Bronwyn Auckram 241

From:	Christine Stenning
Sent:	Thursday, 6 December 2018 3:37 p.m.
To:	Bronwyn Auckram
Subject:	FW: Consent application - South Pro Maitland Limited - email 1 of 2
Attachments:	Form A - South Pro Maitland.jpg; South Pro Maitland Limited - Application - Appendix.pdf; South Pro Maitland Limited - consent application - 2018.pdf; Maitland Dairies Leak test report March 2017 - NIWA.pdf; Maitland Dairies Ltd, drop test March 2017 V2.doc; South Pro Maitland Limited - effluent pond visual inspection.pdf

Hi Bron – can you please print, scan and put in inwards mail as one application document – there is another email with more documents to go with this.

Cheers, Christine

From: Nessa Legg [mailto:nessa.dgl@xtra.co.nz]
Sent: Thursday, 6 December 2018 2:52 p.m.
To: Consents Team
Cc: 'Grant and Camille Taylor'; 'Luke and Sarah Taylor'
Subject: Consent application - South Pro Maitland Limited - email 1 of 2

Dear sir/madam,

I am hereby submitting an application for resource consent on behalf of South Pro Maitland Limited. This application is for a land use consent for expanded dairy farming (additional cows) and for the replacement of an existing discharge permit. Relevant documents are contained in two emails:

Email 1 of 2:

- Form A
- Consent application
- Consent application – Appendix
- Pond drop test report
- NIWA – drop test report
- Visual inspection SQP report

Email 2 of 2:

- FEMP
- FEMP – Appendix
- Overseer nutrient budget analysis report
- Milk production reports
- Overseer XML files (6 in total)

The deposit of $1,500 has been made electronically. Could you please forward a receipt of payment?

Many thanks,

Nessa Legg
Dairy Green Ltd
PO Box 5003, Waikiwi, Invercargill
Phone 03 215 4381 (office)
03 2255277 (home office)
Mobile 021 1165106

Email nessa.dgl@xtra.co.nz

Application for Resource Consent (PART A)

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

environment SOUTHLAND
REGIONAL COUNCIL
Te Taiao Tonga

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: South Pro Maitland Limited.

Address: C/- Grant & Camille Taylor
371 Piako Road, RD1 Hamilton 3281

Email: gctaylor@glenmarie.nz

Phone: 0274929700 (Preferred) ______ (Additional) Fax: ______

Consultant contact details ***(if different from above)***

Contact name/agent: Nessa Legg

Address: Dairy Green Ltd, 10 Kinloch St, P.O. Box 5003, Waikiwi, Invercargill 9843

Email: nessa.dgl@xtra.co.nz

Phone: 021-1165106 (Preferred) ______ (Additional) Fax: ______

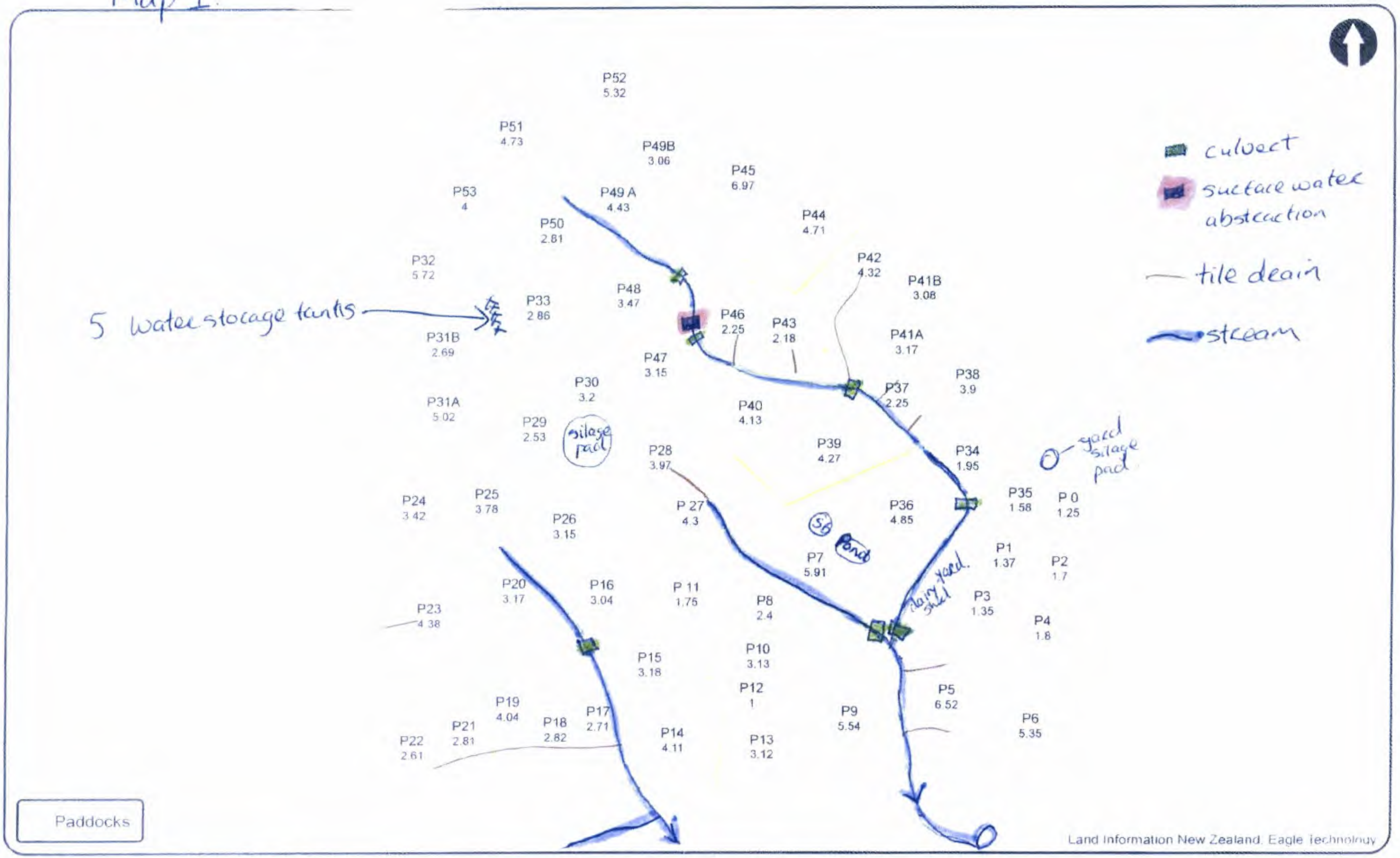
Please tick the box for the consent(s) you are applying for and complete the relevant Part B form(s) where available:

Land Use	***Discharge***	***Coastal***
☐ Bore/well	☐ To air	☐ Whitebait stand
☑ New or expanded dairy farming	☐ To water	☐ Structures/occupation of space
☐ Effluent storage	☑ To land	☐ Removal of natural materials
☐ Cultivation	***Water***	☐ Disturb foreshore/seabed
☐ Tree planting	☐ Take and use surface water	☐ Discharge/deposit substances
☐ Gravel extraction	☐ Take and use groundwater	☐ Commercial surface water activity
☐ Feed-pad, wintering pad, calving pad or silage pad	☐ Dam water	☐ Reclaim/drain foreshore/seabed
☐ Riverbed activity	☐ Divert water	☐ Marine farming
☐ Bridges and culverts		☐ Other coastal activities

South Pro Maitland Limited

Application – Appendix

Map 1.



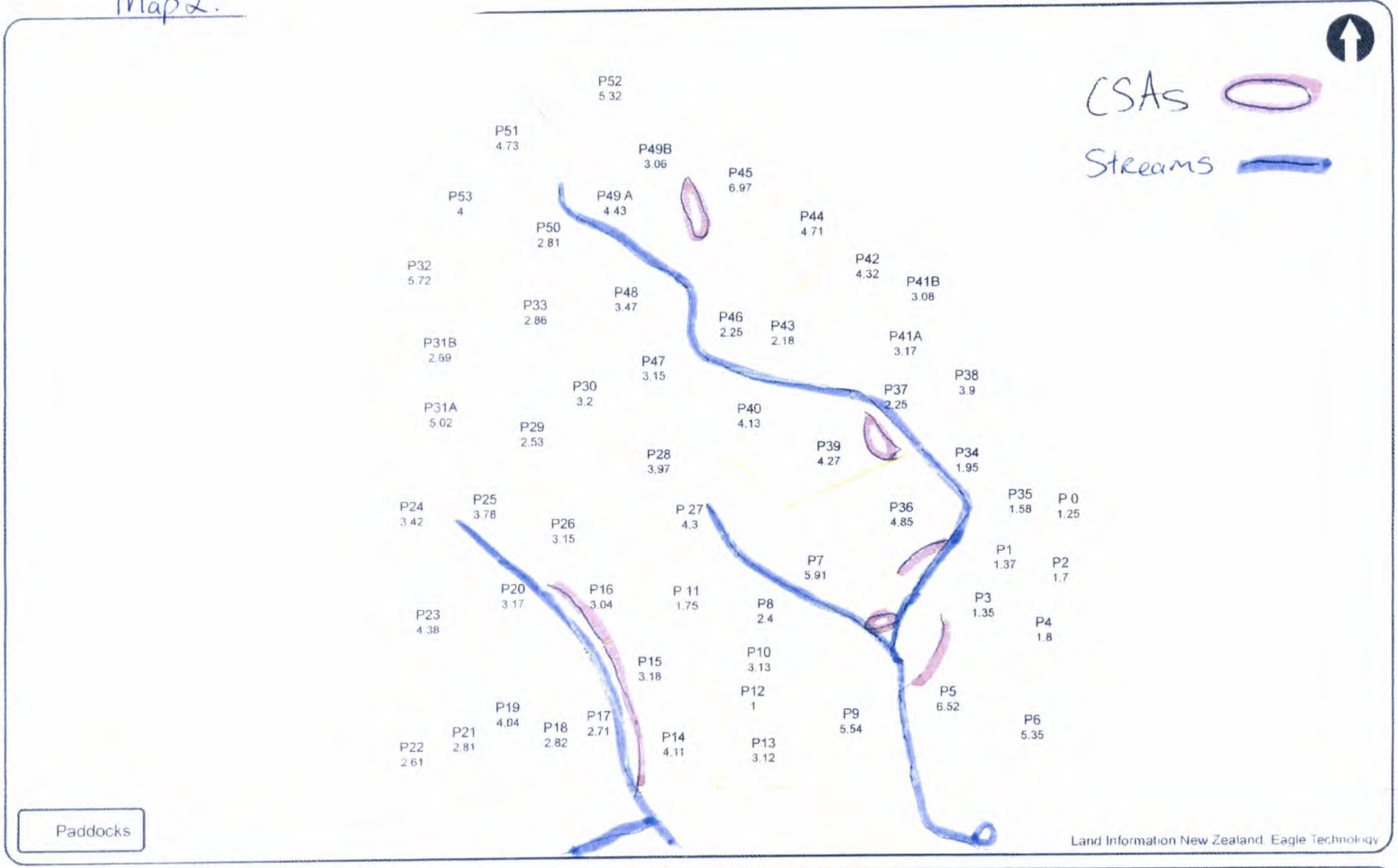
My Ravensdown Smart Maps
www.myravensdown.co.nz
Note: Areas are in hectares

SOUTH PRO MAITLAND

0 70 140 280 420 560 Metres

ravensdown

Map 2.



My Ravensdown Smart Maps
www.myravensdown.co.nz
Note: Areas are in hectares
Copyright Ravensdown Ltd

SOUTH PRO MAITLAND

0 70 140 280 420 560 Metres

ravensdown

Dairy Effluent Storage Calculator
Summary Report

Regional authority: Environment Southland Regional Council
Authorised agent: Dairy Green Limited
Client: South Pro Maitland Limited
Program version: 1.49
Report date: Wednesday, 31 October 2018
General description:
600 cows peak milk
Catchments include yards, races and vat stand
50 l/cow/day water use
Low rate irrigation
Existing pond 2,420 m3 pumpable volume
Solids separation = sludge beds

Climate
Rainfall site: Gore
Mean annual rainfall: 959 mm/year

Effluent Block
Area of low risk soil: 0.0 hectares
Minimum area of high risk soil: 100.0 hectares
Surplus area of high risk soil: 0.0 hectares

Wash Water
Yard wash:
- Milking season starts: 01 August
- Milking season ends: 31 May

Month	Number of Cows	Hours in Yard	Wash Volume (cubic metres)
January	590	3.0	29.5
February	590	3.0	29.5
March	580	3.0	29.0
April	560	3.0	28.0
May	450	3.0	22.5
June	0	0.0	0.0
July	0	0.0	0.0
August	300	3.0	15.0
September	520	3.0	26.0
October	600	3.0	30.0
November	600	3.0	30.0
December	590	3.0	29.5

Irrigation
Winter-spring depth: 3 mm
Spring-autumn depth: 4 mm
Winter-spring volume: 72 cubic metres
Spring-autumn volume: 144 cubic metres
Irrigate all year? No
Don't irrigate start: 25 June
Don't irrigate end: 28 July

Catchments

Yard Area:	994 square metres
Diverted?	Yes
- diversion start:	06 June
- diversion end:	30 July
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:	0 square metres

Storage

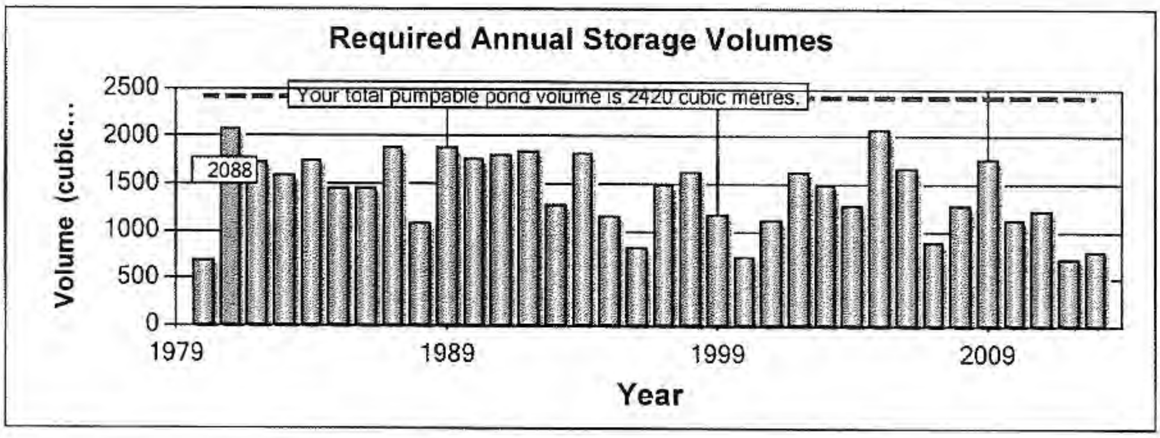
Pond/s present?	Yes
No. of ponds:	1 pond/s
Includes irregular ponds?	No
Pond 1	
- total volume:	2997 cubic metres
- pumpable volume:	2420 cubic metres
- surface area:	1224 square metres
- width:	34.0 metres
- length:	36.0 metres
- batter:	2.0:1
- total height:	4.0 metres
- pumped?	Yes
Tank/s present?	No
Emergency storage period:	0 days

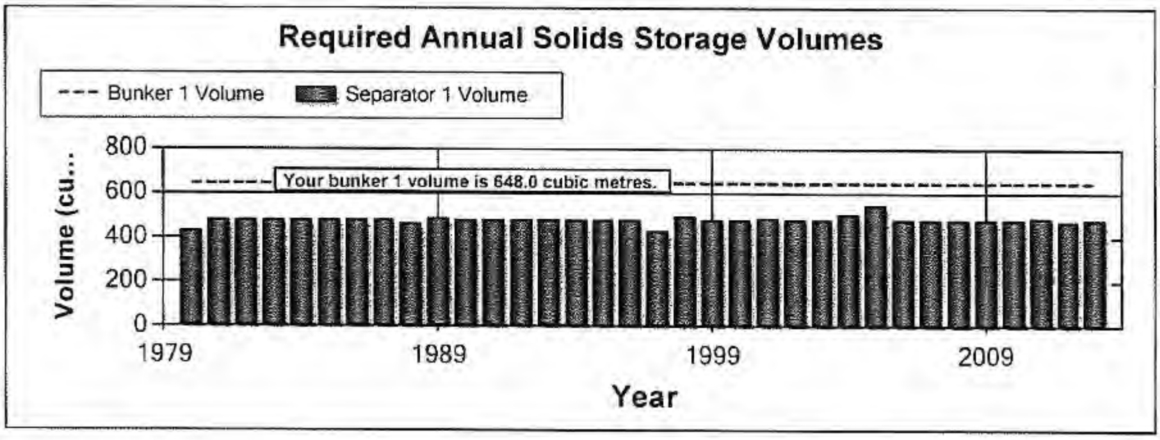
Solids Separation

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:	15 May
- bunker length:	30.0 metres
- bunker width:	18.0 metres
- bunker height:	1.2 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:	2088 cubic metres
90 % probability storage pond volume:	1946 cubic metres
Maximum required solids bunker volume:	549.2 cubic metres
During the period from:	01 July 1979
To:	30 June 2013





NEW ZEALAND COMPANIES OFFICE | COMPANIES REGISTER

Certificate of Incorporation

SOUTH PRO MAITLAND LIMITED

3013643

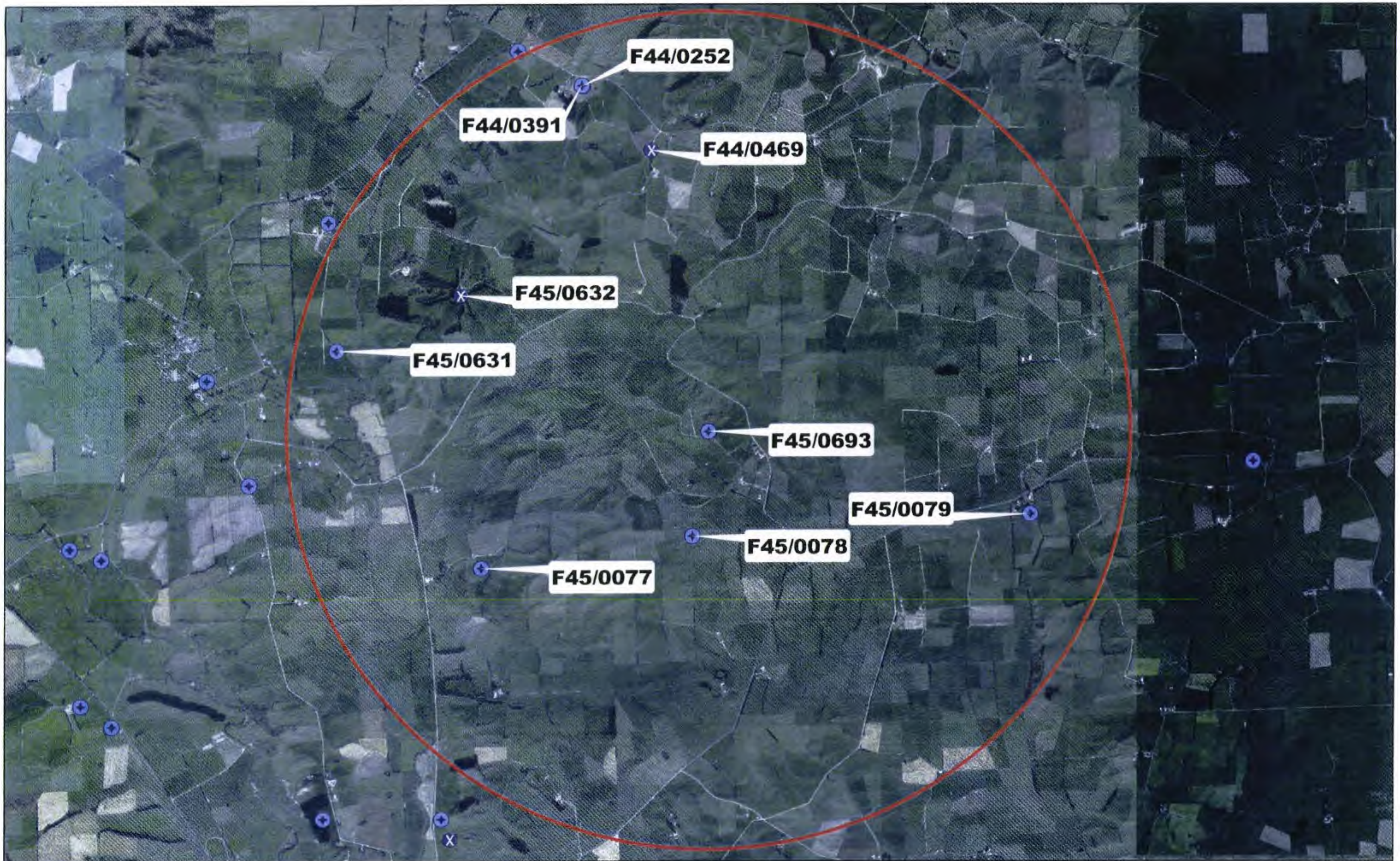
NZBN: 9429031473491

This is to certify that MCINTOSH FARMS LIMITED was incorporated under the Companies Act 1993 on the 1st day of July 2010
and changed its name to MAITLAND DAIRY LIMITED on the 18th day of April 2012
and changed its name to SOUTH PRO MAITLAND LIMITED on the 17th day of April 2014.

Registrar of Companies
21st day of November 2018

REGISTRAR OF COMPANIES NEW ZEALAND

Site Name	Time	Entercocci <CFU>	Faecal Coliform <CFU>	Nitrogen (Nitrate Nitrite)	Nitrogen (Nitrate)	Nitrogen (Total Ammoniacal)
			(cfu)	(g/m3)		(g/m3)
F44/0252	09-Oct-2007 09:30:00	<1.00	<1.00	0.04	0.04	0.26
F45/0631	24-Sep-2013 09:00:00	<1.00	<1.00	0.19		0.09



environment SOUTHLAND REGIONAL COUNCIL Te Taiao Tonga

Bore Search 4000 m 1295936E 4906064N

Wednesday, 15 August 2018

Wells

N

1:46,130

DISCLAIMER
While every effort has been made to ensure the content is correct. Environment Southland cannot guarantee the accuracy of the data. This information should not be reused in any manner without consultation.

Aerial Photography dated 5/2/2007 to 24/03/2011.

Soil name: Chatton

Overview

Chatton soils occupy 4000 ha on rolling downlands north of Gore. They are formed into windblown loess overlying old and strongly weathered gravelly alluvium. They are moderately deep, moderately well drained soils, with silt loam texture. Present use is pastoral farming with sheep, dairy and deer with some cropping. Regular rain occurs though soils can be seasonally dry in some summers.

Soil classification

NZ Soil Classification (NZSC): Typic Firm Brown; soils with stones; silty over skeletal
Previous NZ Genetic Classification: Moderately leached yellow-brown earth

Classification explanation

The NZSC of Chatton soils is consistent with the previous classification. These are moderately well drained, moderately weathered soils, with a compact gravelly subsoil below 45cm depth. The gravels are commonly quartz, although weathered greywacke gravels are equally abundant. The soils typically have silty texture, although the gravelly layer is more clayey.

Soil phases and variants

Identified units in the Chatton soils are:

- Chatton hilly moderately deep (CtH2): has gravel between 45 and 90cm depth; occurs on slopes of 15-25°
- Chatton undulating moderately deep (CtU2): has gravel between 45 and 90cm depth; occurs on slopes of 0-7°
- Chatton rolling moderately deep (CtR2): has gravel between 45 and 90cm depth; occurs on slopes of 7-14°
- Chatton steep moderately deep (CtS2): has gravel between 45 and 90 cm depth; occurs on slopes >25°

The soil properties described in this Technical Data Sheet are based on the most common phase, Chatton hilly moderately deep (CtH2). Values for other phases and variants can be taken as being similar. Where they differ significantly they are recorded with a separate versatility rating, e.g., Chatton undulating moderately deep (CtU2).

Associated soils

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

- Waikoikoi: has no gravels within 90cm depth; poorly drained with a subsoil fragipan.
- Benio: shallow soil with gravels through the profile.
- Jacobstown: poorly drained floodplain soil
- Arthurton: imperfectly drained soil formed in deep loess; shows Brown-Pallic intergrade properties

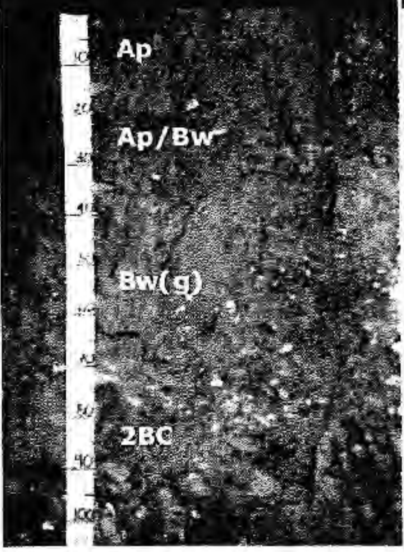
Similar soils

Some soils that have similar properties to Chatton soils are:

- Oteramika: predominantly shallow soils forming on terrace shoulders and sideslopes in southern Southland
- Wairaki: occurs on high terraces and fans from the Takitimu mountains. Formed in tuffaceous greywacke alluvium

Typical profile features

The following is a 'generic' or composite profile description representing the most common combination of characteristics for this soil type. The actual profiles for which descriptions and data are available are listed at the end of this Technical Data Sheet.

Chatton profile	Horizon	Depth (cm)	Description
	0-15	Ap	Greyish yellow brown slightly gravelly silt loam; slightly firm soil strength; moderately developed fine to medium polyhedral structure; gravels moderately weathered and rounded; abundant roots.
	15-35	Ap/Bw	Dull yellow orange slightly gravelly silt loam; many worm casts; slightly firm soil strength; strongly developed fine to medium polyhedral structure; gravels moderately weathered and rounded; many roots.
	35-72	Bw(g)	Bright yellowish brown moderately gravelly silt loam; few light yellow mottles; few worm casts; slightly firm soil strength; moderately developed very fine to medium polyhedral structure; gravels moderately weathered and rounded; many roots.
	72-90	2BC	Bright yellowish brown very gravelly clay loam; slightly firm soil strength; massive; gravels moderately weathered and rounded; many roots.

Key profile features

Chatton soils have a 15-25cm deep topsoil that has a moderately developed structure. Subsoil structure is also moderately developed and grades to massive in the gravelly subsoil layer.

Typical physical properties

Note: values in Italics are estimates

Horizon	Depth (cm)	Bulk density	Permeability	Texture	Gravel content
Ap	0-15	Moderate	Moderate	Silt loam	Slightly gravelly
Ap/Bw	15-35	Moderate	Moderate	Silt loam	Slightly gravelly
Bw(g)	35-72	Moderate - High	Moderate	Silt loam	Moderately gravelly
2BC	72-90	Moderate - High	Slow	Clay loam	Very gravelly

Profile drainage: Moderately well
Plant readily available water: Moderately high
Potential rooting depth: Moderately deep
Rooting restriction: Very gravelly subsoil

Key physical properties

Chatton soils have a moderately deep rooting depth and moderately high plant available water. The soils are moderately well drained, but have slow permeability in the lower subsoil. Textures are silt loams, with clay loams occurring in the gravelly subsoil (below 45cm depth). Topsoil clay content is 20-30%. Stones and gravel are present in the subsoil and can occasionally occur in the topsoil.

Typical chemical properties

Horizon	Depth (cm)	pH	P retention	CEC	BS	Ca	Mg	K	Na
Ap	0-15	Low	Moderate	Moderate	Low	Very low	Moderate	Moderate	Low
Ap/Bw	15-35	Low	Moderate	Moderate	Very low	Very low	Low	Very low	Low
Bw(g)	35-72	Moderate	Moderate	Low	Very low	Very low	Low	Very low	Low
2BC	72-90	Moderate	Low	Low	Very low	Very low	Very low	Very low	Low

Key chemical properties

Topsoil organic matter levels are 5-6%; P-retention values 30-40% and pH values low (mid 5s). Cation exchange values are moderate in the topsoil, but base saturation is low. Available calcium levels are low and magnesium and potassium levels moderate. Natural reserves of phosphorus are low. Micronutrient levels are generally adequate although boron responses in brassicas and molybdenum responses in legumes can be expected.

Vulnerability to environmental degradation

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 moderate clay content and P-retention values.
Nutrient leaching	moderate	These soils have a moderate vulnerability to leaching to groundwater. This rating reflects the good drainage that is offset by the moderately high water-holding capacity.
Topsoil erodibility by water	slight	Due to the moderate organic matter and 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	slight	These soils have a slight vulnerability to waterlogging during wet periods. This rating reflects the moderate drainage and slow subsoil permeability.

General landuse versatility ratings for Chatton soils

Note: The versatility ratings in the table below are indicative of the major limitations for semi-intensive to intensive landuse. 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.

CtH2 (Chatton hilly moderately deep)

Versatility evaluation for soil CtH2		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Unsuitable	Hilly slopes
Arable	Unsuitable	Hilly slopes
Intensive pasture	Limited	Hilly slopes
Forestry	Moderate	Hilly slopes; restricted rooting depth

CtU2 (Chatton undulating moderately deep)

Versatility evaluation for soil CtU2		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Moderate	Risk of short-term waterlogging after heavy rain; restricted rooting depth
Arable	Moderate	Risk of short-term waterlogging after heavy rain
Intensive pasture	Moderate	Restricted subsoil root penetrability
Forestry	Moderate	Restricted rooting depth

CtR2 (Chatton rolling moderately deep)

Versatility evaluation for soil CtR2		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Moderate	Risk of short-term waterlogging after heavy rain; restricted rooting depth
Arable	Limited	Rolling slopes
Intensive pasture	Moderate	Restricted subsoil root penetrability
Forestry	Moderate	Restricted rooting depth

CtS2 (Chatton steep moderately deep)

Versatility evaluation for soil CtS2		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Unsuitable	Steep slopes
Arable	Unsuitable	Steep slopes
Intensive pasture	Limited	Steep slopes
Forestry	Limited	Steep slopes

Management practices that may improve soil versatility

- Care with intensive grazing to minimise pugging when soils are excessively wet.
- Management of nutrient applications that minimise leaching losses

Soil profiles available for Chatton soils

Soil symbol	Profile ID	Topoclimate map sheet	Profile description available	Physical data available	Chemical data available	Profile photo available
CtS2	TT11	23	✓	✓	✓	✓
CtR2	GG/GW54	35	✓			

Published by Crops for Southland with financial support from Environment Southland.

