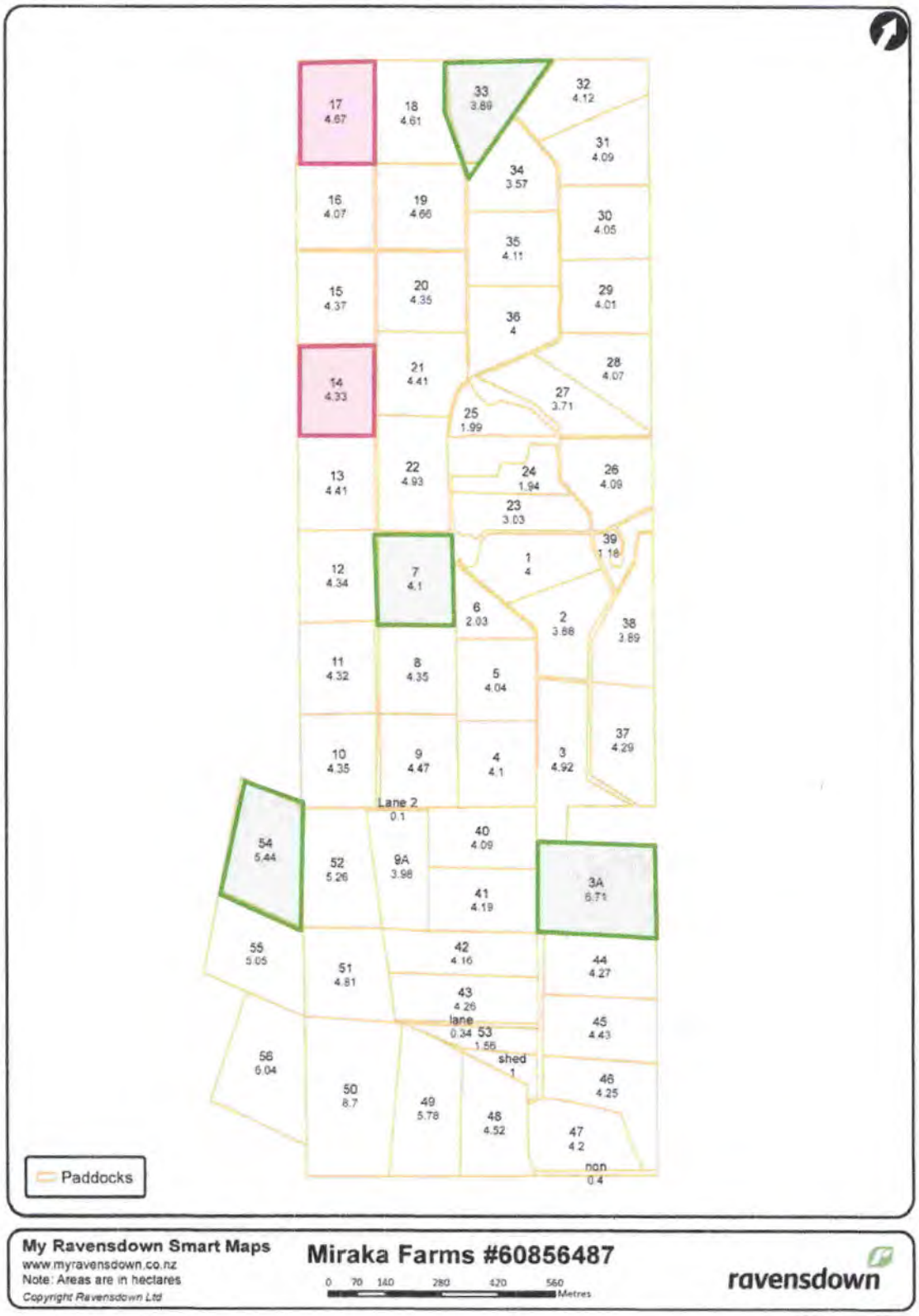

1a
1b
1c
1d
2
Wilton-Wreys Bush Hwy
Property boundary
Open stream
Intermittent drain
Known tiles
Culvert
Groundwater-take

- All open drains are fenced with two wire electric fences to exclude stock. All open drains have culverts for stock to cross.
- There are no sheep on the farm.
- Define the critical source areas and plan fencing of these.
- Riparian areas are well vegetated with pasture species and some planting. Noxious weeds will be controlled.
- There will be no grazing of riparian margins.
- The existing drains have gravel bottoms and do not require cleaning

The plan for 1 June to 2017 to 31 May 2018

- Identify any tiles and outlets.
- Identify additional critical source areas where storm water runs in heavy rain.
- The farm will check that the riparian strips are adequate and that fences are the correct distance from waterways.
- Ensure all fences keep stock out of water.
- Fence known critical source areas temporarily initially to establish the optimum location for fences.

7 and 8 **CULTIVATION and WINTER GRAZING**



Up to 20 ha of fodder crops and 10ha of cultivation for re-grassing - 1 June 2017 to 31 May 2018

Fodder crop

Cultivation

9 COLLECTED AGRICULTURAL EFFLUENT

Property boundary

Effluent discharge area

Groundwater-take

R

Residential area (200m radius)

B

Other bore (100m radius)

The farm map is to be marked up each time effluent is applied. For each effluent application record the date, depth and application rate.

Also refer to the Collect Agricultural Effluent Management Plan and Appendix 1 to confirm all separation distances to drains boundaries and bores.