Crops for Southland
PO Box 1306, Invercargill. New Zealand

Crops for Southland Inc

www.cropssouthland.co.nz

Soil name: Waikoikoi

Overview

Waikoikoi soils occupy about 62,600 ha on terraces and downlands in the Gore, northern Southland, west and south Otago areas. They are formed in deep wind-deposited loess derived from greywacke and schist rocks. They have silty textures and are poorly drained, with a dense fragipan at a depth of about 50cm which restricts water drainage. These soils respond well to mole and tile drainage and are used for sheep and dairy production, with some cropping. Regular summer rain occurs and soils are seldom dry.

Soil classification

NZ Soil Classification (NZSC): Fragic Perch-Gley Pallic; stoneless; silty
Previous NZ Genetic Classification: Yellow-grey earth.

Classification explanation

The NZSC of the Waikoikoi soils is consistent with the previous classification. Waikoikoi soils are poorly drained, due to perching of water on a dense fragipan. The subsoil above the fragipan also typically has high density, which limits root growth. Waikoikoi soils also have silty textures and P-retention of <30% throughout the profile, and are typically stone free.

Soil phases and variants

Identified units in the Waikoikoi soils are:

- Waikoikoi rolling deep (WqR1): has no gravel within 90cm depth; occurs on slopes of 7–15°
- Waikoikoi rolling moderately deep, gravelly subsoil variant (WqR2vg): has gravel between 45 and 90cm; occurs on slopes of 7–15°
- Waikoikoi hilly deep (WqH1): has no gravel within 90cm depth; occurs on slopes of 15–25°
- Waikoikoi steep deep (WqS1): has no gravel within 90cm depth; occurs on slopes of >25°
- Waikoikoi undulating deep (WgU1): has no gravel within 90 cm depth; occurs on slopes of 0–7°
- Waikoikoi undulating deep, argillic subsoil variant (WqU1vj): shows accumulation of clay in the subsoil; has no gravel within 90cm depth; occurs on slopes of 0–7°
- Waikoikoi undulating moderately deep, gravelly subsoil variant (WqU2vg): has gravel between 45 and 90 cm; occurs on slopes of 0–7°
- Waikoikoi undulating deep, imperfectly drained variant (WqU1vi): has no gravel above 90cm; occurs on slopes of 0–7°

The soil properties described in this Technical Data Sheet are based on the most common phase, Waikoikoi rolling deep (WqR1). Values for other phases and variants can be taken as being similar. Where they differ significantly they are recorded with a separate versatility rating, e.g., Waikoikoi hilly deep (WqH1).

Associated soils

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

- Arthurton: imperfectly drained Brown soil that is associated with Pallic soils of northern Southland and west Otago.
- Crookston: well drained Brown soil, that is associated with Pallic soils of northern Southland and west Otago
- Jacobstown: poorly drained soil formed in alluvium; on floodplains with high groundwater
- Benio: shallow soil formed in old weathered gravely alluvium.

Similar soils

Some soils that have similar properties to Waikoikoi soils are:

- Warepa: imperfectly drained equivalent of the Waikoikoi soil
- Athol: has perch-gley properties, but occurs where the fragipan is not within 90cm depth
- Glenure: poorly drained gley soils on terraces and downlands
- Pukemutu: have silty clay subsoil, and fragipan occurs below 60cm depth and does not have prismatic structure
- Hokonui: has clayey textures, and is formed in mixed loess and alluvium on fans from the Hokonui hills.

Typical profile features

The following is a 'generic' or composite profile description representing the most common combination of characteristics for this soil type. The actual profiles for which descriptions and data are available are listed at the end of this Technical Data Sheet.

Waikoikoi profile	Horizon	Depth (cm)	Description
	Apg	0–15	Greyish yellow-brown silt loam; few reddish brown mottles; weak soil strength; moderately developed medium polyhedral structure; abundant roots
	Apg/Bg	15–29	Greyish yellow silt loam; common orange mottles; many worm casts; weak soil strength; moderately developed medium polyhedral structure; many roots
	Bg	29–53	Greyish yellow silt loam; common yellowish brown mottles; few worm casts; slightly firm soil strength; weakly developed coarse polyhedral structure; common roots
	BCx	53–90	Dull yellowish brown silt loam; few greyish yellow veins with reddish brown selvedge; firm soil strength; weakly developed extremely coarse prismatic structure; few roots in veins

Key profile features

Waikoikoi soils have a 15–25cm deep topsoil that has moderately developed structure. Subsoil structure is moderate to weak in the upper subsoil, abruptly changing in the lower subsoil to the weakly developed extremely coarse prismatic of the fragipan. Greyish colours are dominant in the upper subsoil, indicating the poor drainage caused by water perching on the fragipan.

Typical physical properties

Note: values in Italics are estimates

Horizon	Depth (cm)	Bulk density	Permeability	Texture	Gravel content
Apg	**0–15**	Moderate – High	*Moderate*	Silt loam	Gravel free
Apg/Bg	**15–29**	Moderate – High	*Moderate*	Silt loam	Gravel free
Bg	**29–53**	Moderate – High	*Slow*	Silt loam	Gravel free
BCx	**53–90**	High	*Slow*	Silt loam	Gravel free

Profile drainage: Poorly drained
Plant readily available water: *Moderately high*
Potential rooting depth: Slightly deep
Rooting restriction: Fragipan

Key physical properties

Waikoikoi soils have a slightly deep potential rooting depth that is severely restricted by the fragipan at 45–60 cm depth. The soils are poorly drained, with very slow permeability in the subsoil and limited aeration during sustained wet periods. Textures are typically silt loams, but range between loamy silt and heavy silt loam (15–30% clay). Topsoil clay content is typically 20–25%, and stone free. The moderately deep variants have gravels between 45 and 90cm depth.

Typical chemical properties

Horizon	Depth (cm)	pH	P retention	CEC	BS	Ca	Mg	K	Na
Apg	**0–15**	Moderate	Low	Moderate	High	High	Very low	Very low	Very low
Apg/Bg	**15–29**	Moderate	Low	Low	Moderate	Low	Very low	Very low	Very low
Bg	**29–53**	Moderate	Low	Low	Moderate	Low	Very low	Very low	Low
BCx	**53–90**	Moderate	Low	Low	Moderate	Low	Moderate	Very low	Low

Key chemical properties

Topsoil organic matter levels are 5–7%; P-retention values mostly under 30%; pH values are moderate and tend to decrease down the profile. Cation exchange values are moderate to low and base saturation values moderate. Available calcium magnesium and potassium levels are usually low. Reserves of phosphorus are low and there is some increase in sulphate sulphur levels n the subsoil. Micro-nutrient levels are generally adequate, although boron responses in brassicas and molybdenum responses in legumes can be expected.

Vulnerability to environmental degradation

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	Very severe	These soils have a very severe vulnerability to structural degradation by long-term cultivation, or compaction by heavy stocking and vehicles. This rating reflects the poor drainage, low clay and P-retention in the topsoil that results in low structural stability.
Nutrient leaching	Slight	These soils have a slight vulnerability of leaching to groundwater. This rating reflects the moderately high water-holding capacity and slow permeability of the fragipan, but leaching risk can be increased by lateral mole and tile drains.
Topsoil erodibility by water	Moderate	Due to the low clay content, the topsoil erodibility of these soils is moderate. Erodibility is highly dependent on management, 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 permeability of the subsoil.

General landuse versatility ratings for Waikoikoi soils

Note: The versatility ratings in the table below are indicative of the major limitations for semi-intensive to intensive landuse. 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.

WqR1 (Waikoikoi rolling deep)
WqR2vg (Waikoikoi rolling moderately deep gravelly subsoil variant)

Versatility evaluation for soil WqR1, WqR2vg		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Limited	Inadequate aeration during wet periods; restricted rooting depth.
Arable	Limited	Inadequate aeration during wet periods; rolling slopes
Intensive pasture	Limited	Risk of short-term waterlogging after heavy rain; rolling slopes
Forestry	Limited	Inadequate aeration during wet periods; restricted rooting depth.

WqU1 (Waikoikoi undulating deep)
WqU1vj (Waikoikoi undulating deep argillic variant)
WqU2vg (Waikoikoi undulating moderately deep gravelly subsoil variant)

Versatility evaluation for soil WqU1, WqU1vj, WqU2vg		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Limited	Inadequate aeration during wet periods; restricted rooting depth.
Arable	Limited	Inadequate aeration during wet periods; restricted rooting depth.
Intensive pasture	Limited	Vulnerability of topsoil to structural degradation by cultivation and compaction; risk of short-term waterlogging after heavy rain.
Forestry	Limited	Inadequate aeration during wet periods; restricted rooting depth.

WqU1vi (Waikoikoi undulating moderately deep imperfectly drained variant)

Versatility evaluation for soil WqU1vi.		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Limited	Inadequate aeration for sustained periods; restricted rooting depth.
Arable	Limited	Vulnerability of topsoil to structural degradation by cultivation and compaction; vulnerability to sustained waterlogging.
Intensive pasture	Limited	Risk of short-term waterlogging after heavy rain.
Forestry	Limited	Restricted rooting depth.

WqH1 (Waikoikoi hilly deep)
WqS1 (Waikoikoi steep deep)

Versatility evaluation for soil WqH1, WqS1.		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Unsuitable	Hilly to steep slopes
Arable	Unsuitable	Hilly to steep slopes
Intensive pasture	Limited	Vulnerability of topsoil to structural degradation by cultivation and compaction.
Forestry	Limited	Inadequate aeration during wet periods; restricted rooting depth.

Management practices that may improve soil versatility

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

Soil profiles available for Waikoikoi soils

Soil symbol	Profile ID	Topoclimate map sheet	Profile description available	Physical data available	Chemical data available	Profile photo available
WqU1	TT4	23	✓	✓	✓	✓
WqU1	B5	12	✓	✓	✓	✓
WqU1vi	B7	12	✓	✓	✓	✓
WqU1	0T03	42	✓	✓	✓	✓
WqU1	FT10	15	✓	✓	✓	✓
WqU1	GG/GW/72	35	✓	✓		
WqU1	GMT2	27	✓	✓	✓	✓
WqU1	GT3	4	✓	✓	✓	✓
WqU1	H9	3	✓	✓	✓	✓
WqR1	H10	3	✓	✓	✓	✓
WqU1	M102R	1	✓	✓		
WqU1	M3159	1	✓	✓		
WqU1	PCT07	33	✓	✓	✓	✓
WqU1	PCT13	33	✓	✓	✓	✓
WqU1	PCT14	33	✓	✓	✓	✓
WqU1	RT2	11	✓	✓	✓	✓
WqU1	RT3	11	✓	✓	✓	✓
WqU2vg	RT7	11	✓	✓	✓	✓
WqR1	SB09118	27	✓	✓		
WqU1	TT5	23	✓	✓	✓	✓
WqU1	TT6	23	✓	✓	✓	✓
WqU1	TT7	23	✓	✓	✓	✓
WqU1	WCT1	34	✓	✓	✓	✓
WqU1vj	WT8	24	✓	✓	✓	✓

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Manaaki Whenua
Landcare Research

SOIL REPORT

Environment Southland

Report generated: 20-Nov-2018 from https //smap landcareresearch co nz

This information sheet describes the typical average properties of the specified soil to a depth of 1 metre, and should not be the primary source of data when making land use decisions on individual farms and paddocks.

S-map correlates soils across New Zealand. Both the old soil name and the new correlated (soil family) name are listed below.

Family: Claremont*f*

Smap ref: Clar_34a.1

Waikoikoi hilly deep (Claremont_34a.1)

Key physical properties

Depth class (diggability)		Moderately deep (50 - 70 cm)
Texture profile		Silty loam
Potential rooting depth		50 - 70 (cm)
Rooting barrier		Pan
Topsoil stoniness		Stoneless
Topsoil clay range		20 - 30 %
Drainage class		Poorly drained
Aeration in root zone		Very limited
Permeability profile		Moderate over slow
Depth to slowly permeable horizon		50 - 70 (cm)
Permeability of slowest horizon		Slow (< 4 mm/h)
Profile available water	(0 - 100cm or root barrier)	Moderate (94 mm)
	(0 - 60cm or root barrier)	High (94 mm)
	(0 - 30cm or root barrier)	High (52 mm)
Dry bulk density, topsoil		1.22 g/cm³
Dry bulk density, subsoil		1.22 g/cm³
Depth to hard rock		No hard rock within 1 m
Depth to soft rock		No soft rock within 1 m
Depth to stony layer class		No significant stony layer within 1 m

Key chemical properties

Topsoil P retention	Low (22%)

About this publication

- This information sheet describes the *typical average properties* of the specified soil.
- For further information on individual soils, contact Landcare Research New Zealand Ltd. www landcareresearch co nz
- Advice should be sought from soil and land use experts before making decisions on individual farms and paddocks.
- The information has been derived from numerous sources. It may not be complete, correct or up to date.
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- Landcare Research shall not be liable on any legal basis (including without limitation negligence) and expressly excludes all liability for loss or damage howsoever and whenever caused to a user of this factsheet.

Family: Claremont*f*

Smap ref: Clar_34a.1

Waikoikoi hilly deep (Claremont_34a.1)

Additional factors to consider in choice of management practices

Vulnerability classes relate to soil properties only and do not take into account climate or management

Soil structure integrity

Structural vulnerability	High (0.70)
Pugging vulnerability	not available yet

Water management

Water logging vulnerability	High
Drought vulnerability - if not irrigated	Moderate
Bypass flow	Medium
Hydrological soil group	D

Contaminant management

N leaching vulnerability	Medium
P leaching vulnerability	not available yet
Bypass flow	Medium
Dairy effluent (FDE) risk category	C if slope > 7 deg otherwise B

Relative Runoff Potential

Slope	0-3°	4-7°	8-15°	16-25°	>25°
Risk	H	VH	VH	VH	VH

Additional information

Soil classification	Fragic Perch-gley Pallic Soils (PPX)
Family	*Claremontf*
Sibling number	34
Profile texture group	Silty
Soil profile material	Stoneless soil
Rock class of stones/rocks	Not applicable
Rock origin of fine earth	From hard sandstone and schist rock
Parent material origin	Loess

Characteristics of functional horizons in order from top to base of profile:

Functional Horizon	Thickness	Stones	Clay*	Sand*
Loamy Weak	15 - 20 cm	0 %	20 - 30 %	5 - 15 %
Loamy Weak	10 - 20 cm	0 %	20 - 30 %	5 - 15 %
Loamy Coarse Slightly Firm	20 - 30 cm	0 %	20 - 30 %	5 - 15 %
Loamy Coarse Firm	30 - 55 cm	0 %	20 - 30 %	5 - 15 %

* clay and sand percent values are for the mineral fines (excludes stones). Silt = 100 - (clay + sand)

Soil information for OVERSEER

The following information can be entered in the OVERSEER® Nutrient Budget model. This information is derived from the S-map soil properties which are matched to the most appropriate OVERSEER categories. Please read the notes below for further information.

Soil description page

1. Select **Link to S-map**
2. Under S-map sibling data enter the S-map name/ref: **Clar_34a.1**

Considerations when using Smap soil properties in OVERSEER

- The soil water values are estimated using a regression model based on soil order, parent rock, soil functional horizon information (stone content, soil density class), as well as texture (field estimates of sand, silt and clay percentages). The model is based on laboratory - measured water content data held in the National Soils Database and other Manaaki Whenua datasets. Most of this data comes from soils under long-term pasture and may vary from land under arable use, irrigation, etc.

- Each value is an estimate of the water content of the whole soil within the target depth range or to the depth of the root barrier (if this occurs above the base of the target depth). Where soil layers contain stones, the soil water content has been decreased according to the stone content.

- S-map only contains information on soils to a depth of 100 cm. The soil water estimates in the > 60 cm depth category assume that the bottom functional horizon that extends to 100 cm, continues down to a depth of 150cm. Where it is known by the user that there is an impermeable layer or non-fractured bedrock between 100 and 150 cm, this depth should be entered into OVERSEER. Where there is a change in the soil profile characteristics below 100 cm, the user should be aware that the values provided on this factsheet for the > 60 cm depth category will not reflect this change. For example, the presence of gravels at 120 cm would usually result in lower soil water estimates in the > 60 cm depth category. Note though that this assumption only impacts on a cropping block, as OVERSEER uses soil data from just the top 60 cm in pastoral blocks.

- OVERSEER requires the soil water values to be non-zero integers (even though zero is a valid value below a root barrier), and the wilting point value must be less than the field capacity value which must be less than the saturation value. The S-map water content estimates supplied by the web service have been rounded to integers and may be assigned minimal values to meet these OVERSEER requirements. These modifications will result in a slightly less accurate estimate of Available Water to 60 cm (labelled PAW in OVERSEER) than that provided on the first page of this factsheet, but this is not expected to lead to any significant difference in outputs from OVERSEER.

Manaaki Whenua
Landcare Research

SOIL REPORT

Environment Southland

Report generated: 20-Nov-2018 from https //smap landcareresearch co nz

This information sheet describes the typical average properties of the specified soil to a depth of 1 metre, and should not be the primary source of data when making land use decisions on individual farms and paddocks.

S-map correlates soils across New Zealand. Both the old soil name and the new correlated (soil family) name are listed below.

Family: Waikiwi*f*

Smap ref: Waiki_29a.1

Chatton hilly moderately deep (Waikiwi_29a.1)

Key physical properties

Depth class (diggability)		Moderately deep (45 - 90 cm)
Texture profile		Silty loam
Potential rooting depth		45 - 90 (cm)
Rooting barrier		Extremely gravelly
Topsoil stoniness		Slightly stony
Topsoil clay range		20 - 30 %
Drainage class		Moderately well drained
Aeration in root zone		Slightly limited
Permeability profile		Moderate over slow
Depth to slowly permeable horizon		45 - 90 (cm)
Permeability of slowest horizon		Slow (< 4 mm/h)
Profile available water	(0 - 100cm or root barrier)	Moderate (103 mm)
	(0 - 60cm or root barrier)	High (95 mm)
	(0 - 30cm or root barrier)	High (55 mm)
Dry bulk density, topsoil		1.09 g/cm³
Dry bulk density, subsoil		1.09 g/cm³
Depth to hard rock		No hard rock within 1 m
Depth to soft rock		No soft rock within 1 m
Depth to stony layer class		Moderately deep

Key chemical properties

Topsoil P retention	Medium (43%)

About this publication

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- Landcare Research shall not be liable on any legal basis (including without limitation negligence) and expressly excludes all liability for loss or damage howsoever and whenever caused to a user of this factsheet

Family: *Waikiwif*

Smap ref:

Chatton hilly moderately deep (Waikiwi_29a.1)

Additional factors to consider in choice of management practices

Vulnerability classes relate to soil properties only and do not take into account climate or management

Soil structure integrity

Structural vulnerability	Moderate (0.54)
Pugging vulnerability	not available yet

Water management

Water logging vulnerability	Low
Drought vulnerability - if not irrigated	Moderate
Bypass flow	Medium
Hydrological soil group	C

Contaminant management

N leaching vulnerability	Medium
P leaching vulnerability	not available yet
Bypass flow	Medium
Dairy effluent (FDE) risk category	C if slope > 7 deg otherwise D

Relative Runoff Potential

Slope	0-3°	4-7°	8-15°	16-25°	>25°
Risk	VL	L	L	M	M

Additional information

Soil classification	Typic Firm Brown Soils (BFT)
Family	*Waikiwif*
Sibling number	29
Profile texture group	Silty
Soil profile material	Moderately deep soil
Rock class of stones/rocks	From hard sandstone rock
Rock origin of fine earth	From hard sandstone rock
Parent material origin	Loess on alluvium

Characteristics of functional horizons in order from top to base of profile:

Functional Horizon	Thickness	Stones	Clay*	Sand*
Loamy Fine Slightly Firm	10 - 20 cm	3 - 5 %	20 - 30 %	10 - 30 %
Stony Loamy Fine Slightly Firm	15 - 30 cm	5 - 10 %	20 - 30 %	10 - 30 %
Stony Loamy Fine Slightly Firm	20 - 40 cm	15 - 35 %	20 - 35 %	10 - 30 %
Very Stony Loamy Compact	25 - 40 cm	40 - 70 %	25 - 40 %	30 - 60 %

* clay and sand percent values are for the mineral fines (excludes stones). Silt = 100 - (clay + sand)

Soil information for OVERSEER

The following information can be entered in the OVERSEER® Nutrient Budget model. This information is derived from the S-map soil properties which are matched to the most appropriate OVERSEER categories. Please read the notes below for further information.

Soil description page

1. Select **Link to S-map**
2. Under S-map sibling data enter the S-map name/ref: **Waiki_29a.1**

Considerations when using Smap soil properties in OVERSEER

- The soil water values are estimated using a regression model based on soil order, parent rock, soil functional horizon information (stone content, soil density class), as well as texture (field estimates of sand, silt and clay percentages). The model is based on laboratory - measured water content data held in the National Soils Database and other Manaaki Whenua datasets. Most of this data comes from soils under long-term pasture and may vary from land under arable use, irrigation, etc.

- Each value is an estimate of the water content of the whole soil within the target depth range or to the depth of the root barrier (if this occurs above the base of the target depth). Where soil layers contain stones, the soil water content has been decreased according to the stone content.

- S-map only contains information on soils to a depth of 100 cm. The soil water estimates in the > 60 cm depth category assume that the bottom functional horizon that extends to 100 cm, continues down to a depth of 150cm. Where it is known by the user that there is an impermeable layer or non-fractured bedrock between 100 and 150 cm, this depth should be entered into OVERSEER. Where there is a change in the soil profile characteristics below 100 cm, the user should be aware that the values provided on this factsheet for the > 60 cm depth category will not reflect this change. For example, the presence of gravels at 120 cm would usually result in lower soil water estimates in the > 60 cm depth category. Note though that this assumption only impacts on a cropping block, as OVERSEER uses soil data from just the top 60 cm in pastoral blocks.

- OVERSEER requires the soil water values to be non-zero integers (even though zero is a valid value below a root barrier), and the wilting point value must be less than the field capacity value which must be less than the saturation value. The S-map water content estimates supplied by the web service have been rounded to integers and may be assigned minimal values to meet these OVERSEER requirements. These modifications will result in a slightly less accurate estimate of Available Water to 60 cm (labelled PAW in OVERSEER) than that provided on the first page of this factsheet, but this is not expected to lead to any significant difference in outputs from OVERSEER

Dairy Green Ltd

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South Pro Maitland Limited

December 2018

Application for:

- Land Use Consent for Dairy Farming
- Discharge Permit – Replacement of **20146428**

Farm Location: Garden Gully Road, Maitland

Application prepared for South Pro Maitland Limited by Dairy Green Ltd.

Table of Contents:

1. Overview

1.1 Background

South Pro Maitland Limited operate a dairy farm at 131 Garden Gully Road, Gore. Existing consents are held in the name of *Maitland Dairies Limited.*

In March 2016 resource consent for the discharge of agricultural effluent to land from 550 cows was granted to Maitland Dairies Limited (AUTH-20146428). During the process of renewing the discharge permit at the time, the authorised cow number was decreased from 599 cows to 550 cows. It has since been revealed that this was an error; the consent holders did not intend for the renewed consent granted in 2016 to decrease cow numbers. Their intention was to renew the discharge permit for 599 cows. This application sets out to correct the error made in the 2016 renewal application that resulted in a reduction in consented cow numbers. It is proposed to replace the existing discharge permit to authorise the discharge of effluent from 600 cows.

The regulatory environment in Southland has changed significantly since 2016; in order to increase cow numbers on the discharge permit the applicants are now required to apply for a land use consent for farming under the decision's version of the proposed Southland Water and Land Plan (2018).

This application is structured as follows:

Section 1 – Overview

Section 2 – Consents required

Section 3 – Statutory considerations

Section 4 – Notification

Section 5 – Description of receiving environment

Section 6 – Proposal details including GMPs, mitigations and nutrient budgets

Section 7 – AEE of effluent discharge activity, AEE of dairy farming activity

Section 8 – Consultation

Section 9 – Conclusion

Section 10 - References

As is explained in section 2.1, the name of the new consent holder on the land use consent for dairy farming and the discharge permit will be "South Pro Maitland Limited."

1.1.1 Land use consent for farming

It is proposed to apply for land use consent for farming under Rule 20 d) of the proposed Southland Water and Land Plan 2018 (hereafter referred to as "pSWLP") due to an increase from 550 to 600 cows. The landholding contains a dairy platform, the land area of which is no greater than at 3 June 2016. The landholding boundary is as per the existing Appendix 1 Discharge Map, with all areas contained within the boundary being part of the dairy platform. There are no other land areas under control of the applicants that are regarded to be part of the landholding. The dairy platform contains a milking shed and an effluent management system.

To allow for the proposed increase in cow numbers, resource consent is being sought under **Rule 20 d)** of the pSWLP for the ongoing use of the land for dairy farming including an increase in cow numbers. As is described in Section 2, this is a restricted discretionary activity under Rule 20 due to the proposed increase in cow numbers. According to Beacon, the land is classed in the Gleyed and Oxidising (overland flow variant) physiographic zones.

An output-based land use consent is requested, which will specify a limit for nitrogen that must not be exceeded annually. A year-end Overseer nutrient budget will be prepared annually and reported to Environment Southland to demonstrate that nutrient limits have not been exceeded. Proposed conditions for the land use consent are included in the section 2.3.

The proposed activity has been considered in terms of key pSWLP objectives and policies and based on this assessment should be granted. Effects on the existing environment have been considered and are described in the assessment provided in Section 7 of the application. The assessment concludes that effects on receiving surfacewaters, groundwater and soils, including cumulatively, will be no more than minor due to the proposed activity.

Importantly, there will be no increase in contaminant loss compared to average annual losses over the last five years and the N loading to receiving waters in the Mataura River catchment will not increase. In terms of a large wider catchment, the proposed increase of 50 cows (9%) over what is currently permitted (550) is a very small increase. Due to the scale of the activity and proposed change, in parallel with the implementation of mitigation measures, values associated with groundwater, receiving surfacewaters and soils will not be adversely affected by the proposed activity.

Note: In this application, the term "landholding" is used interchangeably with "dairy farm" "dairy platform," and "property."

1.1.2 Overseer nutrient budgets

Overview

Overseer nutrient budget analysis has been carried out using Overseer version 6.3.0 and using "Overseer Best Input Standards, March 2018." Five pre-expansion nutrient budgets (for years 13/14 to 17/18 inclusive) and one proposed post-expansion nutrient budget for 600 cows have been prepared. The pre-expansion nutrient budgets were derived by modelling the actual lawful use of land. The inputs used in pre-expansion nutrient budgets are supported with evidence, which is appended to the nutrient budget analysis report.

Nutrient losses

Comparison of nutrient losses as modelled by Overseer for the five-year pre-expansion period and the proposed system shows the following:

- No increase is predicted in the average annual N loss for the proposed system (49 kg N/ha/year) compared to the pre-expansion N loss (49 kg N/ha/year).
- The average annual P loss is predicted to increase slightly from 0.9 kg/ha/year to 1.0 kg/ha/year. This amounts to a net increase in P loss annually for the landholding of 24 kg. A large proportion of the increase (10 kg) is attributed to a sub-model in Overseer that assumes that 30% of P that lands on tracks, lanes and infrastructure ends up in waterways. P loss from infrastructure and from the wider farming activity will be mitigated through the implementation of an effective farm environmental management plan (FEMP).
- Using P loss as a proxy for sediment and microbial losses, there will be no increase in loss of sediment or microbes through the implementation of an effective FEMP.

Farm management

The applicants believe that there will be no increase in contaminant to water loss by implementing the proposed system. In recent years, they have increased production through improved nutrient, soil and pasture management. They are committed to operating a sustainable farming model, both environmentally and economically, and believe that a milking herd of 600 cows is optimal for the property. Farm profitability will be maintained by increasing the dairy herd by 50 cows, which was the cow number authorised on the discharge permit until March 2016. A FEMP has been developed for the farm in line with Appendix N of the pSWLP. Implementation of good management practices described in the FEMP relating to nutrient management, riparian management including the implementation of a planting programme, winter grazing management, and cultivation will result in improved environmental management for the dairy farm following intensification.

1.1.3 Discharge permit

It is proposed to replace the existing discharge permit with a permit authorising the discharge of agricultural effluent to land from 600 cows.

1.1.4 Water permit

As the farm is supplied water (for stock drinking water and dairy shed use) from the Glenkenich Rural Water Scheme, no water permit is required.

1.2 Property Details

1.2.1 Overview

The landholding is located in the Waikaka Stream East catchment at 131 Garden Gully Road, Gore and consists of 206 hectares of land, with an effective farm area of 195 hectares. The dairy platform encompasses the entire landholding.

Table 1.1 General property details

Landholding details	
Total area (ha)	205.7
Effective area (ha)	194.5
Consented effluent disposal area (ha)	180
Stocking rate (cows/ha)	3.1
Fodder crop/intensive winter grazing	Yes (part of herd)
Freshwater management unit	Mataura
Legal descriptions	Section 4 Block I Glenkenich SD Section 5 Block I Glenkenich SD Lot 1 DP 4553

Table 1.2

Soils*	**Soil Type**	**Vulnerability Factors**		
		Structural Compaction	**Nutrient Leaching**	**Waterlogging**
	Waikoikoi**	Very severe	Slight	Severe
	Claremont*	Very severe	Slight	Severe
	Chatton**	Moderate	Moderate	Slight
	Waikiwi*	Slight	Moderate	Slight
	Benio	Moderate	Severe	Slight
	Jacobstown**	Severe	Slight	Severe
	Eureka*	Severe	Slight	Severe
FDE land classification	A - artificial drainage/coarse soil structure C – sloping land			
Characteristics of FDE risk classification	Low risk to groundwater High risk to surfacewater			
Topography	Easy to rolling, steeper at north			

Surfacewater Management Zone	Mid-Mataura
Groundwater Zone	Unmapped
Groundwater nitrate levels	0.4 – 1.0 g/m^3
Physiographic zones	Gleyed
	Oxidising (overland flow variant)
FMU	Mataura
Nearest downstream registered drinking water supply	Gore – OTI002 - Otikerama RWS, operated by Otikerama Stock Water Supply Company, approx. 21 km to south west of dairy farm
Downstream Regionally Significant Wetland/Sensitive Waterbody	Toetoes Flats (ID:97) to west of lower Mataura River, approx. 65 km to south west of dairy farm
	Awarua Plain - Southland Estuaries: Fortrose Harbour (including lower Mataura River) (ID:1), approx. 70 km to south west of dairy farm

Topoclimate and S-Map have the same soil map but different soil names for three soil types. Physical, chemical and vulnerability properties are the same for soils named differently (e.g. Chatton and Waikiwi).

*S-Map name of soils.

**Topoclimate name of soils.

See section 5 for further information.

Figure 1.0 View to the south across the dairy farm from effluent pond location.

Figure 1.1 View to north west along waterway.

Wintering

A portion of the herd is winter grazed on farm on fodder beet in June, July and August. Fodder beet is also grazed in the shoulders of the season (May, September), when cows generally are grazed on it for 2 hours per day.

A portion of the herd is winter grazed off farm in June, July and part of August at a third-party grazier. This practice has occurred in all pre-expansion years and will continue in the future.

Third-party winter grazing of cows is described in sections 5 and 6, and its effects are considered in section 7/AEE. It is proposed to winter a maximum of 150 cows on fodder crop (fodder beet) on farm going forward, with the balance of cows (c.300) wintered off farm. Approximately 150 cows from the herd of 600 will be culled in May/June each year.

Good management practice is implemented when winter grazing cows.

Young stock

All young stock is grazed off from weaning until they return as in-calf heifers for calving. Young stock is grazed at a third-party grazier. Third-party grazing of young stock is described in sections 5 and 6, and its effects are considered in section 7/AEE.

Cultivation

Paddocks have been cultivated to sow fodder crops to provide feed for a portion of the herd over winter and in the shoulders of the season. It is proposed to continue this practice, with paddocks undergoing full cultivation into fodder beet in spring. Less area will be sown than in the previous three years when excess fodder beet was grown. Fodder crop rotates across the Claremont and Waikiwi flats and rolling blocks (~143 ha) and is part of the re-grassing programme at the farm.

Less area of fodder crop was grown on farm in 13/14 and 14/15 compared to the following three years. Correspondingly in 13/14 and 14/15, most cows were wintered off farm at third-party graziers.

Good management practice is implemented when cultivating paddocks.

1.2.2 Effluent:

Existing discharge conditions

Agricultural effluent is currently managed by way of an existing discharge permit (20146428), which expires on March 30th 2026. The existing discharge consent is for effluent from a 550 cow herd milked twice a day and silage pad leachate. The consented discharge methods include low rate pods and a high rate travelling irrigator. The existing operation does not involve winter milking.

Existing FDE areas

The discharge area of 180 hectares includes most of the landholding. Council recommended buffers are implemented and the N loading from effluent is less than 150 kg/hectare. A monitoring bore was installed in 2017 as required by the discharge permit, although no water quality data is available from the bore to date.

Existing infrastructure

South Pro Maitland Limited allows for deferred irrigation when soils are near or at field capacity by storing filtered effluent is a storage pond. The pond was constructed in c.2011 and is synthetically lined. Effluent is pumped from a concrete sump to sludge beds/weeping walls, from where it gravity flows into the storage pond (2,412 m^3 storage capacity plus 0.5 metre freeboard).

The pond passed a drop test in March 2017; the drop test report was submitted to Council and is appended to this application.

A visual assessment of the sand trap, concrete sump, sludge beds and effluent storage pond was carried out by a Suitably Qualified Person (SQP) in October 2018. Certification reports prepared by a SQP are appended to this report.

If drop tests are required for ancillary effluent storage structures, these will be provided within a timeframe agreeable to the applicants (i.e. the off-season) and Environment Southland. In the meantime, these structures will continue to be used to store, contain or treat effluent under existing use rights.

Effluent is pumped from the pond for irrigation via a low rate Larall system. Although the use of a travelling irrigator is authorised on the discharge permit, it is obsolete.

A disused effluent pond is located adjacent to the dairy shed. This will be removed in February/March 2019.

Proposed changes to effluent management and permit

It is proposed to:

- Replace existing discharge permit for 550 cows milked twice daily with a discharge permit for 600 cows;
- Include an umbilical system and slurry tanker as contingency irrigation methods;
- Remove the travelling irrigator from the discharge permit; and
- Remove the silage pad leachate from the discharge permit as the silage pad and management of silage leachate meet permitted activity rules.

No other changes are proposed for the effluent discharge permit.

Although the entire the dairy platform is authorised to receive effluent, in practice effluent is discharged to a smaller area. The effluent irrigation scheme will be expanded in the 18/19 season, to allow the discharge of effluent at low rate to a greater area (c.70 ha) via a low rate Larall system. As the entire landholding is authorised to receive effluent, this does not represent any change for the discharge permit.

No affected party approvals are required.

No change in effluent storage is proposed. According to the Massey DESC, the 90% probability volume for dairy shed effluent from 600 cows is 1,946 m^3. The existing storage capacity is 2,412 m^3, so is sufficient to meet requirements.

1.2.3 Water supply

Water supply for stock drinking water and the dairy shed is from the Glenkenich Rural Water Scheme. Water pumped from the Scheme is stored in five water storage tanks at a high point on the farm. Water gravity feeds from the hill top tanks to a stock drinking water scheme and to two storage tanks at the dairy shed. Since the Glenkenich Rural Water Scheme supplies water for dairy shed use, resource consent is not required.

Occasionally water supply from the Glenkenich Scheme ceases temporarily. When this occurs, supply to the dairy shed from the hill top tanks is turned off and water stored in the hill top tanks is exclusively used for stock drinking water. The stock drinking water supply is supplemented by surface water from a stream on farm, which is authorised under Section 14(3)(b) of the Act. The surfacewater take to supplement the Glenkenich Scheme water used for stock drinking water is small, the rate of take does not exceed 2 litres per second and the meets permitted activity rules in accordance with Rule 49 of the pSWLP.

When the Glenkenich Scheme supply ceases temporarily, the dairy shed solely relies on water stored in two tanks situated outside the shed. Water use at the dairy shed is then minimised. The frequency of yard wash down is reduced to a minimum or water is only used for plant wash. Water stored in two water storage tanks is used as efficiently as possible. In practice, water stored in the tanks has been found to last 5 days at the dairy shed. Once water reserves in dairy shed tanks are low, water is purchased from a potable water supplier who tank it into the farm and pump it into the storage tanks for supply to the dairy shed.

2. Consents

The decisions version of the pSWLP was notified on 4 April 2018. In accordance with Section 86B(1)(a) and (3) of the Resource Management Act 1991, all provisions of the Proposed Plan have had legal effect since this date. Since the Regional Water Plan (2010) and Regional Effluent Land Application Plan are still operative, all provisions in both Plans have legal effect. The provisions of these plans therefore need to be considered alongside the provisions of the pSWLP.

Consent holder name

The existing consent holders ***Maitland Dairies Limited*** have changed their name to ***South Pro Maitland Limited***. In accordance with Section 124C of the RMA, *Maitlands Dairies Limited* confirms in writing that they will not be making any future applications as *Maitlands Dairies Limited* on this property. Future applications for this landholding will be made by ***South Pro Maitland Limited*** and future consents will be held by ***South Pro Maitland Limited.***

2.1 Consents required

2.1.1 Expansion of dairy farming:

Rule 20 of the pSWLP manages farming activities, including new or expanded dairy farming of cows.

The proposed activity does not meet Rule 20 (a) (ii) (3) since cow numbers are increasing beyond the maximum number specified in the dairy effluent discharge permit that existed on 3 June 2016. Rule 20 (a) (ii) (6) is met as the land area of the dairy platform is no greater than at 3 June 2016.

Rules 20 (b) and (c) relating to intensive winter grazing practices do not come into effect until 1 May 2019; however, they will be met as a permitted activity after that date.

The proposed activity meets the conditions described in Rule 20 (d) since:

- A Farm Environmental Management Plan (FEMP) has been prepared and is implemented in accordance with Appendix N, and
- The application includes an assessment prepared by a suitably qualified person. The assessment provided reflects the annual amount of N, P, sediment and microbial contaminants lawfully discharged on average over five years prior to this application. The assessment that shows that the annual amount of N, P, sediment and microbiological contaminants discharged from the landholding will be no greater than that which was lawfully discharged annually on average for the five years prior to this application. Evidence of land use activities during the five-year period has been supplied with this application.
- A detailed mitigation plan is included in the application.

As the application meets all the provisions of Rule 20 (d), **the use of land for the proposed farming activity is a restricted discretionary activity**.

2.1.2 Discharge activity

Rule 35 of the pSWLP manages the discharge of agricultural effluent to land other than provided for under Rules 32A, 32B and 32D. In this case the discharge activity does not meet all provisions described in Rule 35 (a). The discharge activity does not meet Rule 35 (b) (ii) since it is proposed to increase cow numbers above the maximum number specified on an existing discharge consent. The discharge activity meets all provisions described in Rule 35 (c) so is regarded as a **discretionary activity**.

Rule 50 of the Regional Water Plan (RWP) (2010) manages the discharge of agricultural effluent to land. In this case the discharge activity does not meet Rule 50 (a) or (b) of the Regional Water Plan. It does not meet Rule 50 (c) since it is proposed to increase the scale of the discharge activity through an increase in cow numbers. The discharge activity meets Rule 50 (d) as the scale of the activity is increasing with the increase in cow numbers and the discharge is primarily by low rate irrigation to soil/landscape types Category A and C; **the discharge activity is a restricted discretionary activity**.

Rule 5.4.6 of the Regional Effluent Land Application Plan provides for the discharge as a **discretionary activity**.

The accepted convention for activities where more than one consent category applies is to treat the application as one requiring overall assessment based on the most restrictive activity; **the discharge activity is therefore assessed as being a discretionary activity.**

2.1.3 Existing effluent storage facilities

Rule 32D of the pSWLP manages existing agricultural effluent storage facilities. The use of land for the maintenance and use of an existing agricultural effluent storage facility(pond) that was authorised prior to Rule 32D taking legal effect, and any incidental discharge directly onto or into land from that storage facility which is within the normal operating parameters the pond drop test criteria set out in Appendix P, is a permitted activity provided it meets Rule 32D (a).

In this case, the effluent storage pond at the dairy platform meet Rule 32D (a) (i) (2) in that construction was lawfully authorised by a resource consent. The effluent storage pond was drop tested in accordance with Appendix P in March 2017 and passed the drop test. A drop test report was submitted to Environment Southland and is also appended to this application.

A visual assessment of the pond and ancillary structures (i.e. concrete sump and sludge beds) was carried out in line with Rule 32D (a) (ii) (2) (a). The visual inspection found these structures to have no visible cracks, holes or defects that would allow effluent to leak. A report certifying the visual inspections by a SQP is appended to this application.

2.1.5 Permitted activities

Cultivation

The use of land for cultivation meets all permitted activity criteria under Rule 25 of the pSWLP.

Intensive winter grazing

The use of land for intensive winter grazing is a permitted activity until 1 May 2019. Rule 20 (b) and (c) of the sSWLP relating to intensive winter grazing practices come into effect on 1 May 2019. Intensive winter grazing will be carried out according to permitted activity rules under Rule 20 (b) and (c) after that date or resource consent will be applied for as required.

Silage storage

The use of land for two silage storage facilities is a permitted activity as it meets all conditions specified in **Rule 40 (a)** of the pSWLP; resource consent is not required for the silage storage facilities.

The use of land as two silage storage facilities is a permitted activity as it meets all conditions specified in **Rule 51 (a) (i) to (vii)** of the Regional Water Plan (2010); resource consent is not required for the silage storage facilities.

Both rules are met as follows:

The hill top silage pad is situated on a dry, elevated site; the yard silage pad is situated on dry site. The underlying substrates are rock or are well compacted and sealed. There is no overland flow of stormwater into either silage pad and neither are not situated within a critical source area. They are not located on land that is made permanently or intermittently wet by the presence of springs, seepage, high groundwater, ephemeral rivers or flows of stormwater other than from any cover of the silage.

No part of either silage pad is within 50 metres of a lake, river, artificial watercourse, modified watercourse, natural wetland or any potable water abstraction point. The nearest waterway to the hill top pad is a fenced off stream, which is approximately 300 metres to the south east of the silage pad. The nearest waterway to the yard pad is a fenced off stream, which is approximately 200 metres to the west of the silage pad.

Neither silage pad is within 100 metres of any dwelling or place of assembly, on another landholding.
Neither silage pad is within 100 metres of the microbial health protection zone of a drinking water supply site identified in Appendix J of the pSWLP, or within 250 metres of the abstraction point of a drinking water supply site identified in Appendix J.

Cattle do not graze directly from either silage pad, rather silage is carted from the pads to cows on paddocks in Feb/March, late April/May and Aug/Sept.

Silage leachate

There is no discharge of leachate directly to groundwater via a pipe, soak pit or other soil bypass mechanism and there is no overland flow or ponding of silage leachate outside of either silage storage facility. Due to design and management of the silage pads and stacks, little or no leachate is generated. If any leachate is generated occasionally, it does not flow or pond outside the silage storage facilities but remains on the pad. The activity meets Rule 41 (a) (iia), (iii) and (iv) of the pSWLP and is therefore a permitted activity.

The discharge of silage leachate onto or into land is a permitted activity as it meets all conditions specified in **Rule 51 (d)** of the Regional Water Plan (2010); resource consent is not required.

Discharge of solids

The discharge of solids from operations at the property meets all provisions of Rule 38 of the pSWLP, and as such is a permitted activity.

The discharge of solids from operations at the property meets all provisions of Rule 5.3.1 of the Regional Effluent Land Application Plan (RELAP); as such it is a permitted activity.

Water supply

The dairy farm is supplied water from the Glenkenich Rural Water Scheme for stock drinking water and dairy shed use. This activity does not require authorisation via a water permit from Environment Southland.

Stock drinking water is occasionally supplemented with surface water abstracted from a stream on farm. In accordance with Section 14(3) of the Act, this is a permitted activity as its purpose is to meet the reasonable needs of a person's animals for drinking water. No surface water is abstracted for use at the dairy shed.

The occasional abstraction of surface water for stock drinking water meets permitted activity rules described in Rule 49 (a) of the pSWLP; the volume does not exceed 40,000 litres per day, the rate of take does not exceed 30 percent of the instantaneous flow at the time of take, the rate of take does not exceed 2 litres per second and fish are prevented from entering the reticulation system.

The occasional abstraction of surface water for stock drinking water meets permitted activity rules described in Rule 18 (a) of the RWP. The take is only for stock drinking water and is authorised under Section 14(3) of the Act, the rate of abstraction does not exceed 5 litres per second, the abstraction and use does not result in adverse effects on existing water users, aquatic ecosystems or water quality; and fish are prevented from entering the reticulation system.

2.2 Duration

Consent durations of 10 years are proposed for all consents. Special consideration is given to Policy 40 of the pSWLP and Policies 14A and 43 of the Regional Water Plan in terms of determining the duration. The duration sought is considered consistent with these policies given the replacement nature of the discharge permit for an activity that is already well established, has benefited from a significant degree of capital investment and is operating within limits established by its existing consent and associated conditions. The land use consent for farming through an increase in cow numbers at the dairy platform is reasonable in that it sees no increase in effects due to the implementation of good management practices and specific mitigation measures; these ensure that the activity is sustainable in the long term. An increase of 50 cows is proposed, which is a small increase and is a return to the number authorised on the discharge permit until 2016.

2.3 Proposed consent conditions

The applicants propose to agree conditions with Consent Authority once draft conditions are issued. They request that draft conditions recognise the following:

Land use consent for farming:

1. That the land use consent is an output-based consent, using the N figure from Overseer (X kg N/hectare/year) as a limit. The below example can be used as guidance.

2. The Consent Holder shall maintain records of the following for each year between 1 June and 31 June:
    a. Fertiliser application, including rates;
    b. Types of crops and total area of cropping, including winter feed/forage crops;
    c. Cultivation methods;
    d. Stock units by references to type, age and breed;
    e. Effluent application areas;
    f. All other inputs to the OVERSEER nutrient budgeting model.

Example:

Nitrogen Loss Rate and Nutrient Budget

1. *The Consent Holder shall ensure nitrogen losses from farming activities undertaken at the dairy platform are maintained at or below the following nitrogen loss rate of X kg/ha/yr, or as amended in accordance with Condition X.*

Advice Note: *The nitrogen loss rates represent the modelled discharge of nitrogen below the root zone as modelled with OVERSEER version 6.3.0 in accordance with the OVERSEER Best Practice Input Standards as of 11 May 2018.*

The determination of whether the nitrogen loss rates have been met will be made using the nitrogen loss from the most recent year, modelling using the latest version of OVERSEER®.

2. *The Consent Holder shall prepare an annual nutrient budget for the period of 1 June to 31 May for the subject land using OVERSEER in accordance with the OVERSEER Best Practice Input Standards, or an equivalent model approved by the Chief Executive of the Consent Authority.*

3. *The nutrient budget and accompanying report shall be provided to the Consent Authority by 30 September each year.*

4. *The nutrient budget shall be prepared by a Certified Nutrient Advisor or the budget may be prepared by suitably experienced person and reviewed by a Certified Nutrient Advisor.*

5. *The nitrogen loss rates described in Condition 2 shall be amended following the release of a new version of OVERSEER or the Best Practice Data Input Standards. Following the update of the nitrogen loss rates, the Consent Holder shall provide the updated OVERSEER files to the Consent Authority with the report required by Condition 5.*

Discharge permit:

The following conditions are proposed:

1. *This consent shall be exercised in conjunction with Land Use Consent AUTH-X.*

   (a) This consent authorises the discharge of dairy shed effluent ("agricultural effluent") onto land, via a land disposal system consisting of one effluent storage pond, sand trap, sump, sludge beds, low rate system, slurry tanker and umbilical system, as described in the application (X) for resource consent dated X 2018 and further information dated X.

   The activity shall be limited to:

   i. The discharge to land of agricultural effluent generated from milking of up to 600 cows milked twice daily;
   ii. The discharge of agricultural effluent to land via low rate system, slurry tanker and umbilical system;
   iii. The discharge of agricultural effluent to an area of no more than X hectares at the dairy platform as per the plan attached as Appendix 1;

   (b) This consent excludes the discharge of effluent from winter milking (winter milking refers to cows milked to supply a winter milking contract), or from any feed pad/calving pad/structure not listed in condition 2(a).

2. *This consent shall be exercised in conjunction with Land Use Consent AUTH-X*

3. *The discharge authorised by this consent shall not exceed the following rates at any time:*
   (a) For the slurry tanker and umbilical system: A maximum depth of application of 5 millimetres for each individual application; and
   (b) Low rate system: a maximum depth of application of 15 millimetres for each individual application, and an instantaneous rate of 10 millimetres per hour;

4. *The maximum loading rate of nitrogen from effluent onto any land area as a result of the exercise of this consent shall not exceed:*
   (a) 150 kilograms of nitrogen per hectare per year at the dairy platform.

5. *The minimum return period for the discharge of effluent to land shall be no less than 28 days.*

6. *Effluent shall not be discharged within:*
   (a) 20 metres of any surface watercourse;
   (b) 100 metres of any water abstraction point;
   (c) 200 metres of any place of assembly or dwelling not on the subject property;
   (d) 20 metres from any property boundaries.

Where there is inconsistency between the plan attached as Appendix 1 and the conditions of this consent, the conditions of this consent shall prevail.

7. *The application of effluent to land shall not occur when:*
    (a) *the moisture content of the soils is at or above field capacity, and*
    (b) *during wind conditions that may result in odour or spray drift beyond the property boundary.*

Other conditions for land use and discharge consents – to be agreed with Consent Authority once draft conditions are issued.

3. Statutory Considerations

3.1 Statutory considerations:

Environment Southland must consider the following matters when they consider an application. The application is consistent with relevant plans and policies because effects on water quality and the soil resource should be less than minor.

Resource Management Act 1991

- The provisions of section 104 of the Resource Management Act 1991;
- Part 2 of the Resource Management Act;
- The applicant's assessment of effects on the environment;
- The provisions of Sections 104B, 104C, 105 and 107 of the Resource Management Act 1991.

Schedule 4 of the RMA requires that an assessment of the activity against the matters set out in Part 2 and any documents referred to in Section 104. Sections 104B and 104D of the Act set out the matters that, subject to Part 2, the Consent Authority must have regard to when considering an application for discretionary activities. Sections 105 and 107 set out additional matters the Consent Authority must have regard to when considering applications to do something that would otherwise contravene Section 15. An assessment of each of these matters follows:

Part 2 of the RMA

The activity is considered to represent an efficient use of natural resources that will give rise to significant positive benefits in terms of providing for the social and economic wellbeing of the applicants and the wider regional economy. There is, however, the potential for adverse effects on the environment to arise, including on water quality. However, it is considered that the effects of the activities have been adequately identified and assessed in the Assessment of Environmental Effects in Section 7 below and that such effects will be no more than minor.

Section 6 of the RMA lists the matters of national importance that a Consent Authority shall recognise and provide for when considering applications for resource consent. The relevant matters under Section 6 to this proposal are considered to be:

(a) the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development:

(c) the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga:

It is considered that the proposed activities do not impact directly on the coastal environment, wetlands, and lakes and rivers and their margins, although there is potential for adverse effects on the wider receiving environment which is inclusive of some of these features. However, as is discussed in Section 7 below, the actual and potential adverse effects of the activities are considered to be no more than minor.

Section 7 of the Act lists a number of other matters that a Consent Authority must have particular regard to when considering applications for resource consent. The matters in Section 7 that are considered relevant to this application are:

(a) kaitiakitanga:

(aa) the ethic of stewardship:

(b) the efficient use and development of natural and physical resources:

(c) the maintenance and enhancement of amenity values:

(d) intrinsic values of ecosystems:

(f) maintenance and enhancement of the quality of the environment:

(g) any finite characteristics of natural and physical resources:

(h) the protection of the habitat of trout and salmon:

For the reasons discussed in Section 7 of this report below, the proposal is considered consistent with relevant provisions of Section 7 of the RMA.

Section 8 sets out a Consent Authority's responsibilities in relation to the Treaty of Waitangi. The proposal is considered consistent with the provisions of all regional planning documents, including Te Tangi oTauira, and Sections 6(c) and 7(a) of the Act. Therefore, the proposal can also be considered consistent with Section 8 of the Act.

To avoid repetition, the following documents have been grouped together under common headings in the sections that follow.

The final part of this section of the application focuses on why the activity is consistent with key policies in the proposed Southland Water and Land Plan (2018).

- National Policy Statement for Freshwater Management (2017);
- Regional Policy Statement for Southland (2017);
- Regional Effluent Land Application Plan (1998);
- Regional Water Plan (2010);
- Proposed Southland Water and Land Plan (2018);
- Te Tangi a Tauira;

Ngai Tahu values

Table 3.1: Ngai Tahu Values

Regulatory Document	Relevant Sections

National Policy Statement for Freshwater Management 2017	• Objectives C1, D1 • Policies C1, D1
Southland Regional Policy Statement 2017	• Objectives TW.2, TW.3, TW.4 and TW.5 • Policies TW.3, TW.4 and TW.5
Regional Water Plan 2010	• Objective 9C • Policy 1A
Regional Effluent Land Application Plan 1998	• Objectives 4.1.4, 4.1.5 • Policies 4.2.4, 4.2.7,4.2.8, 4.2.9
Proposed Southland Water and Land Plan 2018	• Objectives 3, 4, 5, 15 • Policies 1, 2, 3
Te Tangi a Tauira:	• Whole Document

Tangata Whenua values have been considered when preparing this application including reference to Te Tangi a Tauira (Iwi Management Plan). The principles of protection of the mauri of the water and mana of the land while minimising adverse effects on mahinga kai will continue to be recognised and have regard to in the exercise of the consents and the operation of the dairying activity. There are no known wahi tapu, ancestral sites, heritage sites or other taonga associated with the property.

Water quality

Table 3.2 Water Quality

Regulatory Document	Relevant Sections
National Policy Statement for Freshwater Management 2017	• Objectives A1, A2, B1, B2, B3, B4, • Policies A3, A4, B5, B6, B7
Regional Policy Statement for Southland 2017	• Objectives WQUAL.1 and WQUAL.2 • Policies WQUAL.1, WQUAL.2, WQUAL.3, WQUAL.7, WQUAL.8, WQUAL.12
Regional Effluent Land Application Plan 1998	• Objectives 4.1.2

	• Policies 4.2.3, • Rule 5.4.5
Regional Water Plan 2010	• Objectives 3,4,8 • Policies 1, 4, 6, 7, 13
Proposed Southland Water and Land Plan 2018	• Objectives 1, 2, 6, 7, 8, 9, 13, 18 • Policies 6, 10, 13, 14, 15, 16, 17, 18, 39A, 40
Te Tangi a Tauira	• Policies 1, 4, 5, 6, 11, 16, 17, 18

Dairy farming at the property is carried out following good management practices relevant to the physiographic zones present at the property (Gleyed and Oxidising (overland flow variant)). These practices are recommended by Council and are implemented on farm to mitigate the risk of adverse effects on water quality from contaminants transported via artificial drainage, overland flow and deep drainage where relevant. Due to topography where Oxidising soils are found and the presence of Gleyed soils, overland flow and artificial drainage are recognised by the applicants as key contaminant pathways and are managed as such. Deep drainage is also a contaminant pathway managed by the applicants. Good management practices and specific mitigation measures implemented on farm are described in Sections 6 and 7 of the application, and in the Appendix N FEMP.

There will be no increase in contaminant loss due to the proposed expansion of dairy farming in this instance. Importantly neither will effects be exported off-site to another location. This expansion will be achieved through the implementation of mitigation measures on farm, alongside the implementation of a suite of good management practices.

The discharge is to land rather than water and is undertaken in a manner to minimise adverse effects on water quality. Good management practices for the management of the effluent system and mitigation measures have been included in the application and in the FEMP. By only irrigating FDE to land when ground conditions are less than field capacity, and by ensuring that irrigation of FDE to land does not result in the soils reaching field capacity, the risks of effluent leaching through the soil profile or via overland flows are mitigated. The use of low rate irrigation, as discussed in the Section 7 AEE, should reduce the risk of exceeding a soil's infiltration rate, thus preventing ponding and surface runoff of freshly applied FDE. The recommended buffer zones from waterways are adhered to when applying effluent.

Soil health and effluent management

Table 3.3 Soil Health and Effluent Management

Regulatory Document	Relevant Sections
Regional Policy Statement for Southland 2017	• Objectives WQUAL.1 and WQUAL.2 • Policies WQUAL.1, WQUAL.2, WQUAL.3, WQUAL.7, WQUAL.8, WQUAL.12
Regional Effluent Land Application Plan 1998	• Objectives 4.1.1 • Policies 4.2.1, 4.2.2
Regional Water Plan 2010	• Policy 41 • Rule 49
Proposed Southland Water and Land Plan 2018	• Objectives 13, 13A, 14, 15, 18 • Policies 6, 10, 17, 33 • Rule 25, 20, 32D, 35, 40, 41
Te Tangi a Tauira	• Policies 4, 7, 8, 9, 11, 13, 14, 15

The applicants seek to ensure the life supporting capacity of the soil is safeguarded, along with the sustainability of the soil ecosystem by utilising land treatment of effluent without significant adverse effects. The soils are suitable for effluent irrigation and the discharge follows current good management practice, which is described in Section 6 of the application and in the FEMP. These include practices of a general nature and those specific to the key contaminant transport pathways for the physiographic zones found at the property.

An existing effluent storage pond allows for deferred storage of dairy shed effluent until the soil moisture content is suitable for irrigation for 600 cows on the farm. The land disposal area meets the best practice recommendation of 8 hectares per 100 cows. The nutrient loading of soils from dairy shed effluent will not exceed 150 kg N/hectare at the dairy platform. This system is sustainable in the long term and allows the effluent to be used both as a fertiliser and a soil conditioner.

In addition to the matters in Section 104 of the Act, when considering an application for a discharge permit a Consent Authority must also have regard to Section 105. As is discussed in the assessment under Section 7, it is considered that provided the discharge is undertaken in accordance with the conditions of the consent and the best practice management techniques outlined in Section 6 of the application and in the Farm Environmental Management Plan, the adverse effects of the activity should remain no more than minor. The best method for dealing with effluent from the dairy operation is considered to be discharging to land.

There are not considered to be any matters under Section 107 of the Act that would require the Consent Authority to decline the application for discharge permit.

3.2 Proposed Southland Water and Land Plan (2018)

An assessment of the application in terms of the proposed Southland Water and Land Plan (2018):

The application meets the relevant objectives and policies described in the pSWLP (2018). The policies are numerous, however, the following policies are particularly relevant because of their focus on good practice management of land used for dairy farming and the discharge activity in the appropriate physiographic zones; effects including cumulatively, on water quality and the soil resource should be less than minor.

Proposed Southland Water and Land Plan 2018 - Objectives and Policies relevant to land-use and discharges:

- **Objectives 6, 7, 8, 9, 13, 18**
- **Policies 6, 10, 13, 14, 15, 16, 17, 18, 39A, 40**

Policies 6 and 10 are physiographic zone (PZ) policies. Policy 6 gives direction on the land located in the Gleyed physiographic zone; Policy 10 gives direction on land located the Oxidising physiographic zone.

Policy 6 states that in the Gleyed PZ, adverse effects on water quality from contaminant loss must be avoided, remedied or mitigated by implementing parts 1 and 2 of the policy.

Policy 6.1 requires the implementation of good management practices to manage adverse effects on water quality from contaminants transported via artificial drainage and overland flow, where relevant. Contaminants include N, P, sediment and microbes. Given the rolling topography found at the landholding, overland flow is a contaminant pathway that must be managed to avoid, remedy or mitigate adverse effects on water quality. Artificial drainage (subsurface), installed in places to reduce waterlogging and improve soil structure, is a potential contaminant pathway to receiving waters; it too must be managed to avoid, remedy or mitigate adverse effects on water quality. The range of good management practices described in section 6 of the application and in the FEMP, address the risk of contaminant loss to receiving surface waters via overland flow and artificial drainage. They include management practices that relate to the wider farming activity, including activities such as intensive winter grazing, cultivation, riparian and CSA management, as well as ones that relate to the effluent discharge activity. For instance, wide, well vegetated riparian buffers are maintained and a riparian planting programme is underway. Good management practice in relation to these activities has been implemented since the applicants took over the farm in 2016, and they are committed to continuing to improve management practice in the future.

Policy 6.2 requires that when resource consent applications are assessed, and Farm Environmental Management Plans are prepared or considered, particular regard must be given to adverse effects on water quality from contaminants transported via artificial drainage, and overland flow where relevant. Both the resource consent application and FEMP have identified and considered adverse effects on water quality from contaminants (N, P, sediment and microbes) transported by overland flow and artificial drainage. As is explained in the consent application (section 6, section 7/AEE) and FEMP, through implementation of good management practice and mitigation measures, the risk of adverse effects on receiving waters will be avoided or mitigated. The AEE is supported by Overseer nutrient budget analysis

Under **Policy 10.1**, adverse effects on water quality from contaminant loss via deep drainage, and artificial drainage and overland flow where relevant must be avoided, remedied or mitigated by the implementation of good management practices. Classification of land in the Oxidising PZ at the dairy farm is primarily based on soil types (Waikiwi and Benio). Due to rolling topography where these soil types are found, there is particular risk of contaminant loss via overland flow from Oxidising areas. This is reflected in the classification of Oxisiding land as the "overland flow" variant. Nitrate levels underlying the landholding are low (0.4 – 1.0 g/m^3), which indicates that there is minimal risk nitrate leakage from Oxidising soils to groundwater.

The range of good management practices described in section 6 of the application and in the FEMP, address the risk of contaminant loss to receiving surface waters via overland flow, artificial drainage and if present deep drainage. These include management practices that relate to the wider farming activity, including activities such as intensive winter grazing, cultivation, riparian and CSA management, as well as ones that relate to the effluent discharge activity. Good management practice in relation to these activities has been implemented since the applicants took over the farm in 2016, and they are committed to continuing to improve management practice in the future.

In order to meet **Policy 10.2,** this application and the accompanying FEMP have particular regard to adverse effects on water quality from contaminants transported via overland flow and artificial drainage. For reasons explained in sections 5 and 7, there is reduced risk of contaminant loss via deep drainage due to topography found at the property.

Policy 10.3 gives direction to decision makers on generally not granting resource consent for additional dairy farming of cows or additional winter grazing where contaminant losses will increase as a result of the proposed activity. This application is for the additional dairy farming of cows through an increase of 50 cows. It is proposed in parallel with other changes such as the cultivation of less area in winter crop, a lower N fertiliser application rate than in most recent years and increasing the size of the FDE area.

At a whole farm scale, Overseer nutrient budget analysis has been carried out to determine pre-expansion nutrient N and P contaminant losses. In the absence of a suitable alternative method, P loss has been used as a proxy for sediment and microbial loss, as they generally move from land to water in a similar way (i.e. via overland flow and artificial drainage). At the whole farm scale, several mitigation measures are included in the post-expansion nutrient budget and FEMP. This is to ensure that the proposed nutrient budget represents the proposed farming system in its entirety, as well as ensuring that nutrient losses overall will not increase post expansion. These measures will be implemented on farm, to ensure that contaminant losses do not increase.

Within the whole farm nutrient budget, land classed as Oxidising can be extracted and reported on. When this is carried out, it shows that Oxidising land has stable N loss both pre and post expansion (52.0 kg/ha/year and 52.6 kg/ha/year respectively). Oxidising land under the proposed system is predicted to have an increase of 0.6 kg N loss/hectare/year (or 1%), which within the margin of error can reasonably be regarded as stable N loss. P loss for Oxidising land will not increase under the proposed system, with both pre and post expansion P loss predicted to be 0.3 kg/hectare/year. Using P as a proxy for sediment and microbes, neither will there be an increase in the loss of sediment or microbes on Oxidising land under the proposed system. Rolling topography has a significant effect on the drainage properties and contaminant pathways for Oxidising soils at the property; rather than leaking nitrate to groundwater, Oxidising soils lose N via overland flow and artificial drainage to surfacewaters.

Since contaminant losses (N, P, and by proxy sediment and microbes) will not increase on land classed as Oxidising and Oxidising soils will lose minimal nitrate to groundwater, this application for resource consent for additional dairy farming of cows should be granted.

Policy 13 gives direction on the management of land use activities and discharges. In line with Policy 13.1 the proposed expansion will better enable the applicants to provide for their social, economic and cultural well-being. The increase in herd size of 50 cows seeks to correct an error that was made in the renewal of the discharge permit in 2016, when the herd size was erroneously reduced from 599 to 550 cows. It will allow the applicants to increase the herd size to where they believe it can and should sustainably be maintained at the landholding. Returning to a herd size of 600 will allow the applicants to operate a profitable and sustainable business model. The maintenance of a profitable and sustainable business model is central to the success the business, and provides social, economic and cultural benefits to the applicants, their employees, families and whanau, and to the wider community. In the context of an agricultural-based local economy, the use and development of the land and water resources at the property for primary production should be recognised. In line with Policy 13.2, land use activities and discharges (point source and non-point source) are managed to enable the achievement of Policies 15A, 15B and 15C.

In line with **Policy 14,** the discharge is to land and there is no discharge to water at the property.

Policy 16 gives direction on farming practices that affect water quality.

Policy 16.1 (a) discourages the establishment of new dairy farming of cows in close proximity to Regionally Significant Wetlands and Sensitive Waterbodies. The nearest such downstream waterbodies are located over 70 kilometres to the south west of the landholding; the *Lower Mataura River at Fortrose Harbour* (part of the Awarua Plain – Southland Estuaries Complex) and Toetoes Flats (a.k.a. Toetoes Scenic Reserve). Neither of the waterbodies are *in close proximity* to the dairy farm allowing Policy 16.1(a) to be met.

Policy 16.1 (b) ensures that until the development of freshwater objectives under FMU processes, applications to establish new, or further intensify existing dairy farming of cows, or to intensify winter grazing activities will generally not be granted under certain situations. The situations relate to different effects on and measures of water quality. This application is for an increase of 50 cows (9%) on land that has been dairy farmed for c.25 years to date. As such this application is not to establish new dairy farming of cows but is to intensify through an increase in cow numbers. As already explained, this application is to return the herd size to the size that was authorised on the discharge permit until 2016 when the herd size was erroneously reduced during the consent renewal process.

In parallel with an increase in cow numbers, it proposed to implement several mitigation measures, such as reducing the area cultivated into fodder crop and an associated reduction in the area intensively winter grazed, an increase in the FDE area, a reduced N fertiliser application rate compared to recent years and more efficient use of N fertiliser. Importantly, the effects of the expansion are not being exported off-site to a different landholding as no more cows will be winter grazed off farm than have been in recent years. The practice of grazing young stock off farm at a third-party grazier from weaning until they return as in-calf R2 heifers for calving will continue as it has done in pre-expansion years. It is explained in the following three paragraphs why the proposed further intensification of existing dairy farming through an increase in cow numbers should be granted in this instance.

Policy 16.1 (b) (i) gives direction on generally not granting further intensification of existing dairy farming of cows where the adverse effects, including cumulatively, on the quality of groundwater and receiving surface waterways such as rivers, wetlands and estuaries cannot be avoided or mitigated. Section 7 of the application provides an in-depth assessment of effects (AEE) of the proposal on groundwater and receiving surface waters. The assessment covers contaminants N, P, sediment and microbes and is supported by Overseer nutrient budget analysis. The AEE identifies that the potential for adverse effects on groundwater due to the proposed activity is low. It identifies that the potential for adverse effects on surfacewater including Drowning Creek, Waikaka Stream, Mataura River, Toetoes Estuary, coastal waterbodies and Toetoes Bay is higher, assesses this risk and describes a range of measures that will be implemented on farm to mitigate this risk. The Overseer analysis shows that the modelled N loss for the proposed 600 cow system is no greater than for the pre-expansion system due to the implementation of several mitigation measures. A small increase in P loss predicted by Overseer modelling will be mitigated through the implementation of on farm mitigation measures that are not detected by Overseer. These will also mitigation sediment and microbial loss. The assessment supports the conclusion that adverse effects, including cumulatively, due to further intensification of existing dairy farming through an increase in cow numbers will be fully mitigated in this instance. The proposal meets Policy 16.1 (b) (i) and so should be granted.

Policy 16.1 (b) (ii) gives direction on generally not granting further intensification of existing dairy farming of cows where existing water quality is already degraded to the point of being over-allocated.

As is shown in sections 5 and 7, groundwater quality is generally good in the vicinity of the property; there are no known areas of elevated groundwater nitrate levels or issues with microbial contamination of groundwater. Prior to FMU processes, only situations where a surface waterway is highly degraded to the point of being overallocated, should fall under Policy 16.1 (b) (ii). Water quality in the lower catchments of the Waikaka Stream and Mataura River show evidence of adverse land use effects but cannot reasonably be classed as being "degraded to the point of being overallocated." The limit setting/FMU process will be better equipped to evaluate, address and make decisions regarding overallocation. Other receiving waters such as Toetoes Estuary and coastal waters can similarly be regarded. On this basis, in conjunction with mitigation measures that will be implemented to ensure there will be no increase in contaminant loss to receiving waters, this application to further intensify the existing dairy farm through an increase in cow numbers should be granted.

Policy 16.1 (c) gives direction on processes after the development of freshwater objectives under FMU processes. As freshwater objectives have not yet been developed, this policy does not apply at the present time.

Policy 16.2 gives direction on farming activities, including existing activities.

Under **part (a)**, all such activities are required to implement a farm environmental management plan (FEMP), as set out in Appendix N. The applicants implement a FEMP as set out in Appendix N, so meet part (a) of Policy 16.2.

Under **part (b)**, sediment runoff risk must be actively managed by identifying critical source areas (CSAs) and implementing practices such as setbacks from waterbodies, riparian planting, sediment traps, preventing stock from entering the beds of surface waterbodies and limiting the duration of exposed soils. Topography at the landholding is easy to rolling, with some steeper areas at the north. CSAs occur across the property, especially where slopes are found. Major CSAs have been mapped and are actively managed to minimise the risk of sediment loss. Due to topography, there are more CSAs than have been mapped. See the FEMP for locations of major CSAs.

Practices such as fencing off waterways are implemented at the property and have been for many years as part of the Dairy Accord. Stock do not have access to waterways at any time. Wide riparian buffers are maintained, with mature vegetation or good grass cover in place. A riparian planting programme is underway. Farm infrastructure such as tracks, lanes and sheds can also act as CSAs following periods of prolonged rainfall, where water can pool and move via overland flow to waterways, carrying contaminants such as sediment and microbes with it. Farm infrastructure is managed to ensure that surface drainage does not flow via overland flow directly into waterways, but is directed through pasture or riparian strips, where runoff is filtered, and sediment and microbes are trapped before reaching waterways.

The applicants endeavour to limit the duration where soils are bare as much as possible to further reduce the risk of sediment runoff.

Under part (c) of Policy 16.2, collected and diffuse runoff must be managed, as well as leaching of nutrients, microbial contaminants and sediment through the identification and management of CSAs *within individual properties*. The applicants manage their farm layout, infrastructure, soil types, drainage, CSAs and overall farming system to control and minimise collected and diffuse runoff, leaching of nutrients, microbial contaminants and sediment from such sources.

Policy 17 gives direction on agricultural effluent management.

In line with Policy 17, significant adverse effects on water quality from the operation of, and discharges from, the effluent management system at the dairy farm are avoided. Other adverse effects are also avoided, remedied or mitigated. The effluent management system on farm, including sand trap, concrete sump, sludge beds, effluent storage pond and low rate irrigation system, follows best industry practice for effluent storage and discharge given the nature of soils and topography at the property. The effluent system is described in detail in Section 6. It has been designed, constructed and located in accordance with best industry practice including the relevant practice notes and guidelines, and the system is maintained and operated in accordance with best practice guidelines. By only irrigating effluent to land when ground conditions are at less than field capacity, and by ensuring that irrigation of effluent to land does not result in soils reaching field capacity, the risks of nutrient rich effluent leaching through the soil profile or moving via overland flow are mitigated. The recommended buffer zones from waterways are adhered to when applying effluent nor is effluent discharged over tile drains when the soil is at or near field capacity. The effluent receiving area is sufficiently large to ensure that the N loading to land from dairy shed effluent does not exceed 150 kg N/hectare at the dairy farm.

In line with **Policy 18**, all stock is excluded from waterways at the property.

The range of the good management practices implemented on farm, result in improved integrated management of freshwater through good dairy farm land management practices. This is in line with **Policy 39A**.

In line with **Policy 40**, the applicants seek a term of 10 years for the activities. There is good certainty regarding the nature and scale of the activity going forward; there will be an increase in cow numbers as well as implementation of good management practices and specific mitigation measures to ensure that the activity is sustainable in the long term. Importantly the effects of the expansion have been carefully considered and will not being exported off-site but will be managed on farm. The applicants have made significant investment in the property over many years (e.g. re-grassing, infrastructure, effluent system, drainage and fencing), and are committed to the permanence and socioeconomic life of their investment. The expansion will allow the applicants to return to what they believe is a sustainable environmental and economic model. The applicants have a good compliance history; they are conscientious dairy farmers committed to avoiding adverse environmental effects and operating a sustainable farming and business model.

Having assessed the matters above, it is considered that both the application for the expansion of dairy farming and the discharge activity are generally in accordance with the relevant policies and objectives of the documents set out above, and having regard to Section 104, the proposal achieves the purpose of the RMA.

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4. Notification

Section 95A of the Act requires that the Consent Authority must publicly notify an application if it decides under Section 95D of the Act that the activity will have or is likely to have adverse effects on the environment that are more than minor. The only exception to this is when a rule or NES precludes public notification of the application and that there are no special circumstances in relation to the application that would warrant such a rule or NES to be dispensed with. However, in this instance there is no rule or NES that precludes public notification of the application and therefore the 'more than minor effect on the environment' test provided by Section 95D of the Act applies.

In deciding whether an activity will have adverse effects on the environment that are more than minor, Section 95D of the Act states that a Consent Authority must disregard:

- Any effects on persons who own or occupy the site or adjacent land;
- Trade competition and its effects;
- Any effects on persons who had given written approval of the application;
- Any adverse effect that does not relate to a matter which a rule or NES reserves control or restricts discretion.

Section 95D also states that a Consent Authority may disregard any adverse effect if a rule or NES permits an activity with that effect.

For the reasons described in the Assessment of Environmental Effects in Section 7 below, the adverse effects of this proposal are considered to be no more than minor and as a consequence it is proposed that application should not be publicly notified. It is noted that implementing the proposed land use changes, should be a cumulative reduction in adverse effects over time.

Section 95A(1) of the Resource Management Act provides that a Consent Authority may, in its discretion, decide whether or not to publicly notify an application for resource consent. Section 95A(2) states that the Consent Authority must publicly notify an application if the applicant requests public notification or if a rule or National Environmental Standard (NES) requires public notification of the application. In this instance the applicant has not requested public notification, nor is there any rule or NES requiring notification of the application.

If a Consent Authority does not notify an application for resource consent, Section 95B of the Act states that it must decide whether there are any affected persons or affected other holders in relation to the activity. The exception to this is that if there is a rule or NES that precludes limited notification of the application. In this instance, there is no rule or NES that precludes limited notification of the application.

Section 95E states that a person is 'affected' if the adverse effects of an activity on a person are minor or more than minor (but not less than minor). In deciding this, Section 95E(2) of the Act states that a Consent Authority:

- May disregard any adverse effect if a rule or NES permits an activity with that effect;
- Must disregard any adverse effect that does not relate to a matter which a rule or NES reserves control or restricts discretion;
- Must have regard to any relevant statutory acknowledgement;

- Must disregard any effects on persons who have given written approval of the application.

It is concluded in the Assessment of Environmental Effects that the adverse effects of the proposal are no more than minor.

Section 95A(4) of the Act gives the Consent Authority discretion to notify an application if it decides that special circumstances exist. The Courts have held that special circumstances are unusual or exceptional but may be less than extraordinary or unique. Furthermore, it is not mandatory to consider whether special circumstances exist. It is proposed that as there are no significant adverse effects, the integrity of any of the regional plans are not under any threat. Therefore, there are no special circumstances that would warrant any form of notification.

5. Receiving Environment

5.1 Soils

5.1.1 Soil types

Topoclimate soil data shows the property overlies deep undulating Waikoikoi soils, with intergrades of deep, undulating Chatton soils in places. Chatton soils and a small area of shallow, rolling Benio soils are found at the north end of the property. Deep, undulating Jacobstown soils underlie a waterway.

Topoclimate and S-Map naming of soil types differs for three soil types, although both databases have the same soil map. For example, where Topoclimate maps Chatton soils, S-Map maps Waikiwi soils. Reviewing the physical, chemical and vulnerability properties of soil types in Topoclimate and S-Map shows that Chatton soils are the same as Waikiwi soils, and Waikoikoi soils are the same as Claremont. Table 5.1 shows soil types from each database.

Table 5.1 Soil types in Topoclimate and S-Map.

Group	Topoclimate	S-Map
1	Chatton	Waikiwi
2	Waikoikoi	Claremont
3	Jacobstown	Eureka
4	Benio	Benio

Since the Overseer analysis uses S-Map soil data, soil names from S-Map are used in the AEE provided in Section 7, i.e. Waikiwi, Claremont, Benio and Eureka. See figure 5.1 for S-Map mapping of soils.

Table 5.2 summarises vulnerability factors for soils and table 5.3 summarises physical properties of soils.

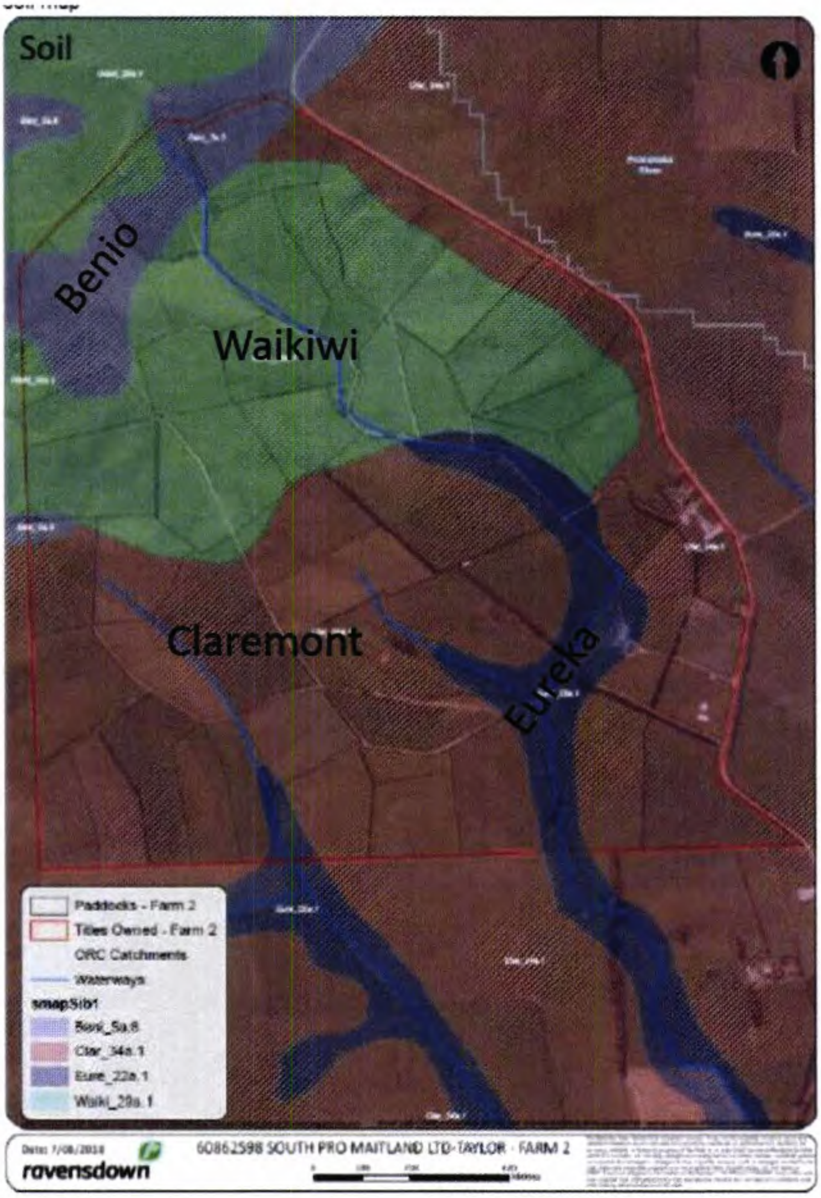

Figure 5.1 S-map mapping of soils (approximate boundary is outlined in red; map source Ravensdown).

Table 5.2

Soil Type	Vulnerability Factors		
	Structural Compaction	Nutrient Leaching	Waterlogging
Claremont	Very severe	Slight	Severe

Waikiwi	Slight	Moderate	Slight
Benio	Moderate	Severe	Slight
Eureka	Severe	Slight	Severe

Table 5.3 Physical properties of soils.

Soil type	Profile drainage	Plant readily available water	Potential rooting depth	Rooting restriction
Claremont	Poorly drained	Moderately high	Slightly deep	Fragipan
Waikiwi	Well	High	Deep	No major restriction
Benio	Moderately well	Moderate	Moderately deep	Extremely gravelly subsoil
Eureka	Poor	High	Deep	Limited subsoil aeration during sustained wet periods

5.1.2 FDE land classification

According to Beacon, the soil FDE Risk category is predominantly Category C (sloping land) with an area classed as Category A (artificial drainage/coarse soil structure) at the centre of the farm See figure 5.2 for Beacon mapping of soils FDE risk at the property. Category C classed land has slopes of greater than 7 degrees. It is the case here, however, that there are many areas where slopes are less than 7 degrees within the Category C block. Please see section 5.5, which describes topography and contains a higher resolution slope map prepared by Ravensdown.

The soil FDE risk for effluent discharge at the property is high. These soils are suitable for dairy farming and receiving effluent provided that their vulnerabilities are recognised and provided they are managed according to best practice.

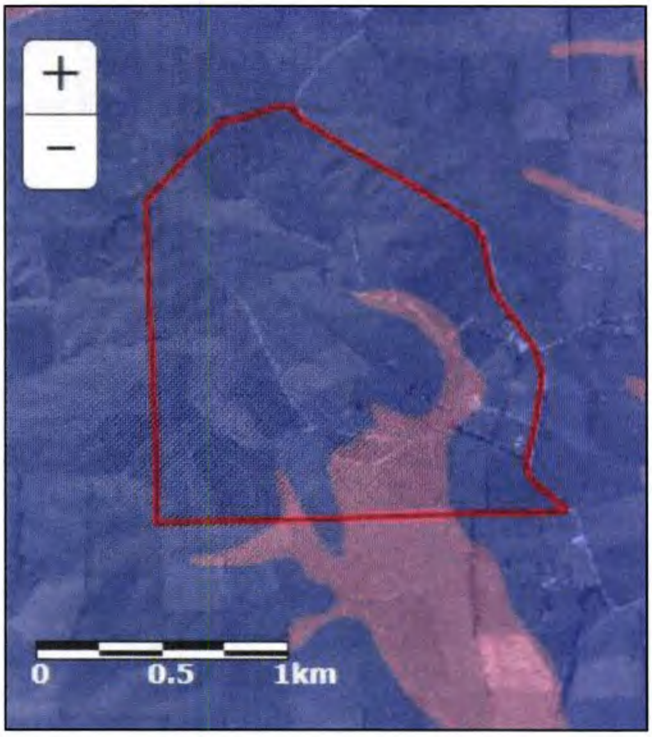

Figure 5.2 Soil FDE risk for the property (approximate boundary is outlined in red).

5.1.3 Soil types at third-party grazier properties

In recent years young stock has been grazed by the same provider and at the same location (Willowbank area), and it is the intention to continue this practice in the future. Soil types underlying the Willowbank grazier property are mapped by Topoclimate as Waikoikoi, Chatton, Jacobstown, Benio and Arthurton (see figure 5.3). As such, soils are broadly similar as soils found at the dairy farm.

Third-party grazier providers for MA cows change from year to year, soil types have changed from year to year. Soil types in the Kaiwera area are Kaiwera, Otaraia, Ferdale, Andrews and Mcnab types. Soil types in the Waikaka area are Waikoikoi, Jacobstown, Wendon, Tailings and Benio types. Soil types in the Willowbank area are as described above.

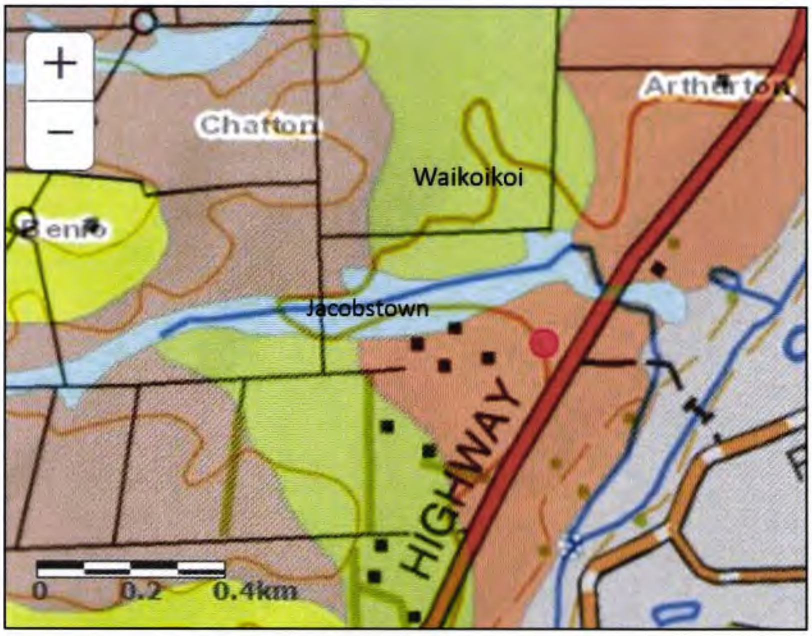

Figure 5.3 Topoclimate mapping of soil types at grazier location (young stock only).

5.2 Surface water

5.2.1 Description

Dairy farm

The property lies in the Waikaka Stream East Branch catchment and mid-Mataura surfacewater management zone (see figure 5.4). Beyond the boundary, waterways flow via Drowning Creek to the Waikaka Stream to the southwest (see figure 5.5). The Waikaka Stream confluences with the Mataura River south of Gore town.

Waterways flow through the property in a north to south/southeast direction (see figure 5.6), are fully fenced off and culverted (see figures 5.7, 5.8). Riparian buffers are vegetated with either mature vegetation or good grass cover, and a riparian planting programme is underway.

Subsurface drainage is installed in places with outfall to streams. Subsurface drains (tiles) generally underlie hollows/depressions, which may act as critical source areas (CSAs) during or following of prolonged heavy rainfall. Sloping land, especially gullies, also act as CSAs following heavy rainfall. See the map included in the Appendix for tile drains, culverts and major CSAs at the property.

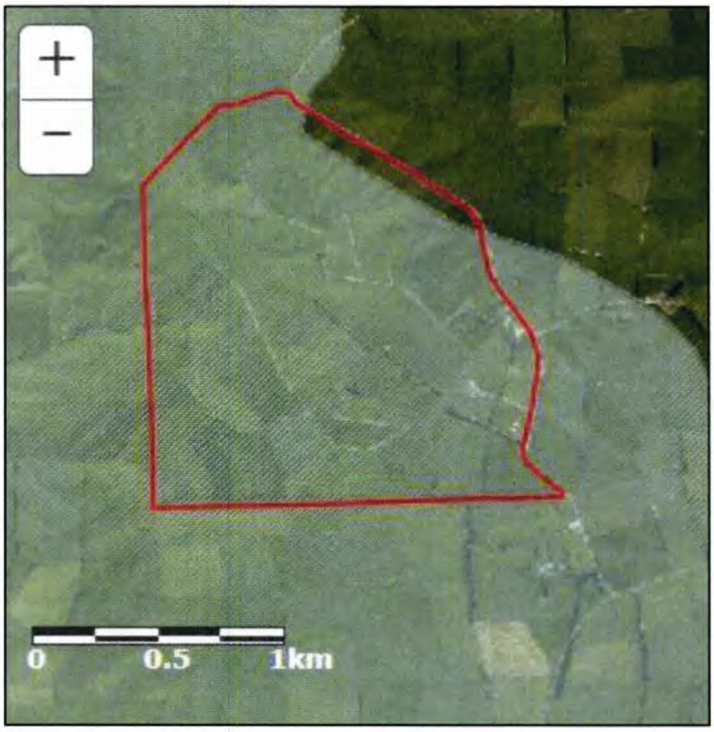

Figure 5.4 Surfacewater catchment: Mid-Mataura (approximate boundary is outlined in red).

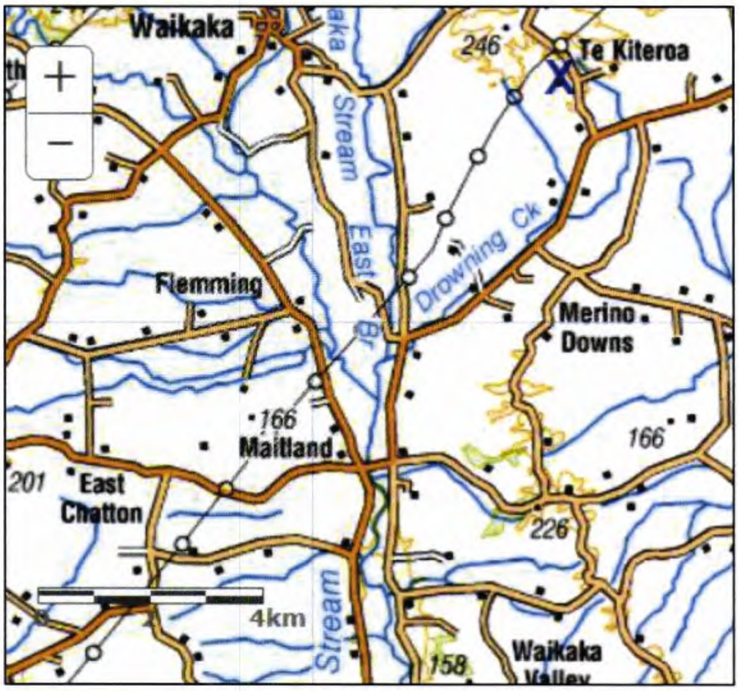

Figure 5.5 Topomap showing waterways in vicinity of dairy farm (approximate location of dairy farm is marked **X**).

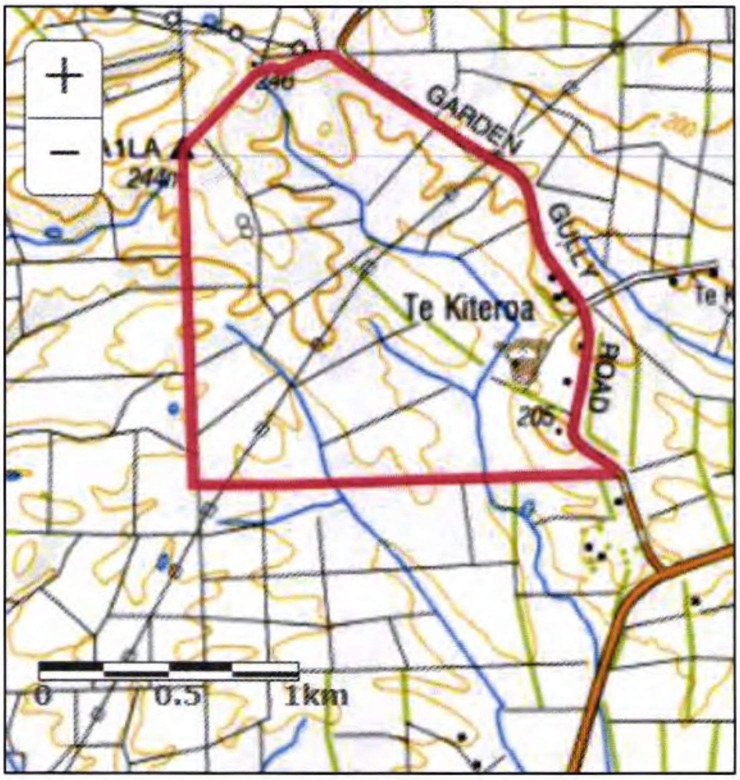

Figure 5.6 Topomap showing waterways in vicinity of dairy (with approximate boundary outlined in red).

Figure 5.7 Photograph of a stream on farm.

Figure 5.8 Photograph of a stream on farm (different location to figure 5.6).

Third-party graziers

Except when MA cows were winter grazed in Central Otago, third-party graziers have been/are located in the mid-Mataura or Lower-Mataura surfacewater management zones. This includes grazier providers for both the winter grazing of MA cows and grazing of young stock.

MA cows have been winter grazed in the Waikaka Stream catchment and Kaiwera Stream catchment, both of which are part of the major Mataura catchment. It is the intention to continue winter grazing MA cows in the Mataura catchment area in the future.

Young stock is grazed at a property located in the Waikaka Stream catchment (major Mataura catchment). Waterways at the grazier property flow from west to east and join the Waikaka Stream on the other side of the Highway, approximately 300 metres beyond the property boundary (see figure 5.9). The property has a mixture of soil types, has flat to rolling topography, and has subsurface drainage installed in places.

Figure 5.9 Surfacewater catchment boundaries in vicinity of grazier (young stock only).

5.2.2 Mataura catchment

The property is located within the Mid-Mataura surfacewater management zone, with the boundary to the Lower-Mataura surfacewater management zone approximately 7 kilometres to the south of the property and the Waikaka Stream flowing north south through both.

The Mataura River catchment is the region's second largest. It extends from the southern tip of Lake Wakatipu to the Toetoes Estuary, east of Invercargill. The Waikaia River is the main tributary, contributing half the flow of the catchment above its confluence with the Mataura, east of Riversdale. It is a world renown trout fishery and has a Water Conservation Order relating to allocation. Impacts on water quality, particularly below Gore, occur through various industrial and municipal water discharges and the cumulative impact of agriculture. Most of the Mataura catchment has been developed for agriculture, which is particularly intensive in the middle and lower reaches. Water is abstracted from the middle reaches of the Mataura River near Riversdale, for pasture irrigation to support intensifying land use activities in the district. Surfacewater drainage from the property flows first to the Waikaka Stream, which flows to the Mataura River at Gore. Similarly, drainage from grazier properties flow to the Mataura River. The mid and lower reaches of the Mataura River tend to have toxic algal blooms in shallow areas/along its margins during warmer periods of the year.

Long term SOE water quality trends can be used as an indication of cumulative effects on water quality. The closest downstream SOE water quality monitoring site for which data could be obtained is from the Waikaka Stream at Gore site. This site is in the Lower-Matuara surfacewater zone and should also be an indicator for effects from third-party grazier properties in the wider catchment. The Waikaka Stream at Gore site captures the entire Waikaka Stream catchment, which is a pastoral farming catchment. The Waikaka Stream is sampled upstream of confluence with the Mataura River at Gore and is located approximately 21 kilometres to the south west of the dairy farm.

Data obtained from The Land and Water website show evidence of cumulative effects on water quality for the Waikaka Stream at Gore site. The median black disc value is in the "worst 25% of like sites." The median *E. coli* value of 315 n/100 ml is in the "worst 25% of like sites" with a likely improving ten-year trend. Median concentrations for both Total Nitrogen and Total Oxidised Nitrogen are in the "worst 25% of like sites". The Total N median concentration is 1.33 g/m^3, which is above the ANZECC guideline of 0.614 g/m^3. The Total Oxidised N median concentration is 0.745 g/m^3, which is above the ANZECC Guideline value of 0.44 g/m^3 but well below New Zealand Drinking Standards Maximum Acceptable Level (MAV) of 11.3 g/m^3 for nitrate nitrogen. The ten-year trend for Total Oxidised Nitrogen is "very likely improving." The annual median is below the National Bottom Line median of 6.9 g/m^3 for nitrate. The annual median DRP value has a very likely improving trend over ten years, with a value of 0.024 g/m^3 is in the "worst 25% of like sites." Total Phosphorous also shows an improving ten-year trend.

The closest downstream SOE site for which ecological data could be obtained is also the Waikaka Stream at Gore site. The median MCI score over a five-year period from 2012 to 2016 was classed as fair, although there is evidence of a decreasing trend in recent years. The median Taxonomic Richness score from 2012 to 2016 was 20, with evidence of a slight increasing trend in more recent years. The median %EPT score was 40% over the same five-year period, with a slight drop in later years.

The nearest National Objectives Framework (NOF) site is located south west of the property at the Waikaka Stream at Gore. NOF water quality indicators show that generally water quality is fair to poor at the Waikaka Stream at Gore site (see figure 5.10 and 5.11 below). Particularly slime algae/periphyton is indicative of high nutrient levels or significant natural flow/habitat disruption at the site. The annual median *E coli* score is ranked in Band B, which is indicative of "low risk of infection (less than 1% risk) from contact with water during activities with occasional immersion (such as wading and boating)." The annual median Total Oxidised Nitrogen value is classed in Band B; water quality at this site is considered "suitable for the designated use," but there may be effects on growth of up to "5% of species."

Figure 5.10 Topomap showing property location (marked X) and NOF site (Waikaka Stream at Gore)

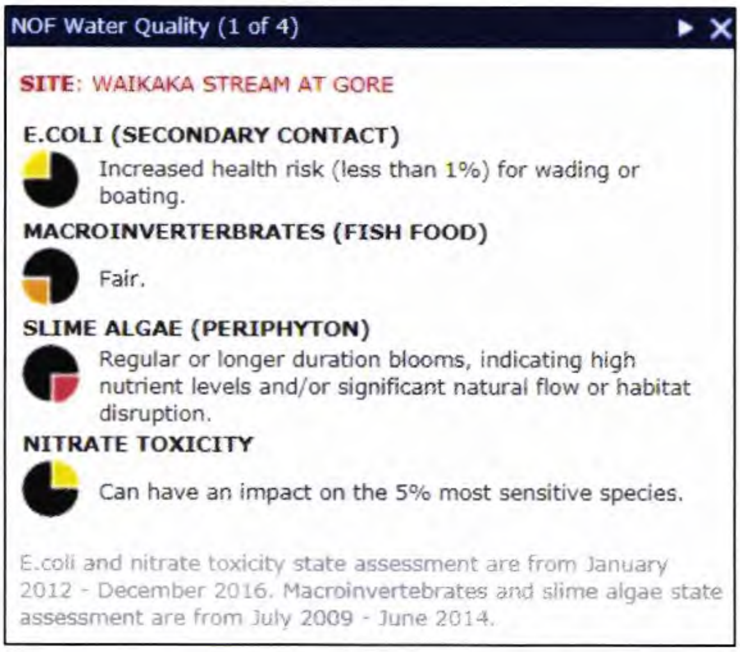

Figure 5.11 NOF key for Waikaka Stream at Gore site.

The lower catchment SOE site for the Waikaka Stream shows evidence of land use effects with elevated level of nutrient N dominating. This relates to the intensity of land use in the catchment, local hydrology and the physiographic land types found in the catchment. Artificial drainage and overland flow to receiving surfacewaters, as well as the low to moderate denitrification potential of some soils are factors that combine to produce this outcome. There is evidence that nutrient levels at the SOE site are decreasing, which is a favourable trend.

5.2.3 Toetoes Estuary

As reported by Stevens and Robertson in a 2013 study, Toetoes Estuary is a medium-sized "tidal lagoon" type estuary (500 ha) that discharges to Toetoes Beach at the mouth of the Mataura River and Titiroa Stream. It drains a large and primarily highly productive agricultural catchment and has a large freshwater influence because the estuary is small in relation to the freshwater input. The estuary has a wide range of habitats such as extensive mudflats and saltmarsh areas, very small patches of seagrass. The extent of the estuary has been modified with areas of saltmarsh surrounding wetlands lost to development. Broad Scale habitat mapping indicated that sediment and eutrophication are ongoing issues within the estuary although large sections of the estuary remain in good condition. A decline in estuary quality is evident over the last fifteen years, specifically increased muddiness and macroalgal growth/loss of sea grass beds in parts of the estuary.

5.2.4 Regionally Significant Wetlands and Sensitive Waterbodies

The nearest downstream regionally significant wetlands/sensitive waterbodies are found at the coastal area. Two such waterbodies are located over 60 kilometres to the south of the property and are coastal wetland/waterbodies (see figure 5.12):

- The *Lower Mataura River at Fortrose Harbour* is classed as a Regionally Sensitive Waterbody and is part of the Awarua Plain – Southland Estuaries complex. The *Lower Mataura River at Fortrose Harbour* includes Toetoes Estuary, described in the previous section.
- *Toetoes Flats* in close proximity to Fortrose Harbour, is also classed as a Regionally Sensitive Waterbody. It is located to the west of the Mataura River.

Figure 5.12 Location of regionally significant wetlands/sensitive waterbodies; Toetoes Flats and Lower Mataura River at Fortrose Harbour.

Lower Mataura River at Fortrose Harbour

The *Lower Mataura River at Fortrose Harbour* regionally sensitive waterbody is part of the Awarua Plain – Southland Estuaries complex. According to the DOC's *A Directory of Wetlands in New Zealand*:

> The Awarua Plains Wetland Complex is an extensive wetland complex located on the southern coast of the Southland Plains. The area contains the estuaries of Awarua Bay, New River Estuary and Toetoes Harbour, as well as the peatlands of the Awarua Plain dominated by wire rush and shrubland. This peatland contains Waituna Lagoon and numerous smaller ponds. The estuaries combine to provide one of New Zealand's most significant waterfowl habitats and are also of great importance for fisheries. The extensive, intact peatland vegetation provides habitat for many birds and invertebrates which are highly representative of southern New Zealand peatlands. The wetland complex supports populations of several threatened species. There are intact vegetation sequences from estuarine mudflats through saltmarsh and a mosaic of wetland communities to tall podocarp forest. The wetland complex is most significant for its ecological values, notably its large populations of migratory shorebirds, other wetland birds, fishery values and intact vegetation sequences.
>
> The peatland is fed largely by direct rainfall, with the wetland complex being fed by direct rainfall and a series of small streams. The smaller rivers include the Waihopai, Kingswell Creek, Mokotua, Duck Creek, Muddy Creek, Waituna, Moffat, Currans and Titoroa. The large Oreti River (with a catchment area of 3,510 sq.km) flows into the New River Estuary at the western extent of the wetland, while the

Mataura River (with a catchment area of 5,360 sq.km) flows into Toetoes Harbour at the eastern side of the wetland. There are two major components to the wetland complex, the first being the large water bodies including the estuaries, Waituna Lagoon and rivers, and the other being the extensive peatlands with a wide range of intact plant communities. The vegetation of the estuaries and lagoon includes intact sequences of communities from seagrass *Zostera novazelandica* on the mudflats and sandflats to saltmarsh (the major species being *Samolus repens*, *Selliera radicans*, *Salicornia australis* and *Scirpus cernuus*), rushlands (dominated by Jointed Rush *Leptocarpus similis*), and finally the peatland communities. The extensive peatlands (c.12,000 ha) consist of a rich variety of plant communities and species which are highly representative of the peatlands of the Southland Plains. These communities are largely associated with topographical features which influence drainage and hence the water table.

Toetoes Flats

There is a lack of information available on the regionally significant waterbody referred to as Toetoes Flats. Toetoes Flats is part of the Waituna Lagoon catchment and was included in a DOC giant kokopu monitoring programme. Results reported by DOC show that relatively large numbers of giant kokopu inhabit the area known as Toetoes Flats.

5.3 Groundwater

Dairy farm

The property lies in an unmapped groundwater zone. The nearest mapped groundwater zone is the Knapdale Groundwater Zone over 12 kilometres to the south west of the property.

Third-party graziers

Third-party graziers have been/are located unmapped groundwater management zones.

5.3.1 Groundwater Quality

Dairy farm

Groundwater nitrate levels underlying the property reflect modern day background land use impacts and are in the region of 0.4 – 1.0 mg/L. Given the soils, topography, geology and physiographic types found in the vicinity of the property, there is low risk to groundwater underlying the property, including for both nitrate and microbial contamination (*E.coli*). Particularly due to sloping topography, any potential risk to groundwater is likely to be transferred to streams into which groundwater will discharge from the better drained parts of the farm, and from overland flow/runoff and artificial drainage from the more poorly drained areas. Chatton soils are Gleyed and as such have denitrification properties. The nearest nitrogen "hotspot" where groundwater nitrate levels regularly exceed New Zealand Drinking Water Standard's MAV of 11.3 ppm is over 25 kilometres to the north west of the property, in different location in terms of topography, geology and hydrology.

Only two bores within a 4 kilometre radius of the property have water quality data available; bore F44/0252 had <1 CFU for faecal coliforms and 0.04 g/m^3 nitrate on one occasion in 2007, and bore F45/0631 had <1 CFU for faecal coliforms and 0.19 g/m^3 nitrate on one occasion in 2013. These data, albeit very limited, show that there is minimal risk to groundwater in the vicinity of the property.

E.coli is widely used as an indicator of faecal contamination of water, including groundwater. *E.coli* is believed remain viable for up to three months in groundwater (Edberg et al., 2000). There is minimal groundwater sampling in the vicinity of the property, with the above-mentioned testing of two bores in 2007 and 2013 being the only data available. Both were negative for faecal coliforms (including *E.coli*) at <1 CFU.

Third-party graziers

Groundwater nitrate levels in the vicinity of third-party grazier properties used in the last five years (in the Waikaka, Willowbank and Kaiwera areas) reflect pristine and modern-day background, and are in the range of 0.01 – 1.0 mg/L.

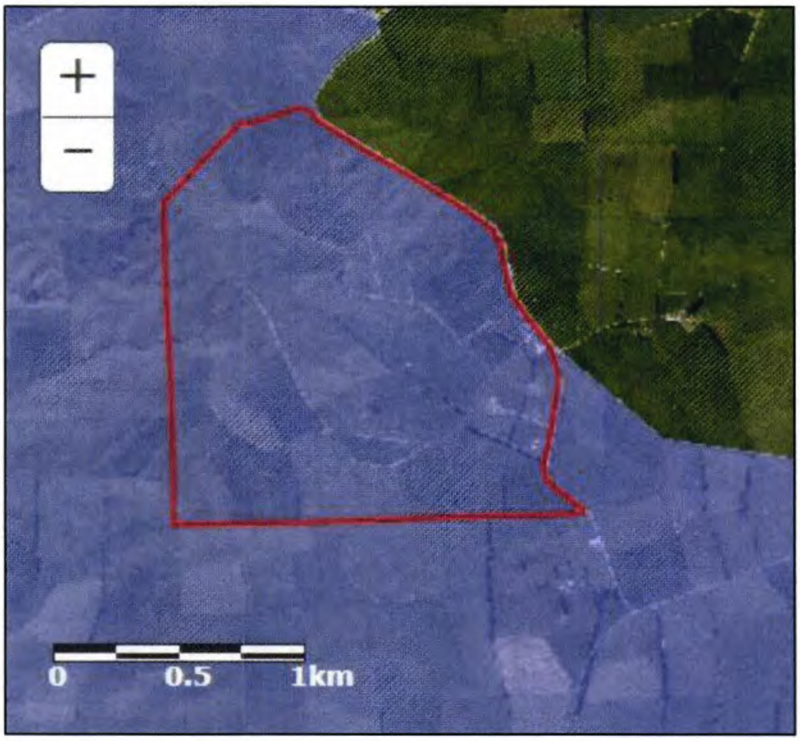

Figure 5.13 Groundwater nitrate levels in the vicinity of the property (approximate boundary is outlined in red).

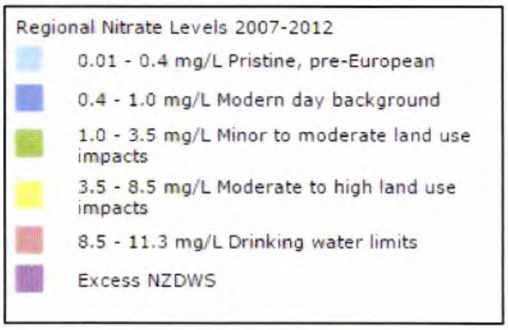

Figure 5.14 Key to groundwater nitrate levels

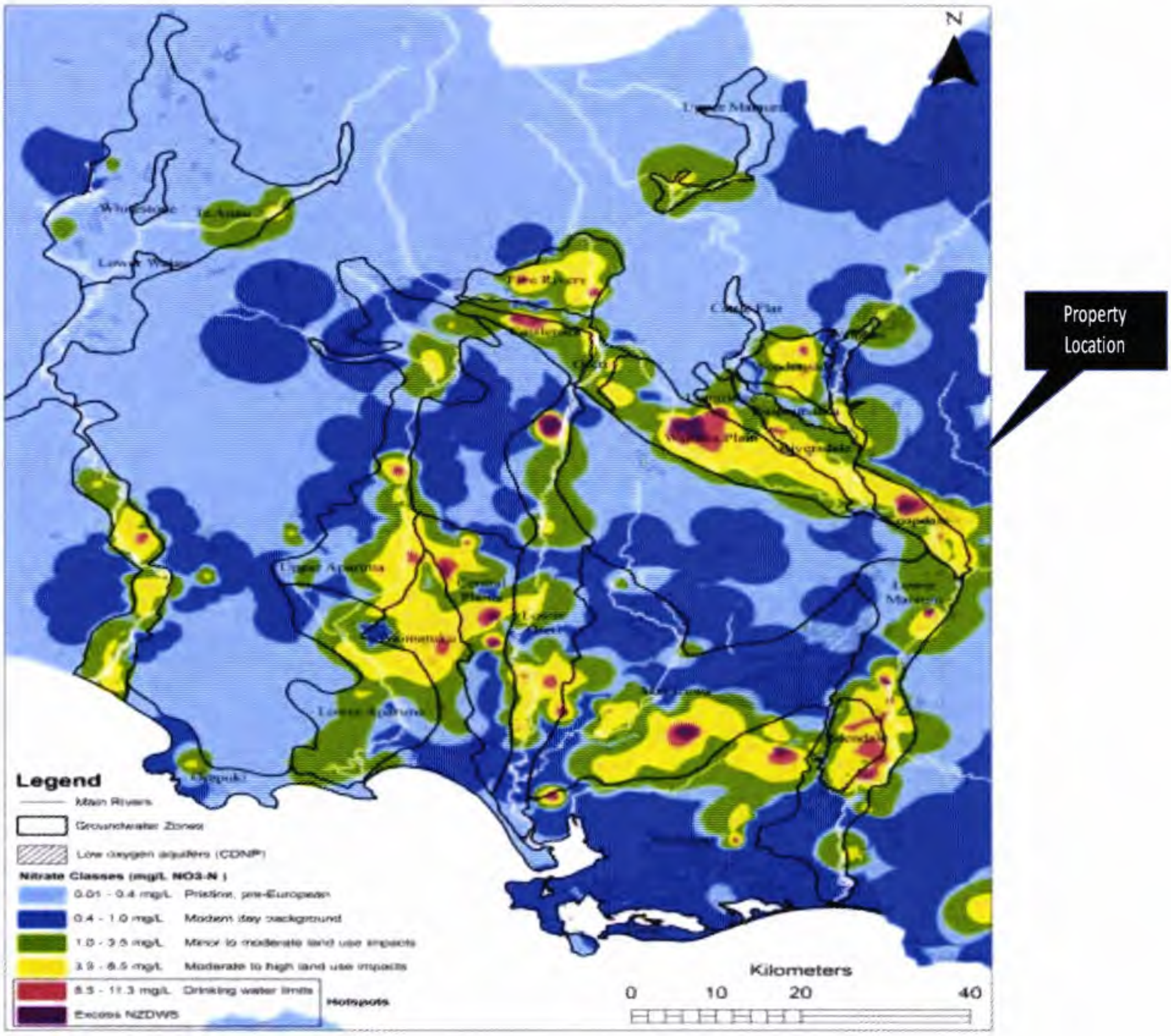

Figure 5.15 Classed NO3-N map for Southland's managed groundwater zones (Rissmann, 2012)

5.4 Physiographics

Dairy farm

The property is identified as being located primarily within the Gleyed (no variant) physiographic zone, with a smaller area of Oxidising (overland flow variant) zoned land at the north of the property (figure 16). The main contaminant pathways for Gleyed soils are artificial drainage, and overland flow where topography is undulating. The main contaminant pathway for Oxidising zoned land is generally deep drainage, however, given the sloping topography and slowly permeable soils, Oxidising land is more prone to contaminant loss via overland flow in this case.

Gleyed soils

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

Oxidising soils (overland flow variant)

Oxidised soils can be very good at absorbing and storing water and any nitrogen it contains. During drier months, nitrogen can 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***). Due to undulating topography, however, overland flow is more likely to be the major contaminant pathway for Oxidising areas in this instance.*** Overland flow down slopes will occur during periods of heavy rain when soils are wet, carrying contaminants such as N with it. Artificial drainage (mole and tile drains) is used where soils have low subsoil permeability to help to reduce waterlogging and can provide a pathway for contaminants to reach nearby streams, especially during wetter months.

Figure 5.16 Physiographic zones in vicinity of the property.

10 Kinloch Street, PO Box 5003, Waikiwi, Invercargill 9843

Phone 03 215 4381

Email: dairygreenltd@xtra.co.nz

Figure 5.17 Key to physiographic zones

Third-party graziers

MA COWS

A portion of MA cows have been winter grazed at different locations/graziers each year.

In the Kaiwera area, the dominant PZ is Bedrock/Hill Country (both overland flow and artificial drainage variants). Small pockets of Gleyed, Oxidising (overland flow variant) and Peat Wetlands PZs are also found in the Kaiwera area.

In the Waikaka area, the dominant PZs are Gleyed and Oxidising (overland flow variant).

In the Willowbank area, the dominant PZs are Gleyed and Oxidising (overland flow variant).

Since the different graziers in the Eastern Southland area are used, a conservative approach to risk management is implemented; contaminant pathways are assumed to be overland flow and artificial drainage, with somewhat less risk of deep drainage.

YOUNG STOCK

Gleyed and Oxidising (overland flow variant) PZs are found at the property used to graze young stock (see figure 5.18).

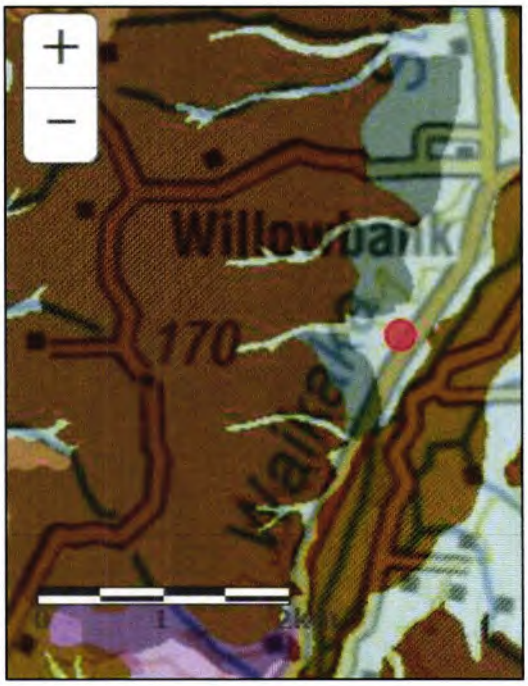

Figure 5.18 PZ at grazier property (young stock only). Red dot shows property address.

5.5 Topography

Dairy farm

The topography at the south end of the landholding is easy to rolling, with slopes generally of 0 to 7 degrees. Steeper slopes are found at the north of the landholding, in the range of 0 – 7, and 8 – 15 degrees. See figures 5.19 - 5.21 below.

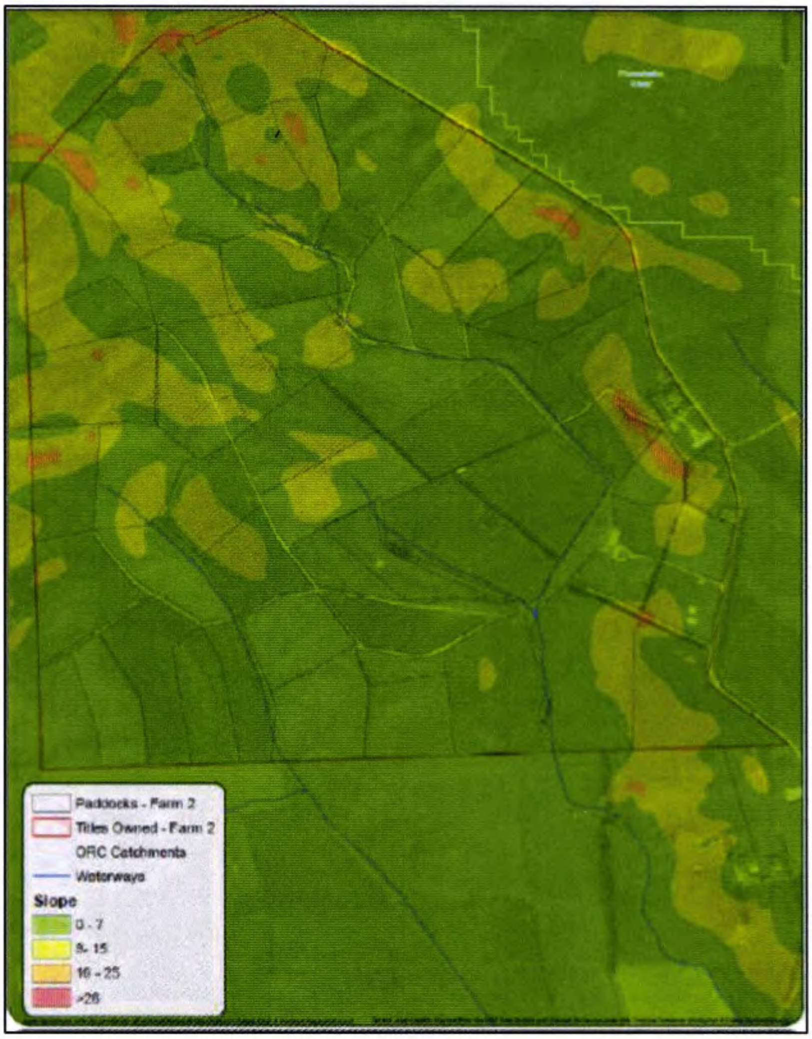

Figure 5.19 Topography at the dairy farm (source of map: Ravensdown nutrient budget report)

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Figure 5.20 Photograph of rolling topography found at the property. Note the fenced off, well vegetated CSAs on either side of lane at the bottom of the slope where a culvert crossing is located.

Figure 5.21 Photograph of rolling topography found at the property.

Third-party graziers

Given the location of third-party graziers in Eastern Southland, topography is generally easy to rolling, with some steeper slopes also.

6. Proposal Details

6.1 Effluent

6.1.1 Overview of effluent discharge activity

Table 6.1

Effluent Discharge	
Replacement of consent number	20146428
Duration of consent sought	10 years
Herd size	600 cows
Period of discharge	Effluent irrigation to the discharge areas will be carried out between August and May, and as ground conditions permit for June and July if deemed necessary.
Milking frequency	Twice per day
Winter milking	Not anticipated, seasonal supply only
Feed pad/wintering pad/stand-off pad	None
Other sources of effluent	Concrete area at vat stand

6.1.2 Effluent sources, collection and storage system

Dairy shed and yard

The maximum daily dairy shed effluent volume comprises 30 cubic metres of effluent plus any rainfall.

I. Raw effluent from the dairy shed and yard gravity flows to a sand trap.
II. From the sand trap raw effluent gravity flows to a concrete pump sump.
III. The concrete sump has a float switch, which automatically turns the pump on when the sump is 50% full. Effluent is pumped to the sludge beds sited on the hill to the west south west.
IV. The sludge beds are used alternately.
V. Having passed through a weeping wall, filtered effluent gravity flows to the storage pond.
VI. When soils are below field capacity and have sufficient soil moisture deficit, filtered effluent is pumped to a low rate Larall system and irrigated to land.
VII. When soils are near or at field capacity, effluent is stored in a buffer storage pond; there is enough storage in the pond so that irrigation is not required.
VIII. An off-season diversion is put in place at the dairy shed.

Silage pads - description

Two silage pads are located on the property. Effluent is not collected from either silage pad. Details regarding each silage pad follow.

HILL TOP SILAGE PAD

A silage pad is located on a dry, elevated site adjacent to paddock #30. See figure 6.1 below and map 1 in the appendix for silage pad location. Silage pad dimensions are 30 m X 25 m giving an area of 750 m^2. The silage stack has a smaller area than the pad.

The site has been excavated and levelled off. The silage pad is protected by clay banks and is underlain by a rock substrate (see figure 6.2). There is no water accumulation into the pad from surface or groundwater sources. The underlying substrate ensures there is no seepage to any underlying groundwater. The nearest waterway is approximately 300 metres to the south east, with grass paddocks in between. This pad has been used to store silage very infrequently (once in the last seven years).

YARD SILAGE PAD

A silage pad is located on a dry site adjacent to a silo at a yard. See figure 6.3 below and map 1 in the appendix for silage pad location. Silage pad dimensions are approximately 19 m X 12 m giving an area of 228 m^2. The silage stack has a smaller area than the pad.

There is no water accumulation into the pad from surface or groundwater sources. The substrate is well compacted and sealed, which ensures there is no seepage to any underlying groundwater (see figure 6.4 below).

The nearest waterway is approximately 200 metres to the west, with a shed, hedge and grass paddock in between.

HILL TOP SILAGE PAD & YARD SILAGE PAD

Rain falling on the plastic cover of the stacks is shed to the sides and away from the pads, without mixing with silage. The silage is cereal silage and has been wilted such that there is no leachate running from it.

If in use, the stack is likely to be open in February/March, late April/May and Aug/Sept as required. When not in use the entire stack is covered. When open, a tight face is always maintained at the front of the stack minimising exposure of silage to air and rainwater. This minimises the generation of leachate when the face of the stack is open. Any leachate that is generated occasionally is contained within both silage pads and does not drain outside either facility.

The pad areas are also used to store baleage as required.

Due to distance, maintenance of pasture cover in paddocks, pad design and management of the silage stack, there is little or no risk of silage leachate reaching surface waterways.

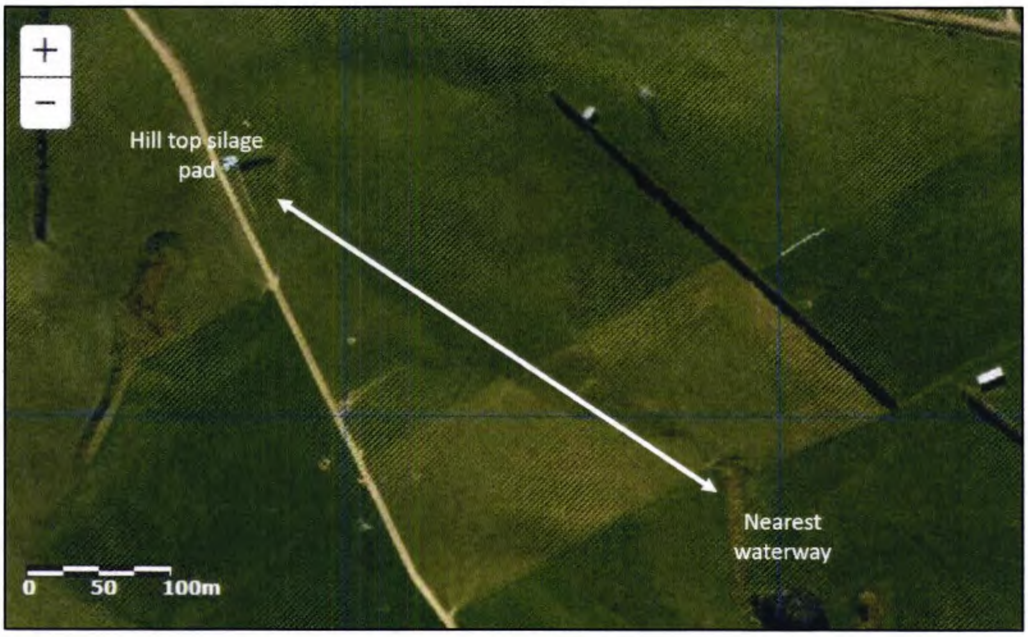


Figure 6.1 Aerial photo of hill top silage pad

Figure 6.2 Hill top silage pad protected by banks.

Figure 6.3 Location of yard silage pad adjacent to silo is marked X.

Figure 6.4 Yard silage pad.

6.1.3 Effluent storage

Effluent pond

The effluent pond was built in c.2011 and has a synthetic liner. The storage capacity of the pond is 2,420 cubic metres (+ 0.5 m freeboard).

The pond was drop tested in accordance with Appendix P in March 2017 and passed the drop test. A drop test report has been submitted to Council and is appended to this application.

The pond does not have a leak detection system.

The pond has been inspected and certified by a SQP as having no visible cracks, holes or defects that could leak effluent. A visual inspection report is appended to this application.

Figure 6.5 Effluent storage pond

Figure 6.6 Effluent storage pond

Other effluent containment structures

The effluent system also operates a sand trap, a concrete sump and sludge beds. The concrete sump and sludge beds have been inspected and certified by a SQP as having no visible cracks, holes or defects that could leak effluent. Visual inspection reports, including photos, are appended to this application.

A disused effluent pond is located adjacent to the dairy shed and yards. It will be removed in February/March 2019.

Storage capacity

The existing pond has sufficient storage for dairy shed effluent from 600 cows. Allowing for 50 litres per cow per day at the dairy shed, the Massey Dairy Effluent Storage Calculator 90% storage probability volume is 1,946 metres cubed.

Summary of Massey DESC parameters:

- 600 cows milked at peak
- Water use = 50 l/cow/day*
- Milking season = 1 Aug – 31 May
- Yard is diverted from 6 June to 30 July
- Yard area = 994 m^2

*Water use of 50 l/cow/day is likely to be an overestimation given a focus on minimising water use at the dairy shed. Using an allowance of 50 l/cow/day in the DESC generates contingency storage capacity in the pond.

6.1.4 Effluent irrigation

Low rate irrigation

The irrigation system comprises a low rate Larrall system, which applies dairy shed effluent to land at a rate of less than 10 mm/hour and at a maximum depth of 10 millimetres per application.

The Larall irrigation system has a safety system to detect blockages or leaks, which automatically switches the system off if there is insufficient or excess flow. Irrigation of effluent only occurs when there is sufficient soil moisture deficit to safely apply effluent to land without risk of drainage to receiving waters.

Contingency methods

The aim is to operate the irrigation systems to always ensure there is buffer storage available. This allows a contingency for wet weather or pump failure.

A slurry tanker or umbilical system may be used as contingency irrigation methods. The slurry tanker and umbilical system will apply effluent at a maximum depth of application of 5 mm for each individual application. They will only apply effluent to flatter areas within land classed as Category C/sloping land by Environment Southland. As is shown from figure 5.19, there are areas of flatter land with Category C classed land, where slopes are less than 7 degrees.

Should the irrigation pump fail, a replacement pump is available within 12 hours. Alternately a petrol motor or tractor-driven pump could be hired. There is adequate storage to allow time for pump replacement.

Other conditions

- A minimum return period of 28 days between applications;
- A maximum of 150 kg of N/hectare from effluent will be applied annually;
- A maximum depth of 10 mm per application;
- A maximum combined depth of application of 25 mm per year to any land area; and
- A minimum land area of 8 hectares/100 cows for the dairy shed effluent.

6.1.5 Nutrient content of effluent

Dairy shed effluent

The nutrient content of dairy shed effluent has not been tested but is expected to be in line with typical dairy shed effluent (Longhurst, Rajendram, Miller and Dexter (2017)). An estimate for nutrient content of typical dairy shed effluent based on the above reference is as follows:

Table 6.2 Nutrient content of effluent (Longhurst et al., 2017)

Nutrient	Effluent content (g/m3)

N	250
P	30
K	300
S	15

Discharging dairy shed effluent at a depth of 10 mm applies 25 kg of N/hectare and 30 kg of K/hectare. Where the application depth is lower, less N is applied per hectare.

Based on 50 litres effluent per cow at the dairy shed, 0.0125 kg N per cow per day will be collected. The average lactation length per cow is 280 days.

600 cows x 0.0125 kg N per cow x 280 days lactation = 2,100 kg N will be collected at the dairy shed annually.

Approximately 2.1 tonnes of N will be discharged at low rate across the effluent discharge area annually. A minimum of 14 hectares is required to apply the Environment Southland limit of 150 kg N/hectare from effluent. Approximately 180 hectares is available in the FDE area authorised under the existing discharge permit, which applies 12 kg N/hectare if the entire area is used.

Sludge

Sludge beds are cleaned out at least once per year. Solids that collect in the sludge beds are applied to land in accordance with permitted activity rules (Rule 38 of pSWLP). Solids are applied at less than 10 millimetres depth, are applied at an N loading of less than 150 kg/hectare and are applied to lea ground. A minimum buffer of 20 metres to surface waterways, bores and the landholding boundary is maintained when applying solids to land. The activity is not carried out when the soil moisture exceeds field capacity or when soil temperatures are below 5 degrees in winter and autumn or 7 degrees in spring.

6.1.6 Effluent discharge and receiving area

According to discharge permit 20146428, the approximate size of the authorised discharge area is 180 hectares.

Effluent irrigation to the discharge area is carried out between August and May, and if ground conditions permit in June and July as necessary. As per the existing permit, the consented effluent receiving area encompasses the majority of the dairy farm, less Council required buffers around waterways, bores, neighbouring dwellings, boundaries etc.:

- 20 metres from any surface watercourse;
- 100 metres from any potable water abstraction point;
- 20 metres from any property boundary (unless the adjoining landowner's consent is obtained to do otherwise);

- 200 metres from any residential dwelling other than residential dwellings on the property;
- Dairy shed effluent shall not be discharged onto any land area that has been grazed within the previous 5 – 10 days; and
- Effluent shall not be discharged over tiles or mole drains, nor to sloping areas when the soil is at field capacity.

No affected party approvals are required.

Effluent will not be discharged at times where there is snow on the ground or when rainwater/irrigation water has ponded on the land surface. Effluent will also not be discharged when soil conditions are considered unsuitable i.e. when soil temperature is at or below 5 degrees Celsius or when the soil moisture deficit is insufficient. Environment Southland's Beacon website will be consulted as a guide to soil moisture levels.

6.3 Water Use

Glenkenich Rural Water Scheme

Water supply for stock drinking water and dairy shed use is from the Glenkenich Rural Water Scheme. Water pumped from the Scheme is stored in five water storage tanks (5 x 30,000 L) at a high point on the farm (see Appendix map for location). Water gravity feeds from the hill top tanks to a stock drinking water scheme and to two storage tanks at the dairy shed (1 x 25,000 L, 1 x 30,000 L).

Supplementary surfacewater take for stock drinking water only

Occasionally water supply from the Glenkenich Scheme ceases temporarily. When this occurs, supply to the dairy shed from the hill top tanks is turned off and water stored in the hill top tanks is exclusively used for stock drinking water. If the drinking water stored in hill top tanks is insufficient, it is supplemented by surface water from a stream on farm (see appendix map for location), which is authorised under Section 14(3)(b) of the Act. The surfacewater take to supplement stock drinking water is small, is only used when the Glenkenich Scheme shuts down, and the rate of take does not exceed 2 litres per second.

When the Glenkenich Scheme supply ceases temporarily, the dairy shed solely relies on water stored in two tanks situated outside the shed. Water use at the dairy shed is then minimised. The frequency of yard wash down is reduced to a minimum or yard wash is stopped altogether, with water used only for plant wash. Water stored in two water storage tanks is used as efficiently as possible. In practice, water stored in the tanks has been found to last 5 days at the dairy shed. Once water reserves in dairy shed tanks are low, water is purchased from a potable water supplier who tank it into the farm and pump it into the storage tanks for supply to the dairy shed.

Figure 6.7 two water storage tanks at dairy shed.

During the milking season (twice per day milking), requirements are 70 l/cow/day for drinking water and 50 l/cow/day for dairy shed wash down water.

During the off-season, cows that remain on farm require approximately 45 l/cow/day for drinking water only.

6.4 Land-use – Dairy farming

6.4.1 Land use activities – dairy platform

Land use

The land is used as a pasture based dairy farm. Calving officially starts on 1 August and cows are typically milked from 1 August to 31 May. Cows (Friesian Jersey Cross) are milked twice per day. The average annual lactation length per cow is 280 days.

A general description of the proposed dairy management system follows. Please see the nutrient budget analysis report prepared by Nouman Kyamanywa (CNMA) from Ravensdown for a more detailed report.

Stock management

- Approximately 600 cows (i.e. mixed age cows and replacements) are calved each year. The milking herd peaks in October/November at 600. It drops slightly over consecutive months depending on seasonal variation in pasture production; approximately 580 cows are milked in March. Cows are dried off in April and May. Approximately 130-160 cows are culled and replaced each year.
- Median calving date is 25 August with approximately 150 heifer calves kept as replacements (25%). Calves are grazed off farm from weaning until they return as in-calf R2 heifers. Grazing of calves and heifers over this time is provided by a third-party grazier.
- Approximately 150 in-calf R2 heifer replacements return to the farm in August each year. Replacements calve in August, September and October and join the milking herd.
- Approximately 14 bulls are grazed on farm and used as part of the mating programme each year.

Wintering, cropping, grazing and supplements

WINTERING

150 cows are wintered on farm where they are winter gazed on fodder crop (fodder beet). The remaining cows (c.300 after culling) are winter grazed off farm. Off farm winter grazing is provided by a third-party grazier.

CROPPING

Fodder crop – approximately 11 hectares of fodder crop (fodder beet) is grown and grazed by a maximum of 150 cows over winter (June, July and August). Fodder crop is also grazed by cows in May, and September, when cows generally graze it for two hours per day.

PASTURE RENEWAL

The pasture renewal programme is either through a fodder crop rotation (grass to fodder beet to grass) or is by grass to grass cultivation. Approximately 5-10% of the farm is re-grassed each year.

GRAZING

Cows are grazed on pasture throughout the season. Cows are also grazed on fodder crop in May and September, when they generally spend two hours per day on crop.

SUPPLEMENTS MADE

If there is a surplus, grass may be harvested at the dairy farm and stored as baleage or silage.

SUPPLEMENTS IMPORTED

Silage, barley, PKE and straw. Barley grain is fed in the milking shed to cows through an in-shed system.

General fertiliser use

For a detailed fertiliser programme, please see the nutrient budget inputs and analysis report. The following is a summary of the proposed fertiliser programme:

Table 6.3 Whole farm average (effluent block, non-effluent block, crop block) NPKS nutrients from fertiliser.

Season	N	P	K	S
Proposed system	246	25	16	38

Applications of fertiliser nitrogen have been proportioned for the effluent and non-effluent area, with the effluent area receiving approximately 35 kg N/ha less than the non-effluent block.

No applications of nitrogen in high risk months May, June and July will be made. If ground conditions are suitable and there is minimal risk of drainage, fertiliser is applied in split applications from August to April.

6.4.2 Land use activities – third-party graziers

Graziers are generally dry stock farmers who graze dairy stock to supplement their income.

MA cows

In previous years (13/14, 14/15 and partly 15/16) most cows were winter grazed by third-party graziers in June, July and part of August. In more recent years (partly 15/16, 16/17 and 17/18), a greater proportion of the herd was wintered on farm, with less cows grazed by third-party graziers. It is proposed to continue with this strategy in the future; approximately 300 MA cows will be winter grazed by third-party graziers over June, July and part of August and the balance (150 cows) will be winter grazed on farm.

Heifers and heifer calves

It is proposed to continue to graze all weaned heifer calves and R2-heifers off farm, as has been done in the past. Approximately 150 heifer calves are weaned at 100 kilogrammes and are grazed by a third-party grazier from December/January until they return for calving as in calf R2-heifers approximately 18-19 months later.

Grazier location

See figure 6.8 for the localities where off farm grazing of MA cows and young stock is carried out.

MA COWS/WINTER GRAZING

Grazier location changes each year depending on the availability of crop, grazier and price of crop or grazing. Winter grazing has generally been carried out in the eastern Southland /central Otago area:

2018 – Willowbank area close to Gore town, approx. 300 cows

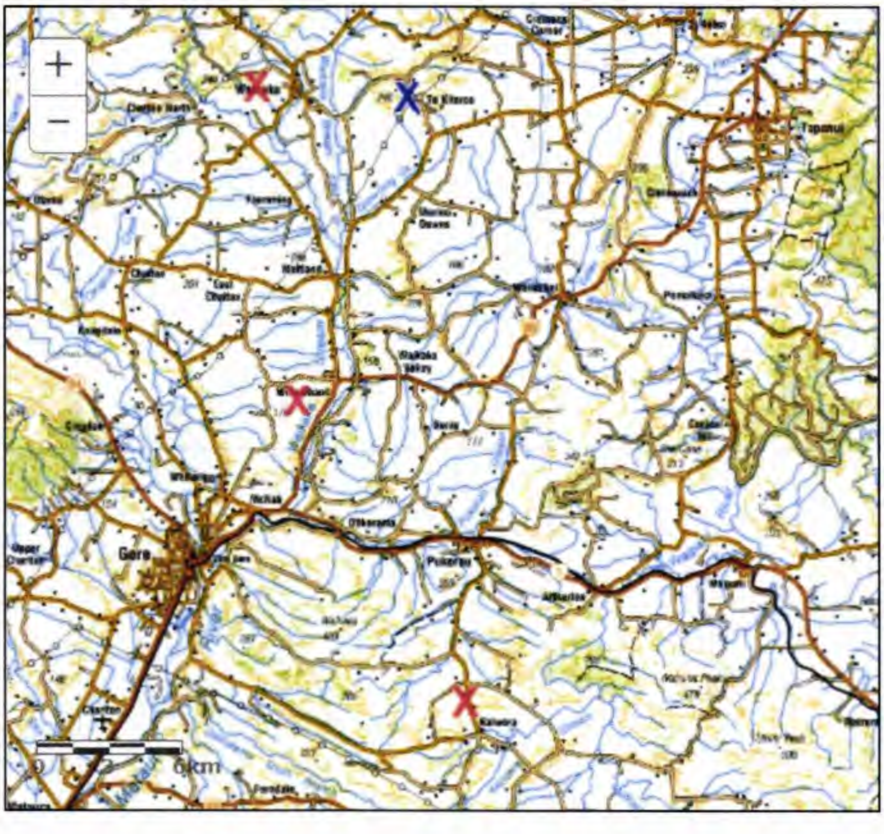
2017 – Ettrick (Otago) and Waikaka areas, approx. 300 cows

2016 – near Kaiwera, approx. 300 cows

2015 – 9 km from dairy farm/Waikaka area, approx. 430 cows

YOUNG STOCK

Grazing of young stock is carried out at a third party property (459 Waikaka Valley Highway) 12 kilometres from the dairy farm, close to Gore town. Young stock has been grazed at the Waikaka Valley Highway farm in recent years and it is the intention to continue with this arrangement in the future.



X = dairy platform location
X = third party grazier locations (excluding Ettrick in Central Otago

Figure 6.8 Localities where wintering grazing of MA cows and grazing of young stock is carried out.

LAND USE AT GRAZIER LOCATION

Land use at grazier farms is generally dry stock farming, including a range of stock types. Fodder crop cultivation, grazing and winter grazing, and grass silage and baleage harvesting are other permitted activities carried out at grazier farms. The winter grazing of dairy cows is a means of supplementing farm income for graziers. Fodder beet is the preferred type of fodder crop for the winter grazing of MA cows, with brassica or beet crops used to winter graze young stock. Baleage and/or silage is generally also fed to animals on crop over winter. Graziers generally harvest surplus grass as baleage/silage, store it and feed it to stock, including dairy cows over winter. Fodder crop rotation is generally incorporated into the re-grassing programmes at grazier farms.

Graziers must comply with Rule 20 of the pSWLP (2018) regarding winter grazing activities, and from May 2019 may be required to obtain resource consent for intensive winter grazing activities carried out at their properties. Responsibility to comply with rules and policies lies with the graziers, when they carry out intensive winter grazing at their properties. They must also follow good management practice for fertiliser use and application, cultivation and intensive winter grazing activities.

6.4.3 Good Management Practices

Good management practices (GMPs) implemented on farm are also described in the FEMP. A general strategy of good management practice is undertaken on farm. Details are described in table 6.4 below.

Table 6.4 General Good Management Practices 1 June 2018 – 31 May 2019

Strategy Type	Summary of Management Practices
Operational	• Utilising a nutrient management plan; • Soil testing is carried out each year; soil Olsen P levels are maintained at a biological optimum and no higher; • Trends in soil testing are evaluated and used to inform on decision making regarding soil health, fertiliser and agronomy plans; • Surface waterways are fully fenced and with good grass cover, fencing is maintained and stock are excluded from the riparian areas;

	• Wide riparian buffers are maintained and a planting programme is underway; • All surface waterways are culverted; • Sufficient land area is available for the dairy operation; • Young stock is grazed off farm from weaning; • Tracks and lanes are sited away from streams where contours allow; • Lane runoff diverted to land with remedial work at lane/culvert/bridge crossings carried out as required; • Good management practice of the silage pads is implemented; • Restricted grazing of draining pastures in autumn/spring; • Care in irrigation of FDE, especially when the ground is near or at field capacity; • A large land application area is available to ensure N & K returns are not excessive; • Effluent volumes are minimized at source through efficient water use; • Low rate FDE irrigation (i.e. Larrall system) is used; • Appropriate FDE storage volume to allow for deferred irrigation for effluent; • All data and maps are kept up to date and all staff are trained and informed of any changes; • Programmed maintenance is done in and around FDE, and piping infrastructure around the dairy shed, cow yard etc.;

6.4.3 Good Management Practices for Key Transport Pathways

See table 6.5 below for a summary of physiographic zones and key transport pathways of contaminants.

Table 6.5 Physiographic zones and key transport pathways

Physiographic Zone	Variant	Key Transport Pathways
Gleyed	n/a	Artificial drainage, overland flow
Oxidising	Overland flow	Overland flow, deep drainage

The dairy farm is classed in the both the Gleyed and Oxidising (overland flow variant) physiographic zones.

- The Oxidising PZ contains Waikiwi (Chatton on Topoclimate) and Benio soil types, and
- The Gleyed PZ contains Claremont (Waikoikoi on Topoclimate) and Eureka (Jacobstown on Topoclimate) soil types.

See section 5.4 for a description of PZs.

Recommendations described on Good Practice Management factsheets issued by Environment are implemented where practical. These measures will be reviewed annually with the inclusion of new measures where appropriate. Table 6.6 describes good management practices currently implemented on farm through the annual cycle to mitigate the risk of contaminant loss to water (N, P, sediment and microbes).

Reference factsheets:

- Artificial drainage
- Deep drainage
- Overland flow

Table 6.6 Good management practices implemented on farm in the 2018/2019 season and further explanations.

Transport Pathway	Mitigation Measure	Summary of Management Practices
Artificial drainage, Overland flow	Protect soil structure (especially near streams)	Match stock management to land use capability, e.g. avoid grazing cows on more vulnerable soils, especially when wet. Fence off waterways and protect CSAs. Stock will not graze riparian strips. Riparian strips are large and well vegetated; Young stock is grazed off farm from weaning; Implement good management practice winter grazing; When appropriate use minimum or no-till cultivation practices such as direct drilling; Re-sow areas of bare or damaged soil as soon as is practical;
Artificial drainage, Overland flow	Reduce P use or loss	Prepare a nutrient budget; Soil test regularly;

		Maintain Olsen P values at agronomic optimum and no higher; Apply P fertiliser outside of high-risk months in autumn and winter; Manage CSAs appropriately;
Artificial drainage, Deep drainage	Reduce accumulation of surplus N in the soil, particularly during autumn and winter	Maintain sustainable stocking rate; Reduce inputs of N where possible through optimal fertilizer application on farm, use little and often approach; Young stock is grazed off farm from weaning; Optimize timing and amounts of effluent irrigation input applications; Substitute autumn diets with low-N feed when practical; Time N application to meet pasture demand using split applications and when pastures are actively growing (>6 degrees Celsius); Control the duration of grazing pastures; Cut and carry feed where practical;
Artificial Drainage Deep drainage	Avoid preferential flow of effluent through artificial drainage channels	Defer irrigation to effluent storage pond when soil conditions are unsuitable; Low rate effluent application is primarily used; A sufficiently large FDE area is available for effluent; Observe buffer zones and placement guidelines e.g. not over tile drains or close to CSAs during high risk periods; Observe discharge consent conditions;
Overland flow	Manage CSAs; gullies, low points	Fence off CSAs and maintain good vegetation cover;

	at the bottom of slopes, close to watereways and/or overlying tiles	Restrict grazing of pasture CSAs when soils are near saturation; Avoid working pasture CSAs and their margins; Move troughs and gateways away from water flow paths; Reduce runoff from tracks and races by using cut offs and shaping to direct surface drainage to paddocks, where it can be filtered by pasture plants before reaching waterways; Carry out remedial work to reduce runoff as required;

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6.4.4 GMPs – intensive winter grazing

Good management practice is implemented when grazing cows on fodder crop (fodder beet) from May to September to mitigate contaminant loss via overland flow and artificial drainage to surfacewaters. Table 6.7 describe GMPs implemented that are specific to intensive winter grazing.

Table 6.7 GMPs – intensive winter grazing

GMPs - intensive winter grazing	
GMP	**Explanation**
Appropriate paddock selection	Judicious paddock selection based on the soil moisture content is a key tool. This is important not only to avoid overland flow, pugging etc. but to ensure that the pasture and soils are not damaged to any extent that would inhibit spring pasture growth. Drainage is put in place as required prior to paddocks being cultivated and subsequently winter grazed.
Back fence stock	Breaks once eaten off, are back fenced to avoid pugging of soils
Graze towards any water course(s)	Breaks are sequenced to ensure that grazing is towards the watercourse, leaving a last bite buffer where possible;
Place baleage in paddock when soils are dry	If baleage is used, baleage is placed in the paddock before soil becomes too wet thereby preventing heavy vehicles from damaging the ground. Supplementary feed (baleage/hay) is placed in portable feeders.
Use portable troughs	Where breaks do not encompass a trough, a portable trough will be used to avoid the pugging of lanes between the water troughs and the feed breaks.
Implement wide buffer zones from waterways	A fenced buffer zone of at least 5 metres from all waterways is maintained. Where land is sloping, larger buffer distances will be implemented, e.g. 10 – 20 metres. Higher risk areas over drainage depressions (swales) and close to waterways are temporarily fenced off. Paddock CSAs are not grazed.
Avoid pugging of soils close to waterways	In wet weather, where there is risk of pasture and soil damage, care is taken to minimise grazing and avoid supplement feeding and pugging within 10 metres of a waterway.

6.4.5 Specific Mitigation Measures – Expansion

As is described in the nutrient budget section, the change from the pre-expansion system to a 600 cow system, in conjunction with the implementation of mitigation measures, is predicted to result in no change in the average annual N loss for the whole farm compared to the average annual N loss over the prior five years. When the land classed in the Oxidising PZ is assessed in isolation, it is predicted to have similar average annual N losses to the five-year pre-expansion average.

For a more detailed summary of mitigation measures, please see the nutrient budget analysis report (page 14).

N loss

It is noted that approximately 600 cows were milked in two of the pre-expansion years, in line with the cow number authorised on the discharge permit at the time. The key mitigation measures that are driving the stable N loss are as follows:

- Reduced area of winter crop (fodder beet) and slightly higher yield;
  - Less mineralisation of organic N in soils and less area winter grazed, increased uptake of N by fodder beet plants
- Reduced fertiliser application rate overall and avoidance of application from May to July;
  - Less N leaching loss
- Expansion of effluent area for liquid application;
  - Less N leaching loss
- As per pre-expansion years, a portion of cows will be wintered off farm;
  - Less N loss from intensive winter grazing
- As per pre-expansion years, all young stock is grazed off farm from weaning until they return as in-calf R2-heifers for calving;
  - Less N loss from animal grazing

P loss

Factors that are driving the modelled small increase in P loss are as follows:

- Higher Olsen P values entered in Overseer to reflect target Olsen P levels across the property;
- "Other farm sources" P loss sub-model (accounting for 10 kg P/year)

Mitigation measures based on the implementation of a farm environmental management plan will address P loss at the farm. The same measures will help to mitigate the loss of sediment and microbial contaminants to water, as they are generally transported to water via overland flow and artificial drainage also. Implementation of effective mitigation measures is critical given the rolling topography at the farm.

These measures include:

- Where lanes are parallel to drains, there are wider buffers of fenced off vegetation;
    - Runoff from tracks and lanes to waterways is reduced into waterways. Overseer does not take the layout of individual farms into account.
- Protect CSAs by fencing and planting, especially on sloping ground;
    - P is filtered and less P is transported to drains and streams.
- Culvert/bridge crossings of waterways are managed to ensure runoff is filtered before draining into waterways;
    - Remedial work is carried out as required to prevent runoff from tracks and lanes reaching surface waterways. Track shaping and cutting is carried out to direct surface drainage at such locations to paddocks and away from waterways. If necessary, nib boarding is put in place.

Due to the suite of measures mentioned above, contaminant losses including N, P sediment and microbes will not increase under the proposed system. Potential losses associated with the expansion will be fully mitigated in line with Policies 5, 10 and 16 of the pSWLP. Mitigation measures are summarised in table 6.8.

Table 6.8 Specific mitigation measures to be implemented at the dairy platform relating to the expansion.

Key pathway	Key mitigation measure	Effect of measure	Implementation
Overland flow, artificial drainage	A maximum of 11 hectares of fodder crop (beet or brassica) is sown annually.	Less mineralisation of organic N in soils, reduced N, P, sediment and microbial loss from intensive winter grazing of fodder crop	Nov-18
Artificial drainage	Expansion of FDE area to at least 68 hectares	Less N, P, and microbial loss from soils to water	Mar-19
Artificial drainage, overland flow	An average of 246 kg N/ha is applied in fertiliser, fertiliser is not applied from May - July	Less N leaching loss from soils	Oct-18
Overland flow, artificial drainage	No more than 150 cows will be intensively winter grazed on farm	N, P, sediment and microbial loss from intensive winter grazing of fodder crop is limited by cow number	Jun-19
Overland flow, artificial drainage	All young stock is grazed off farm from weaning until they return as in-calf R2-heifers for calving	Less N, P, sediment and microbial loss from animal grazing	Nov-18
Overland flow, artificial drainage	Maintain Olsen P levels at the agronomic optimum and no higher.	P loss is avoided	Nov-18

Overland flow, artificial drainage	Management of CSAs through implementation of an effective FEMP	Contaminants such as P, sediment and microbes are filtered and/or adsorbed onto soil particles	Nov-18

A review of good management practices will be carried out annually. Practices undertaken in the previous 1 June to 31 May period will be reviewed and practices will be implemented over the following 1 June to 31 May as appropriate. It is clear from above tables that a range of good management practices is implemented throughout the year.

6.4.5 Nutrient budgets

Six nutrient budgets (NBs) have been prepared, to include all land within the landholding:

- Five pre-expansion nutrient budgets have been prepared based on actual figures for 2013/2014, 2014/2015, 2015/2016, 2016/2017 and 2017/2018 years. Evidence has been provided to support inputs used for all year end nutrient budgets.
- One nutrient budget has been prepared to reflect the proposed 600 cow dairy farm.

Mr. Nouman Kyamanywa (CNMA) from Ravensdown carried out all Overseer work in August/September 2018. Soil nutrient test data, the latest version of the Overseer model (ver. 6.3.0) and Overseer Best Practice Data Input Standards from March 2018 were used. Associated XML files have been submitted electronically.

Table 6.9 Nutrient budget file names

Nutrient budget	File name
2013/2014	Ovr-SOUTH PRO MAITLAND LTD-2013_14.XML
2014/2015	Ovr-SOUTH PRO MAITLAND LTD-2014_15.XML
2015/2016	Ovr-SOUTH PRO MAITLAND LTD-2015_16.XML
2016/2017	Ovr-SOUTH PRO MAITLAND LTD-2016_17.XML
2017/2018	Ovr-SOUTH PRO MAITLAND LTD-2017_18.XML
Proposed	Ovr-SOUTH PRO MAITLAND LTD-PROPOSED – V2.XML

Inputs and report

Mr. Kyamanywa also prepared a nutrient budget analysis report, which is submitted with this application. Rather than duplicate material, **please refer to the appended nutrient budget analysis report for assumptions and inputs for each nutrient budget, as well as outputs and analysis.** For the purpose of this application, a commentary relating to inputs is outlined here:

- The first two years (13/14 and 14/15) were similar in terms of inputs, with approximately 600 cows milked and most cows wintered off farm over June and July.
- The last two years (16/17 and 17/18) were similar in terms of inputs with approximately 550 cows milked and more cows wintered on farm in June and July than previously.
- Fertiliser inputs were higher in the last two years (16/17 and 17/18).
- Milk solids production varied over the five years, with production higher in the last two years (16/17 and 17/18), which is the result of better nutrient, soil and pasture management, as well as better animal husbandry.
- Moderate production seen in 13/14 with relatively low inputs (including fertiliser) resulted in the over grazing of pastures in that year; the farm recovered over the following two years as seen by lower production levels in 14/15 and 15/16.

Potential Nutrient Losses as Modelled by Overseer

Table 6.10 Modelled nutrient losses nutrient budgets (source: Nutrient Budget Analysis Report, N Kyamanywa, table 20).

Nutrient loss	2013/14	2014/15	2015/16	2016/17	2017/18	Averaged Output	Proposed
Nitrogen leaching (Total kg N/year)	7,841	9,348	8,873	11,504	12,470	10,007	9,979
Nitrogen leaching (kg N/ha/year)	38	45	43	56	61	49	49
Phosphorus loss (Total kg P/year)	170	171	187	183	165	175	199
Phosphorus loss (kg P/ha/year)	0.8	0.8	0.9	0.9	0.8	0.9	1.0

Discussion – nutrient losses predicted by Overseer nutrient budget modelling

N LOSS - WHOLE FARM

The pre-expansion average annual N loss based on five years of supported data is 10,007 kg or 49 kg/hectare. The proposed 600 cow dairy farm is predicted to have an average N loss of 9,979 kg/year or 49 kg/hectare/year. Overseer predicts an average reduction in N loss of 28 kg/year with the change to the proposed 600 cow system, which is effectively no change; N loss is predicted to remain stable. The effects of increasing cow numbers by 50 are not being exported off farm, for example through increased off farm winter grazing. Rather they are being contained on farm through the implementation of various mitigation measures.

N loss is predicted to remain stable despite an increase in cow numbers from 550 to 600. Several factors are relevant to this:

- The herd size was approximately 600 in two of the pre-expansion years. The proposed system also has a herd size of 600;
- In the last two pre-expansion years, N fertiliser use was very high, deemed to be excessive by the applicants. The proposed system will use less N fertiliser. The timing of fertiliser application will be changed to avoid applying fertiliser in high risk months from May to July;

- Less area of fodder crop (11 hectares of fodder beet) will be sown in the proposed system than in recent years, when surplus fodder beet was grown to requirements. Soil aggregates are broken up and mixed when cultivated for cropping. This results in a high rate of N mineralisation through accelerated microbial decomposition of soil organic matter and subsequent rapid nitrification, which produces large quantities of nitrate. Dung and urine are deposited in relatively high volumes on winter crop ground, further driving losses of N. Reducing the area of fodder crop reduces N loss to an extent;
- The effluent receiving area will be expanded to 68 hectares in the 18/19 season. This will reduce the N loading of soils from effluent (from 81 kg/ha to 36 kg/ha).

N LOSS – OXIDISING PZ

Table 6.11 N loss from land classed in Oxidising PZ (source: Nutrient Budget Analysis Report, N Kyamanywa, table 21).

Benio and Waikiwi Soils	2013/14	2014/15	2015/16	2016/17	2017/18	Averaged Output	Proposed
Nitrogen leaching (Total kg N/year)	2,992	3,809	3,483	4,637	4,858	3,956	4,001
Nitrogen leaching (kg N/ha/year)	39.3	50.1	45.8	60.9	63.8	52.0	52.6
Phosphorus loss (Total kg P/year)	17	17	27	34	21	23	24
Phosphorus loss (kg P/ha/year)	0.2	0.2	0.4	0.4	0.3	0.3	0.3

In land classed in the Oxidising PZ, the pre-expansion average N loss based on five years of supported data is 3,956 kg/year or 52 kg/hectare/year. The same land under the proposed 600 cow dairy farm is predicted to have an average N loss of 4,001 kg/year or 52.6 kg/hectare/year. This amounts to an increase of 1% or 0.6 kg/hectare/year, which can reasonably be accepted to be within a margin of error. This is effectively no change; N loss for land classed as Oxidising is predicted to remain stable.

PASTURE PRODUCTION – WHOLE FARM

Pasture production (PP) varied over the five pre-expansion years with an average of 15.2 t DM/ha/year for effluent blocks and 14.5 t DM/ha/year for non-effluent blocks. The proposed system has increased PP relative to the five-year pre-expansion averages, with PP of 16.4 t DM/ha/year for the effluent block and 15.5 t DM/ha/year for the non-effluent block. In view of improvements in farm management and systems that have been made in recent years, the applicants believe that PP predicted in the proposed system is achievable. If it is not achieved, then actual production (kg MS/cow) will decrease to reflect this, or alternatively supplements imported will be increased (e.g. barley grain or silage) and production (kg MS/cow) will be maintained as expected. Neither of these situations would be expected to increase N losses from soils.

P LOSS – WHOLE FARM

The pre-expansion average annual P loss is based on five years of supported data is 175 kg or 0.9 kg/hectare. The proposed 600 cow dairy farm is predicted to have an average P loss of 199 kg/year or 1.0 kg/ha/year. At whole farm scale, Overseer predicts an average increase in P loss of 24 kg/year with the change to the proposed system. For both the pre-expansion and proposed 600 cow dairy farm, the risk of P loss from effluent is classed by Overseer as low for all blocks. The risk of P loss from soil and fertiliser is classed as low, moderate or high depending on soil type and topography. Soils underlying steeper land classed as "rolling" has higher risk of P loss, and by proxy loss of sediment and microbes.

A key driver of the modelled increase in P loss is Olsen P values that have been entered for proposed system. Target Olsen P values of 40, 35 and 25 (for effluent, non-effluent and easy hill blocks respectively) have been entered in the proposed system. These are somewhat higher than Olsen P levels in pre-expansion years but are consistent with levels required for high producing dairy farms, and with realistic target Olsen P levels for the farm.

Approximately 10 kg P/year of the modelled increase in P loss originates from "Other sources" P loss. "Other sources" P loss is a sub-model within Overseer® that assumes that 30% of P that lands on tracks, lanes, yards and other infrastructure on dairy farms ends up in waterways. The modelled increase in average annual P loss from "Other sources" will be mitigated by the implementation of an effective FEMP, which will identify practices on farm that target the contaminant pathway (overland flow/runoff) from tracks and lanes to waterways.

Mitigation of P loss (and by proxy loss of sediment and microbes) will be achieved in many ways not detected by Overseer. Management practices will target the contaminant pathway (overland flow/runoff) to waterways, from sources such as CSAs (depressions, swales and gullies) especially on rolling ground, and tracks and lanes. Effective management, as identified in the FEMP, will see a reduction in P loss, and by proxy sediment and microbial contaminant loss. Given the easy to rolling topography, there is variable risk of P loss to water across the property with greater risk where topography is steeper. Sloping/rolling areas will be targeted to mitigate the risk of P loss (and sediment and microbes). This risk is exacerbated following periods of prolonged or intense rainfall and will be mitigated in several ways:

- Where lanes are parallel to drains, there are wider buffers of fenced off vegetation;
    - Runoff from tracks and lanes to waterways is reduced into waterways. Overseer does not take the layout of individual farms into account.
- Protect CSAs by fencing and planting, especially on sloping ground;
    - P is filtered and less P is transported to drains and streams.
- CSAs are not cultivated into fodder crop nor intensively winter grazed;
- Culvert/bridge crossings of waterways are managed to ensure runoff is filtered before draining into waterways;
    - Remedial work is carried out as required to prevent runoff from tracks and lanes reaching surface waterways. Track shaping and cutting is carried out to direct surface drainage at such locations to paddocks and away from waterways. If necessary, nib boarding is put in place.

Discussion – effects of losses

Please see Section 7 (AEE) for a discussion on the effects of predicted nutrient losses.

7. Assessment of Environmental Effects/Mitigations

7.1 Effluent

7.1.1 Odour

Adverse effects from odour can occur due to the discharge of farm dairy effluent where it may be encountered beyond the boundary of the site. The applicants propose the continued use of low rate application technology, which coupled with the proposed effluent discharge buffers means there is little risk of adverse effects from odour and spray drift on surrounding land owners and occupiers. They irrigate according to wind direction and risk. As such the effects of odour are avoided.

7.1.2 Risks to surfacewaters from effluent discharge

Adverse effects on surface water can occur from the discharge of farm dairy effluent where contaminants present in effluent such as nutrients N and P, organic matter and microbes reach receiving surface waters such as streams, rivers and estuaries. Effects such as nutrient enrichment of surface waters *are cumulative*, and can lead to algal blooms including slime, and promote nuisance aquatic plant growth. The collection of plants and animals that inhabit receiving waters are adversely affected by nuisance plant growth, as well as in-stream values such as biodiversity and ecosystem services. Values associated with surfacewater streams and coastal waters are many and relate to the landscape, biodiversity, history and people living in the catchment. These values include maintaining the health of water bodies both in-stream and coastal, protecting biodiversity and ecosystems, protecting recreational activities such as fishing, walking and boating; protecting human and animal health, maintaining sustainable farming practices and the socioeconomic well-being of people through preserving values that relate to inshore fishing, farming and tourism. Iwi/cultural values include the principles of protection or kaitiakitanga of the mauri of the water and mana of the land, while minimising adverse effects on taonga and mahinga kai.

As is described in Section 5, receiving surface waters predominantly lie in the Waikaka Stream catchment, Mataura River catchment, Toetoes Estuary, and coastal waterbodies. These are considered sensitive environments due to the accumulation of nutrients, sediment and microbes. Receiving waters show evidence of land use impacts, with elevated levels of nutrients, sediment and algal blooms/slime at times. As is described in Sections 5 and 6, overland flow and artificial drainage are major contaminant pathways at the property. The effluent discharge activity needs to be managed appropriately in order to mitigate the risk of contaminant loss to receiving surfacewaters. This is achieved by methods described in section 7.1.4.

7.1.3 Risks to groundwater from effluent discharge

Adverse effects on groundwater can occur from the discharge of farm dairy effluent where contaminants present in effluent such as nutrients N (nitrate) and microbes (pathogens such as campylobacter) reach receiving groundwaters via leaching/deep drainage pathways. A major risk of elevated nitrate levels in groundwater is to users (consumers) of groundwater as nitrate becomes toxic to living organisms such as humans, animals and fish at high levels. The New Zealand Drinking Water Standard maximum allowable value for nitrate is 11.3 ppm. Another risk is to consumers of groundwater is waterborne gastroenteritis through the ingestion of groundwater contaminated with pathogens such as campylobacter. This was demonstrated in Havelock North in 2016, when over 5,000 people became ill with camplyobacteriosis. Adverse effects on other users of groundwater such as other farms, small industries, schools or settlements/domestic users are possible and need to be avoided.

As is described in Section 5, the property overlies an unmapped groundwater zone. Due to a combination of topography, soils and drainage pathways at the property, there is low background risk to groundwater due to the discharge activity and greater risk to surfacwaters.

7.1.4 Mitigation of adverse effects due to effluent discharge

Adverse effects, *including cumulative effects*, due to the discharge of agricultural effluent are either avoided, remedied or mitigated at the dairy platform through the implementation of good effluent management practice and mitigation measures. Contaminants present is effluent (N, P, microbes) are held in the root zone, adsorbed by plants or are filtered/adsorbed by soil particles.

Due to its nature and scale, there will be little or no effect on receiving ground and surface waters *including cumulatively*, from the effluent discharge activity in this instance. The discharge system meets industry best practice standards for farm dairy effluent discharge by using buffer storage and low rate application. The use of best practice effluent application should avoid adverse effects on the environment. This principle is well documented in various scientific reports prepared for Environment Southland during the process of setting policies and rules around effluent discharge to land. A 2009 Houlbrooke and Monaghan report provides context and background to the principle that best practice effluent application should not cause adverse effects on water quality. The graph below is taken from the 2009 Houlbrooke and Monaghan report to illustrate that nutrient loss from FDE application is minor if undertaken using best practice. In this example, less than 1% of nutrients applied in effluent reached drainage water on tile and mole drained soil.

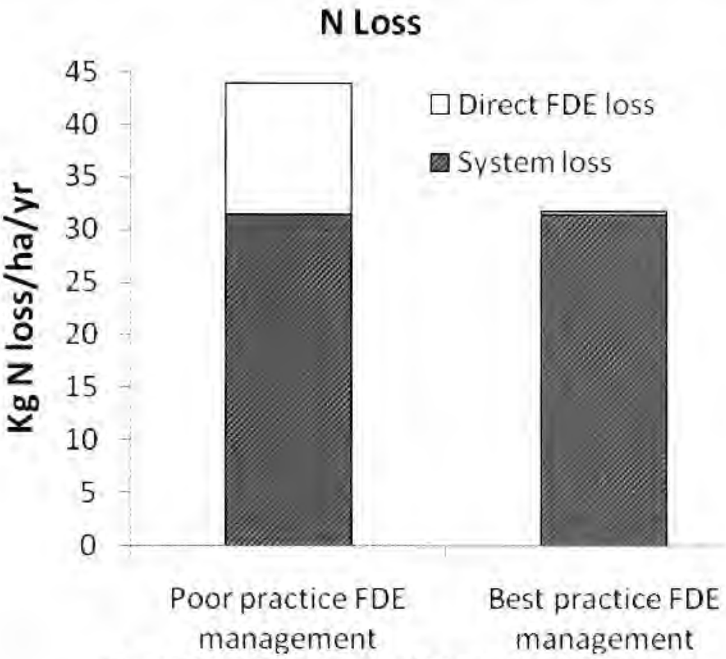

Figure 7.1. Houlbrooke and Monaghan (2009)

The applicants intend to apply effluent in accordance with best practice at all times to avoid adverse or *cumulative effects* on the receiving environment. Houlbrooke and Monaghan (2009) explain that if effluent is applied to soil when a soil moisture deficit exists then the effluent preferentially remains in the soil's root zone as plant available water or is adsorbed onto soil particles. The soluble nutrients in the effluent can then be taken up by the plant and used in nutrient cycling. Microbes can be filtered and held by soil particles until they are no longer viable. The applicants use the closest Environment Southland soil moisture monitoring site, which is available on the ES website, to determine whether a suitable soil moisture deficit exists. Effluent application is deferred if soil moisture levels are too high to safely and correctly apply effluent. Effluent is only applied when there is a ground moisture deficit and when effluent application will not induce drainage.

Deferred irrigation

The dairy platform currently has a storage capacity of 2,412 m^3 in one effluent storage pond, which provides for deferred irrigation for effluent from 600 cows at the dairy shed according to the Massey Dairy Effluent Storage Calculator. 1,946 m^3 is the 90% probability volume according to the Massey DESC. The ability to defer irrigation during marginal times means that effluent will only be applied when a soil moisture deficit exists. By deferring irrigation when ground conditions are unsuitable, losses to drainage water should be considerably less than the 1.1% of the total nutrients applied in the effluent experienced in the above-mentioned trial. When soils are near or at field capacity and there is risk of contaminant loss via artificial drainage or overland flow to receiving surfacewaters, irrigation is deferred by storing effluent in the storage pond. The risk of contaminant loss from effluent discharge via overland flow, artificial drainage, or deep drainage is in this way mitigated.

Low rate irrigation

Low rate irrigation is defined as an application rate of less than 10 millimetres per hour. The Larall system utilised on farm to discharge effluent to land applies effluent at less than 10 millimetres per hour so meets low rate criteria. The application of effluent in this manner should reduce the risk of exceeding a soil's infiltration rate, thus preventing ponding and surface runoff of freshly applied FDE. A low application rate also increases the likelihood of retaining the applied nutrients in the root zone. This decreases the likelihood of preferential flow and allows a greater volume of applied FDE to move through smaller soil pores via matrix flow, thus allowing for greater attenuation of effluent contaminants (Houlbrooke et al. 2006, McLeod et al. 1998). This is of significance where subsurface drainage has been installed.

Best practice irrigation minimises the risk of contaminant loss via pathways relevant to the Gleyed and Oxidising (overland flow variant) PZs; overland flow and subsurface drainage (tiles) when wet in winter/spring or when soils are saturated. Effluent is not applied over low points, where tile drains have been installed, when soils are near or at field capacity. In addition to this, buffer distances from discharge area to surface waterways are maintained minimising the risk of effluent reaching surface waters directly via overland flow or spray.

Contingency irrigation

A low depth slurry tanker and umbilical system will be used as contingency irrigation methods. Both systems apply effluent at less than 5 millimetres depth per application to the FDE area (both Category A and Category C classed land). Both systems will only discharge to flat areas within the Category C classed land in the FDE area. At application depths of less than 5 millimetres, there is minimal risk of adverse effects on receiving ground and surfacewaters due to the use of low depth slurry tanker and umbilical system when there is sufficient soil moisture deficit. When there is insufficient soil moisture deficit to safely apply effluent at less than 5 millimetre's depth, effluent is stored in the pond and the risk of adverse effects is avoided.

Removal of high rate travelling irrigator

In recognition of topography, soil and drainage types and their associated risks, it is proposed to remove the travelling irrigator from the discharge permit. A travelling irrigator will not be used in the future.

Effluent receiving areas and nutrient loading:

The consented effluent receiving area is large (c.180 ha), comprises high risk soils and contains sloping land, subsurface drainage and streams.

A 150 kg N/hectare limit will be adhered to, which is the standard limit placed on farm dairy effluent discharge activities on milking platforms by Environment Southland. In practice the N loading from effluent is less than 150 kg/hectare. As is shown in section 6.1.5, 14 hectares is required to apply 150 kg N/hectare. Applying effluent to a larger area (e.g. 68 ha) reduces the N loading from effluent to 31 kg N/ha. As is modelled in Overseer, where effluent is applied to land, fertiliser is reduced accordingly, which mitigates the risk of overloading soils with nutrients such as N and P causing loss to water.

The scale of the discharge activity allows for the sustainable use of land to receive farm dairy effluent. The consented discharge area is large and has a ratio well above the Council recommended ratio of 8 hectares per 100 cows.

7.1.5 Mitigation of risk of adverse effects on Regionally Sensitive Waterbodies

As is described in Section 5, Toetoes Flats and the Lower Mataura River at Fortrose Harbour lie approximately 70 kilometres to the south west of the FDE area. Risks to these waterbodies from the discharge activity are minimal due to their large distance from the discharge activity and other factors such as soil denitrification processes. Potential risks are mitigated through the use of best practice effluent management at the property, i.e. low rate irrigation, deferred irrigation and the implementation of a buffer of at least 20 metres to the waterways when irrigating effluent. Additionally, all waterways have been fenced off and have good grass cover/mature vegetation along riparian buffers. Adherence to these practices will fully mitigate the risk of contaminants present in effluent (N, P, microbes) adversely impacting Toetoes Flats and the Lower Mataura River at Fortrose Harbour via overland flow or artificial drainage pathways.

7.1.6 Summary of surfacewater mitigations for effluent discharge

There is a large area of high-risk soils available at the property for effluent discharge. Due to the implementation of good management practices and mitigation measures, there will be minimal risk to receiving surfacewaters in the Waikaka and Matuara catchments, Toetoes Estuary, and coastal waterbodies and their values from the discharge activity. The effects on surfacewaters due to the proposed discharge activity have been considered and are no more than minor.

- Irrigation of effluent is deferred when there is insufficient soil moisture deficit to safely apply effluent or when there is risk of drainage to receiving surfacewaters following irrigation of effluent. Effluent is stored in a large effluent pond, which has sufficient storage for effluent from the proposed activity according to the Massey DESC. This is effective at avoiding contaminant loss to surfacewaters from effluent, by overland flow and artificial drainage pathways when soils are at or above field capacity.

- Low rate irrigation (< 10 mm/hour) is the primary irrigation method used to apply effluent to land. This meets best practice standards for irrigating effluent to high risk soils and is of particular benefit given the undulating topography at the property. A slurry tanker and umbilical system serve as contingency methods. Irrigation using the low rate Larall system is deferred by diverting effluent to the storage pond unless there is sufficient soil moisture deficit. There is minimal risk to receiving surfacewaters when irrigating using these methods where there is sufficient soil moisture deficit.

- Subsurface drainage has been installed in places to reduce the risk of waterlogging and to improve soil structure and aeration. Effluent is not discharged over low points underlain by tile drains when soils are near or at field capacity. Streams have been permanently fenced off. Recommended buffers to surfacewaterways are implemented, mitigating the risk of contaminants present in effluent reaching receiving surfacewaters via overland flow when soils are saturated. Effluent is not applied close to waterways when soils are saturated, mitigating the risk of contaminants present in effluent reaching surfacewaters.

- The discharge area is sufficiently large both in terms of the area (ha) per 100 cows, and the N loading from effluent to effectively mitigate the risk of contaminant loss from effluent to surfacewaters and of overloading of soils. The application rate will not exceed 150 kg/hectare from effluent, which is the standard limit placed on discharge permits by Environment Southland.

7.1.7 Groundwater - mitigation of effects

Many good management practices and mitigation measures for effluent discharge described above also apply to avoiding, remedying and mitigating adverse effects on groundwater. These practices and measures are not repeated here; please refer to above.

The major contaminants present in effluent that are of risk to groundwater are nitrate and faecal microbes, with *E.coli* used as an indicator of faecal contamination of groundwater. As is described in Section 5, due to topography, soil and physiographic types found at the property there is low background risk to groundwater quality from the discharge activity in this instance, and higher risk to surfacewater quality.

7.1.8 Nitrate in groundwater due to the discharge activity

Nitrate levels in groundwater are described in Section 5. In short, nitrate levels are low, and are indicative of pristine to background land use impacts (0.4 – 1.0 mg/L). Given the nature of effluent management at the property, in addition to the scale of the discharge activity including the N loading of soils from effluent, it is very unlikely that the discharge of effluent at the property will adversely affect water quality through an increase in groundwater nitrate concentrations from effluent.

The nearest downstream registered drinking supply is at Gore (ID:OTI002, Otikerama Rural Water Supply) over 21 km to the south west of the discharge area. Given its distance from the discharge area, use of deferred/low rate irrigation and the denitrification properties of Gleyed soil types, there is little or no risk to the bore supply at Gore/Otikerama due to the discharge activity.

7.1.9 Faecal contamination of groundwater due to the discharge activity

If faecal microbes from the discharge activity are/have been reaching groundwater, the testing of groundwater in the vicinity of the property, could reveal this to be the case. Historical results from the testing of two bores within a 4 kilometre radius of the dairy farm were negative for faecal coliforms (including *E.coli*). This, in addition to the PZ types at the FDE area produces a low background risk of faecal contamination of groundwater, and generally less than minor risk to groundwater in the vicinity of the discharge area. There is minimal risk that consumers of groundwater will develop gastroenteritis due to adverse effects on groundwater quality relating to the discharge activity.

In conclusion there is minimal risk that consumers of groundwater will develop gastroenteritis due to faecal contamination of groundwater from the discharge activity.

7.1.10 Summary of mitigations for groundwater

Due to the low background risk to groundwater in addition to the implementation of good management practices and mitigation measures, there will be little or no risk to underlying groundwater resources due to the discharge of effluent at the property. The effects on groundwater have been considered and are less than minor.

Mitigations are summarised as follows:

- Irrigation of effluent is deferred when there is insufficient soil moisture deficit to safely apply effluent or when there is risk of drainage following irrigation of effluent. Effluent is stored in a large effluent pond, which has sufficient storage for effluent from the proposed activity according to the Massey DESC.

- Best practice low rate irrigation is primarily used to apply effluent to land at the property.

- The discharge area is sufficiently large both in terms of the area (ha) per 100 cows, and the N loading from effluent. The use of low rate irrigation allows for effective control of N loading and microbial loading of soils, which allows microbes to be retained in the topsoil, filtered and attenuated until they become unviable.

7.1.11 Soil health

There is low risk to the life supporting capacity of soils due to the effluent discharge activity. Land treatment of effluent, as well as solids, allows effluent to be used both as a fertiliser and a soil conditioner, which improve the soil's health. Soils in the FDE area are not overloaded with nutrients from effluent. The soils are suitable for effluent irrigation and the discharge follows current good management practice, which is described in Section 6 of the application and the FEMP. These include practices of a general nature and those specific to the contaminant transport pathway for the PZ types at the property. So long as best practice effluent management is implemented, the potential loss of contaminants N and P, and microbes from soils will be mitigated.

The effects on soil health due to the discharge of effluent have been considered and are no more than minor.

7.1.12 Effluent storage and infrastructure

The effluent system is described in detail in Section 6 and meets the needs of effluent from 600 cows at the dairy shed according to the Massey DESC.

The effluent pond has been drop tested in accordance with Appendix P and passed the leakage test. A *CPEng* report relating to the drop test was submitted to Council and is appended to this application. The pond has been visually inspected by a SQP, and is certified as showing no evidence of cracks, holes or defects that would allow effluent to leak. A certification report for the pond is appended to this application.

The sludge beds and concrete sump have been visually inspected by a SQP, and are certified as showing no evidence of cracks, holes or defects that would allow effluent to leak. Certification reports are appended to this application.

Inspection and testing of the above structures has found that they are fit for purpose and are not leaking effluent. As such, there is minimal risk of adverse effects from using them to store, contain or treat agricultural effluent. Effluent infrastructure will continue to be used according to best practice and consent conditions, which will mitigate the risk of adverse effects in the future.

A low rate system (Larall) is primarily used to discharge effluent to land. The Larall system is operated accordingly with appropriate safety features to ensure there are no adverse effects on surfacewaters, groundwater or soils.

Summary

It is reasonable to conclude that there will be minimal risk to groundwater or surface waters including cumulatively, or to the soil resource by granting replacement of the existing discharge permit to allow for the discharge of effluent from 600 cows at the dairy farm. The effects of the activity have been considered and are no more than minor.

7.1.13 Alternatives to effluent discharge methods

The irrigation systems in place are designed to meet best practice guidelines – specifically the use of low rate irrigation and deferred storage of effluent. There have not been any improvements in technology which would achieve a better environmental result than the current system. The applicants believe their system is both cost-effective and easy to manage.

An umbilical system has been included in the discharge permit because it provides a method of discharging large volumes of effluent at low depths to different parts of the effluent discharge area. The umbilical system will be used as a potential back up to the low rate irrigation system and only when there is sufficient soil moisture deficit (>6 mm).

The umbilical system is a high rate/low depth application method. The depth of application is closely controlled by tractor speed. Typically, the depth of application will not exceed 5 mm for the umbilical system. At this depth it poses no more potential for adverse effects on the receiving environment as the low rate irrigation system.

A slurry tanker has been included in the discharge permit because it provides a method of discharging effluent at low depth to different parts of the effluent discharge area. The slurry tanker will be used as a potential back up to the low rate irrigation system and only when there is sufficient soil moisture deficit.

The slurry tanker is a high rate/low depth application method. The depth of application is closely controlled by tractor speed. Typically, the depth of application will not exceed 5 mm for the slurry tanker. At this depth it poses no more potential for adverse effects on the receiving environment as the low rate irrigation system.

7.2 Dairy Farming – Land Use

7.2.1 Groundwater - AEE including cumulative effects of activity and mitigations

Adverse effects on groundwater can occur from the expanded dairy farm activity where contaminants present in dung, urine, effluent, fertiliser and silage pad leachate, such as nutrients N (nitrate) and microbes (pathogens such as campylobacter) reach groundwater via leaching/deep drainage pathways. A major risk of elevated nitrate levels in groundwater is to users (consumers) of groundwater as nitrate becomes toxic to living organisms such as humans, animals and fish at high levels. The New Zealand Drinking Water Standard maximum allowable value for nitrate is 11.3 ppm. Another risk is to consumers of groundwater is waterborne gastroenteritis through the ingestion of groundwater contaminated with pathogens such as campylobacter. This was demonstrated in Havelock North in 2016, when over 5,000 people became ill with campylobacteriosis. Adverse effects on other users of groundwater such as other farms, small industries or settlements/domestic users can occur and need to be mitigated. Adverse effects in groundwater can be transferred to surfacewaters through groundwater discharge.

Soil types, topography and drainage properties

As is described in Section 5, the property overlies an unmapped groundwater zone. There is a range of soil types, with some (Waikiwi and Benio) having oxidising properties. Oxidising soils store and accumulate N over summer and autumn months, then leach nitrate N to the underlying aquifer over wetter months in winter and early spring. Where Oxidising soils overlie rolling topography, however, in wetter months N is carried by overland flow and artificial drainage to surfacewaters rather than leaching to an underlying aquifer. Topography has a significant effect on the drainage properties of Waikiwi and Benio soils, resulting in less risk to groundwater and greater risk to surfacewater. In better drained parts of the farm where groundwater may be vulnerable to nitrate contamination, sloping topography will transfer the risk to streams via groundwater discharge.

Subsurface drainage (tiles and novaflow) has been installed in places, which also preferentially drains soils down slopes to receiving surfacewaters and lowers the risk of contaminants such as nitrate or microbes reaching the groundwater resource.

Nitrate loss to groundwater from the dairy farming activity

Waikiwi and Benio soils have low denitrificiation potential and are classed as Oxidising. For the proposed system, Overseer estimates that Waikiwi and Benio soils will lose between 15.8 – 22 ppm N in drainage for pasture blocks. Due to the above explanation regarding the influence of topography, very little of this is likely to reach the groundwater resource although it is not practical to measure this, given tools available/present day science. Nitrate losses to groundwater cumulatively will give a concentration of between than 0.4 – 1.0 ppm for the property (according to ES modelling). This is indicative of modern-day background levels and is well below the NZ Drinking Water Standards (>11.3 ppm).

In terms of the proposed dairy expansion through an increase of 50 cows, there will be little or no effect on groundwater and minimal change in background groundwater nitrate concentrations, which cumulatively will give a concentration of between 0.4 – 1.0 ppm for groundwater underlying the dairy platform. This is particularly supported by Overseer analysis of pre-expansion and post-expansion systems for Waikiwi and Benio blocks.

At the whole farm scale, the pre-expansion land use is predicted to have had slightly greater N loss to water than the proposed 600 cow scenario. This predicts that there will be no increase in effects on groundwater due to the proposed system compared to the pre-expansion land use.

Although the proposed activity represents an expansion of dairying through an increase in cow numbers, there will be less N lost to water due to the implementation of mitigation measures and good management practices, and therefore less effect on the groundwater resource and its associated values relative to the pre-expansion system. Mitigation measures and good management practices used to address effects on groundwater are described in Section 6. These help to reduce the accumulation of N in soils, particularly from mineralisation processes associated with fodder cropping, and grazing of fodder crops, particularly during winter and spring. Since less N accumulates in soils, then less N will potentially be lost to groundwater (and surfacewaters) although the background risk to groundwater if low as is explained above.

The main risk of elevated nitrate levels in groundwater is to users (consumers) of groundwater as nitrate becomes toxic to living organisms such as humans, animals and fish at high levels. Nitrate levels are likely to be maintained in the receiving groundwater resource between 0.4 – 1.0 ppm due to the proposed dairy farm activity. This will not result in adverse effects on other users of groundwater such as other farms, small industries, schools or settlements/domestic users; values of bore users in the groundwater zone will not be adversely affected. Values such as the protection of human health, animal health, sustainable farming and economic wellbeing will not be adversely affected by groundwater nitrate levels of 0.4 – 1.0 ppm, which are below the NZDWS maximum allowable value of 11.3 ppm.

Microbial loss to groundwater from the dairy farming activity

If faecal microbes are/have been reaching groundwater, the testing of groundwater in the vicinity of the property, could reveal this to be the case. Section 5 describes data from bores in the vicinity of the property, and the previous section of this section (7.1) describes and assesses the risk of adverse effects on groundwater due to nitrate contamination from effluent discharge. Much of these processes and potential effects apply to the risk of microbial contamination of groundwater due to the dairy farming activity.

Only two bores within a 4-kilometre radius of the property have water quality data available; bore F44/0252 had <1 CFU for faecal coliforms on one occasion in 2007 and bore F45/0631 had <1 CFU for faecal coliforms on one occasion in 2013. These data, albeit very limited, show that there is minimal risk to groundwater in the vicinity of the property.

E.coli is widely used as an indicator of faecal contamination of water, including groundwater. *E.coli* is believed remain viable for up to three months in groundwater (Edberg et al., 2000). There is minimal groundwater sampling in the vicinity of the property, with the above-mentioned testing of two bores in 2007 and 2013 being the only data available. Both were negative for faecal coliforms (including *E.coli*) at <1 CFU.

Summary of mitigations for groundwater

- The ongoing development of soils and pastures at the dairy platform leading to increased soil organic matter content and increased soil water holding capacity;
- Improved fertiliser, nutrient and soil management;
- Good management practice winter grazing;
- The removal of young stock from weaning until they return for as in-calf R2 heifers for calving;
- Less area of fodder crop, improved crop yield; and
- An expanded FDE area and the careful management of effluent application.

AEE on groundwater at third-party grazier locations

WINTER GRAZING OF MA COWS

As has already been explained, a portion of the herd is winter grazed at third-party grazier properties in the wider eastern Southland/Central Otago areas each year. It is the intention to continue this practice in the future. Groundwater nitrate levels in the vicinity of third-party grazier properties used in the last five years (in the Waikaka, Willowbank and Kaiwera areas) reflect pristine and modern-day background levels, and are in the range of 0.01 – 1.0 mg/L. So long as future off farm winter grazing of MA cows occurs in the same wider Eastern Southland area, the effects of the proposed activity on groundwater will be less than minor.

The number of MA cows winter grazed off farm will remain consistent with the number grazed off farm in recent years. Future effects should therefore remain consistent with past effects; there should be no increase in effects due to this activity.

GRAZING OF YOUNG STOCK

Young stock has been grazed by a third-party grazier located in the Willowbank area in recent years. It is then intention to continue with this arrangement in the future, so long as it is deemed to be satisfactory to both the applicants and grazier. Due to soil types, topography and drainage, groundwater nitrate levels in the vicinity of third-party grazier property at Willowbank are in the range of 0.01 – 0.4 mg/L and reflect pristine levels. The grazing of young stock from the dairy platform will pose minimal risk to groundwater in the vicinity of the Willowbank property. Effects on groundwater in the vicinity of the Willowbank grazier property due to the proposed expansion are considered to be less than minor.

The number of young stock grazed off farm will be similar to the number grazed off farm over the last five years. Future effects should therefore remain consistent with past effects; there should be no increase in effects due to this activity.

7.3.2 Surfacewater - AEE including cumulative effects of activity and mitigations

Artificial drainage and overland flow are pathways by which contaminants (nutrients N and P, sediment and microbes) present in dung, urine, effluent and silage leactate may reach receiving waters such as surfacewater streams, the Waikaka Stream, the Mataura River, Toetoes Estuary, and coastal waters. The major risk to surface waters is from contaminant loss via overland flow and subsurface drainage that occurs following periods of heavy rain.

At the farm scale it is difficult to quantify contaminants being lost to surfacewaters and their contribution to cumulative effects on receiving waters; there will be much seasonal and spatial variation in this. Furthermore, measuring the volume of drainage water leaving a sub-catchment and the concentration of nutrients in drainage water would require expensive equipment as well as long term monitoring to allow for temporal and spatial variation; this is not practical given available scientific methods. For these reasons, Overseer modelling is used along with knowledge of soils, climatic data and receiving waters.

Note: The below calculations are carried out using values for N loss for the dairy platform only, as per Overseer nutrient budget analysis for the proposed 600 cow system.

Nitrogen

PROPOSED 600 COW SCENARIO – N CONCENTRATION IN SURFACE DRAINAGE WATERS

Since the property lies in an unmapped groundwater zone, no mean annual land surface recharge rate is readily available for it. An estimation for the N concentration in drainage waters is calculated below based on rainfall, evapotranspiration and the land surface area. The nearest site for which data is available is at Gore.

(1) *Average rainfall (959 mm) – average ET (mm) = drainage (mm)*

where drainage is all losses including runoff, tile drainage and deep drainage;

where average ET is the average annual evapotranspiration rate;

According to NIWA, the mean annual potential evapotranspiration (PET) at Gore = 768mm

According to MfE, the average of annual PED 2000-2016 for Gore = 170mm

where the PED (potential evapotranspiration deficit) accounts for factors such as soil moisture deficit and plant water uptake;

(2) *Actual evapotranspiration = PET – PED* = 768 mm – 170 mm = 598 mm

Using equation (1) above:

the Average rainfall (959 mm) – average ET (598 mm) = drainage (361 mm)

Based on these calculations, drainage is expected to be approximately 38% of rainfall.

To calculate the drainage volume for the 205-hectare dairy farm:

(3) *Area (m^2) X drainage (m) = drainage volume (m^3)*

2,050,000 m^2 x 0.361 m = 740,050 m^3 per year.

This includes runoff, artificial drainage and deep drainage. Most drainage will go to surfacewaters via runoff or artificial drainage, or via the discharge of groundwater to surfacewater in the longer term. For the purpose of these calculations, the value for drainage volume is used to calculate the concentration of N in surfacewater drainage.

If all 9,979 kg of N lost to water annually according to Overseer, is transported to surfacewater drainage then an approximation of the N concentration of water draining to surfacewaters is:

9,979 kg/740,050 m^3 = 13.4 g/m^3 = 13.4 ppm

13.4 ppm is a crude estimate as it assumes all N lost below the root zone ends up in surface drainage water. In fact, some to all N will be lost to the atmosphere via denitrification processes in ~119 hectares of Gleyed soils (Claremont/Waikoikoi and Eureka/Jacobstown). A small quantity of N will be held in the groundwater resource. ***On average the concentration of N in water draining to surfacewaters is expected to be much less than 13.4 ppm. 13.4 ppm N is a crude estimate for the 600-cow scenario as it takes no account of the denitrifying effect from 119 hectares Gleyed soils, which accounts for 58% of the total land area.***

Furthermore, water reaching the receiving surfacewaters undergoes mixing and nutrients are diluted. Due to mixing and some dilution thereafter, it is reasonable to assume that this will change the background N concentration by some degree, and cumulatively will give a concentration of no more than 1.33 ppm for the Waikaka Stream catchment, which is the five-year median Total Nitrogen for SOE site at *Waikaka Stream at Gore*.

PRE-EXPANSION N LOSSES – AVERAGE ANNUAL LOSS BASED ON FIVE YEARS OF DATA

The pre-expansion land use based on five years of data is predicted by Overseer to have slightly greater N loss to water than the proposed system. Using the same calculations, the N concentration of water draining to surface waters would be predicted to be slightly higher than for the proposed system. On this basis no increase in N related effects on receiving surfacewaters is expected due to the proposed system compared to the pre-expansion land use.

Although it is possible to estimate the "worst case scenario" concentration for N in surfacewater drainage from the dairy platform, estimating the N load of drainage water to the Mataura catchment is unfeasible without knowing the flow rate of surfacewater leaving the dairy platform.

N LOAD - WAIKAKA STREAM

The *Waikaka Stream at Gore* SOE site was used as a reference for this calculation.

Total nitrogen median** concentration = 1.33 g/m^3.

The average flow from 2013 – 2017 of the *Waikaka Stream at Willowbank* (~10 km north of SOE site) = 3.33 m^3/s. This is the nearest site for which flow data is available.

(4) *Load = concentration X flow*

Approx. N load in lower catchment Waikaka Stream = 1.33 g/m^3 x 3.33 m^3/s = **4.43 g/s**

**The median was used instead of the mean when the mean value was unavailable.

In order to quantify the contribution from the proposed activity to the N load of the Waikaka Stream, the flow rate of surface water drainage from the dairy platform to the catchment is required. Given available tools and information, the flow rate of surfacewater drainage is unknown. It can reasonably be assumed that the N loading to the Waikaka Stream from the proposed activity will cumulatively contribute, with the loading from all other activities in the catchment, to the lower catchment N loading of c.4.43 g/s for the Waikaka Stream. The contribution to the N loading from the proposed 600 cow activity is slightly less than the pre-expansion activity, which has slightly greater average annual N loss according to Overseer (i.e. 0.03 t N/year greater).

Although the proposed activity represents an expansion of dairying, there will be slightly less N lost to water due to the implementation of mitigation measures, and therefore slightly less effect on receiving surfacewaters and their associated values. Mitigation measures and good management practices used to address effects on surfacewaters water are described in Section 6. Importantly nutrients will not be exported off site to allow for the expansion. By wintering approximately 150 cows on farm, there will be no increase in the number of cows wintered off farm relative to recent years.

Effect of N loss on the receiving environment – including cumulatively

N is a plant macronutrient in aquatic systems. Excess N contributes cumulatively to the eutrophication of receiving waters and promotes nuisance plant growth in the form of algal blooms or slime. This has knock-on effects on the biota that inhabit aquatic ecosystems, and other associated values such as livestock health, human health and recreational use. Excessive algal growth in the water column can block light or can increase BOD, thereby reducing the availability of DO to freshwater organisms. Excessive periphyton growth can smother the streambed or have toxic effects through the proliferation of cyanobacteria (blue green algae). For a summary of effects of N in the receiving environment and mitigations see table 7.2.1.

The median Total Oxidised Nitrogen concentration for the Waikaka Stream at Gore SOE site (0.745 mg/L) is above the ANZECC Guideline of 0.44 mg/L. Similarly, the median Total Nitrogen concentration for the SOE site (1.33 mg/L) is above the ANZECC Guideline of 0.614 mg/L. This indicates that N levels in the Waikaka Stream catchment are elevated, although significantly *both indicators are showing an improving ten-year trend*. As per the NOF framework, water quality at this site is considered "suitable for the designated use," but there may be effects on growth of up to "5% of species." Elevated N levels may contribute to other adverse effects such as nuisance plant growth, which is seen in the lower Waikaka Stream and lower Mataura River in the form of excessive periphyton growth.

As is described in Section 5, the Mataura River, Toetoes Estuary and coastal wetlands and waterbodies are also considered sensitive environments that are adversely affected by N loss from land use in the catchment. Given mitigation measures that reduce N accumulation and protect soil structure, in addition to the denitrifying processes in Gleyed soils, N loss to receiving surfacewaters will be low and slightly reduced compared to the pre-expansion situation. The changes in land use at the dairy platform will see an improvement in land (and nutrient) management, and cumulatively will see less N loss and less effect on receiving surface waters in the long term. N related effects on receiving waters from the dairy farming activity are no more than minor.

Table 7.2.1 Summary of effects of N, including cumulatively, in receiving surfacewaters.

Potential effect of N in receiving surfacewaters	Related effects	Mitigations at Garden Gully Road dairy farm	Risk of effect due to dairy farming activity at Garden Gully Road
Increased algal growth in the water column: • Blocks light	Ecological: exclusion of macrophytes, reduced visibility for fish and other aquatic organisms	Continued development of soils and pastures at the dairy platform leading to increased soil organic matter content and water holding capacity, and less N loss in drainage. Gleyed soils further reduce N loss from soils through denitrification processes Reduced area cultivated in fodder crop and less area under winter grazing leading to less mineralisation of N and less N loss in runoff; Maintenance of wide, well protected and vegetated riparian buffers leading to less N loss from runoff; CSAs fenced off and well vegetated leading to less N loss in runoff; Increasing the FDE area leading to a lower application rate of N from effluent and less N loss in drainage. Optimising the management of fertiliser regime leading to a lower application rate of N from fertiliser and excluding application of N fertiliser in May, June and July; leading to less N loss in drainage.	No more than minor
Increased algal growth in the water column: • Potentially increasing BOD	Ecological: reduced DO causing stress on aquatic organisms	As per above	Less than minor – point source discharges affect BOD rather than diffuse sources
Increased periphyton growth: • Smother streambed	Ecological: effects on invertebrates and organisms in associated food webs, reduced biodiversity	As per above	No more than minor

Increased periphyton growth: • Growth of potentially toxic matts of cyanobacteria (blue green algae)	Toxic effects on biota including domestic animals. Also, people using waterways for recreational activities are at risk	As per above	No more than minor
N toxicity effects if N concentration is high enough	Ecological: fish kills Animal and human health due to nitrate toxicity	As per above	Less than minor

Phosphorous, sediment and microbial contaminants

Following heavy rainfall, water flows down slopes into waterways via overland flow or artificial drainage, carrying P, sediment and microbes with it. In this case, sloping topography gives rise to risk of contaminant loss from CSAs at the bottom of slopes close to waterways. Locations where tiles have outfall to waterways and where tracks cross surface waterways at culverts also behave as CSAs.

Overseer predicts moderate P losses of 1.0 kg/ha/year or 199 kg/year due to the proposed dairying activity. P loss is split between "Other Sources," which is loss from tracks, lanes and infrastructure to waterways via overland flow, and "Blocks," which is P loss from paddocks. "Other sources" P loss is estimated by Overseer to be 87 kg/year, with "Block" loss estimated to be 112 kg/year. "Other sources" P loss is calculated by a sub-model in Overseer, which assumes that 30% of P that lands on tracks, lanes, yards and other infrastructure, ends up in waterways (Gray, Wheeler and McDowell, 2016). Overseer does not account for the individual layout of dairy farms, however. In this case, only one main lane runs parallel to a waterway, which somewhat reduces the risk of runoff from tracks and lanes to waterways. By managing locations where overland flow from tracks and lanes etc. can potentially reach waterways, loss of "Other sources" P can be reduced although Overseer does not recognise this. See figures 5.8 and 5.20 for an example of a well-managed CSA at the bottom of a cow lane.

Protecting CSAs by fencing and maintaining vegetation cover helps to reduce P loss (and sediment and microbial loss), by filtering runoff as it drains to waterways from paddocks (see figures 7.2 and 7.3). With management of such locations, the average annual P loss from the property, as predicted by Overseer, can be reduced. Given available tools, it is not possible to quantify this reduction.

Figure 7.2 Photo of fenced-off, well vegetated paddock CSA in foreground.

Figure 7.3 Photo of fenced-off, well vegetated culvert CSA.

P loss associated with expansion

As is described in Section 6, Overseer predicts that there will be a small increase in P loss associated with the expansion (24 kg/year). Soils underlying steeper land classed as "rolling" have higher risk of P loss, and by proxy loss of sediment and microbes.

A key driver of the modelled increase in P loss is Olsen P values that have been entered for proposed system. Target Olsen P values of 40, 35 and 25 (for effluent, non-effluent and easy hill blocks respectively) have been entered in the proposed system. These are somewhat higher than Olsen P levels in pre-expansion years but are consistent with levels required for high producing dairy farms, and with realistic target Olsen P levels for the farm.

Approximately 10 kg P/year of the modelled increase in P loss originates from "Other sources" P loss. The modelled increase in average annual P loss from "Other sources" will be mitigated by the implementation of practices on farm that target the contaminant pathway (overland flow/runoff) from tracks and lanes to waterways.

Mitigation of P loss

Mitigation of P loss (and by proxy loss of sediment and microbes) will be achieved in several ways not detected by Overseer. Management practices will target the contaminant pathway (overland flow/runoff) to waterways, from sources such as CSAs especially close to waterways. Effective management will see a reduction in P loss, and by proxy sediment and microbial contaminant loss.

- Where lanes are parallel to drains, there are wider buffers with good vegetation cover;
    - Runoff containing P from tracks and lanes to waterways is reduced;
- Protect riparian areas and CSAs (especially on and at the bottom of sloping ground and close to waterways) by fencing off and implementation of a planting programme;
    - P is filtered and less P is transported to drains and streams.
- CSAs are not cultivated into fodder crop nor intensively winter grazed;
    - Runoff is reduced with less P transported to drains and streams.
- Culvert/bridge crossings of waterways are managed to ensure runoff is filtered before draining into waterways;
    - Remedial work is carried out as required to prevent runoff from tracks and lanes reaching surface waterways. Track shaping and cutting is carried out to direct surface drainage at such locations to paddocks and away from waterways. If necessary, nib boarding is put in place.

Effect of P loss on receiving environment

Due to physical and chemical interactions, P tends to be adsorbed by soil particles in surfacewaters and is taken out of solution to a large extent. A small portion of P lost to water, however, will remain soluble and available for uptake by aquatic plants in receiving water bodies. Some P will be released from sediments as soluble P and can then be taken up by plants. P is a plant macronutrient, which is often a growth limiting factor in aquatic systems. Excess P can contribute cumulatively to the eutrophication of receiving waters and promote nuisance plant growth in the form of algal blooms or slime. This has knock-on effects on biota that inhabit aquatic systems and associated values.

The median DRP concentration for the Waikaka Stream at Gore (SOE) site (0.024 mg/L) is above the ANZECC Guideline of 0.01 mg/L and has an improving trend over ten years. This indicates that although the lower Waikaka Stream has elevated levels of soluble P, significantly its concentration has a decreasing trend.

Improved land management in the catchment can see a further reduction in soluble P levels over time. Management of riparian areas and closely associated CSAs is an important mitigation for P loss and is taken seriously at the dairy platform. Collectively these measures mitigate P loss (and by proxy sediment and microbes), including cumulatively, to receiving surfacewaters.

Due to the abovementioned mitigation measures, the loading of P (and sediment and microbial contaminants) to receiving surfacewaters such as the Waikaka Stream, Mataura River, Toetoes Estuary and coastal waters from the dairy platform will be low and will not increase due to expansion. Drainage waters mix with receiving waters and are diluted. Given mixing and dilution of drainage and receiving waters annually, the proposed activity will contribute an immeasurably small amount to the P load of receiving waters, and there will be no increase in the P load of receiving waters relative to the pre-expansion land use. Similarly, there will be minimal change in sediment and microbial contaminant levels of receiving waters due to the proposed activity. P-related effects on receiving surfacewaters due to the proposed activity will be no more than minor.

Summary – AEE on surfacewaters

Although the proposed activity represents an expansion of dairying, there will be no increase in N and P lost to receiving surfacewaters due to the implementation of mitigation measures, and therefore no increase in adverse effects on receiving surfacewaters and associated values compared to pre-expansion system. Mitigation measures and good management practices used to address the effects on surfacewaters are described in Section 6 and are discussed in the previous AEE section. These set out to reduce contaminant loss via pathways already described, which are a risk following periods of heavy rain. These measures also help to mitigate the loss of sediment and microbial contaminants to surfacewaters.

The loading of N to receiving surfacewaters will not increase due to the proposed activity, which is of importance in the Waikaka Stream/Mataura River catchment, which has elevated levels of N. The proposed 600 cow dairy farm is a minor activity in a large catchment. There will be an increase of 50 cows (9%) compared to what is currently permitted, which is a very small increase in a large catchment. Due to the scale of the activity and proposed change, in parallel with less N fertiliser application, an expanded FDE area, less area in winter crop and an associated less area winter grazed, values associated with receiving surfacewaters will not be adversely affected; e.g. Iwi values, health of water bodies both in-stream and coastal, protecting biodiversity and ecosystems, protecting recreational activities such as fishing, walking and boating.

Biodiversity of surfacewaters

The Mataura River is regarded as the best trout fishery in New Zealand. The Water Conservation (Mataura River) Order 1977 (MCO) was established due to the "nationally outstanding" character of the fisheries and angling amenity of portions of the river. Under the MCO provisions the Mataura River is considered to be fully allocated at flows below the mean annual low flow. This means that further allocation of water is only available at moderate to high river flows. No application is being made here for a water take from the Mataura or its catchment.

The Waikaka Stream and Mataura River are used for the recreational fishing of trout and whitebait, with trout and native fish species such as short and long fin eels and galaxids inhabiting these waterways. Toetoes Estuary is also inhabited by a range of aquatic organisms. Nutrient enrichment and sedimentation result in nuisance plant growth such as slime, algal blooms, the choking of waterways by macrophytes and the smothering of stream beds. The collection of plants and animals that inhabit receiving waters are adversely affected, as well as in-stream values such as biodiversity.

As is outlined in Section 5, effects such as excess slime algae/periphtyton growth are seen in the lower Waikaka Stream and Matuara River when temperatures are elevated in summer and autumn. These effects are complex and relate to many interacting factors, e.g. physical factors such as flow rates and temperature, as well as chemical and biological factors. Ecological data for indexes such as MCI, taxonomic richness and %EPT from the lower Waikaka catchment are indicative of land use effects on aquatic biota living in the Stream. Toetoes Estuary has ongoing issues with sedimentation and eutrophication although large sections of the estuary remain in good condition. A decline in estuary quality is evident over the last fifteen years, specifically increased muddiness and macroalgal growth in parts of the estuary, in parallel with loss of seagrass beds.

Due to the implementation of several mitigation measures on farm (see table 7.2.1), biodiversity-related effects due to the proposed activity will be no more than minor. The measures already described set out to mitigate adverse effects on receiving surfacewaters over time, including on the biodiversity of the Waikaka Stream, Matuara River, Toetoes Estuary and coastal waters.

Winter Grazing

Approximately 150 cows will be winter grazed on farm in June, July and August under the proposed system, with approximately 11 hectares of fodder crop grown (fodder beet) grown for winter grazing purposes. Fodder crop will also be grazed by a portion of the herd for approximately 2 hours per day in May and September.

With approximately 11 hectares of fodder beet grown and winter grazed by c.150 cows annually, the scale of the activity is small in a large catchment. A winter grazing area of 11 hectares corresponds to 5% of the total land area at the dairy farm, making it a permitted activity (in the absence of a land use consent for farming). It is well below the threshold requiring resource consent (in its own right), as defined in Rule 20 of the pSWLP. This indicates that the effects of winter grazing on the scale of c.5% of the total landholding are minor. This is supported by Overseer analysis, which shows that the N loss from fodder beet blocks accounts for c.13% of the total N loss.

The main risk posed by intensive winter grazing of cows is of contaminant loss (N, P, sediment and microbes) to receiving surfacewaters via both overland flow and artificial drainage. Several management practices are implemented to mitigate the loss of contaminants via overland flow and artificial drainage to streams and receiving surfacewaters. Please see table 6.7 for a description of management practices. Key measures focus on trapping and filtering runoff by protecting streams with well vegetated buffers in winter crop paddocks. Buffer widths are large since the topography is generally rolling. Figure 7.4 below shows paddock #5, which will be sown in fodder crop and winter grazed in 2019. A large, well vegetated riparian buffer is in place; this will help to mitigate contaminant loss from grazing activity to the stream.

Given the scale of the winter grazing activity in addition to the implementation of mitigation measures, the effects of the winter grazing in this instance are considered as minor.

Figure 7.4 Fodder beet paddock with large, well vegetated buffer in place to protect the stream.

AEE on surfacewater at third-party grazier locations

WINTER GRAZING

Winter grazing activities at third-party graziers also must follow good management practice and implement mitigation measures relating to contaminant pathways (overland flow, artificial drainage and deep drainage) where appropriate. The applicants act in good faith when they engage the services of third-party graziers for winter grazing of cows and young stock. From May 2019 third-party graziers will be required to implement a FEMP, which includes the management of intensive winter grazing. From the same date they will be required to apply for resource consent if the scale and/or nature of the winter grazing activity activates Rule 20 of the pSWLP. As such Environment Southland will be provided with certainty in respect of the mitigation of effects from winter grazing activities at third-party grazier locations.

WINTER GRAZING OF MA COWS

As has already been explained, a portion of the herd is winter grazed at third-party grazier properties in the wider eastern Southland/Central Otago areas each year. It is the intention to continue this practice in the future. So long as future off farm winter grazing of MA cows occurs in the same wider Eastern Southland area, the effects of the proposed activity on groundwater and surfacewater will be no more than minor. The number of MA cows winter grazed off farm will remain consistent with the number grazed off farm in recent years. Future effects should therefore remain consistent with past effects; there should be no increase in effects due to this activity.

GRAZING OF YOUNG STOCK

Young stock has been grazed by a third-party grazier located in the Willowbank area in recent years. This includes winter grazing on fodder crop over June/July/August. It is the intention to continue with this arrangement in the future. The grazing of young stock is a permitted activity, and as such has effects on the environment that are considered to be minor. Effects on groundwater and surfacewater in the vicinity of the Willowbank grazier property due to the proposed activity are considered to be minor.

Consideration of alternatives for land use at the property

The land has been developed and used for dairy farming for approximately 25 years. Through their investment and experience, the applicants have developed a sustainable dairy farming model to suit the property. The proposed intensification is an increase in the herd size by 50 cows (or 9%), however, the proposed system will result in no increase in N loss to water compared to the existing situation, through the implementation of mitigation measures. The pre-expansion land use would not achieve a better environmental result than the proposed 600 cow dairy platform.

8. Consultation

The property is located in a rural area and has been run as a dairy platform for c.25 years when it was converted with full dairy infrastructure on site. The irrigation system is a low rate system with minimal visual or olfactory impact. The proposed changes include an increase in cow numbers by 9% but are of similar nature as existing activities and land use at the property. Good management practices are in place. Environmental effects are expected to reduce slightly with the proposed changes. For these reasons, no potentially affected parties are anticipated.

9. Conclusion

The applicants seek a land use consent for expanded dairy farming and replacement consent for their current effluent discharge permit for a 600-cow dairy operation. The expansion is due to an increase of 50 cows to a maximum of 600 cows, which is a return to the number authorised on the discharge permit up until 2016. As such the scale of the expansion is small. The expansion will occur in parallel with changes to the existing farm system; these changes result in a system with slightly lower average N loss annually according to Overseer. A slight increase in P loss predicted by Overseer will be mitigated through the implementation of an effective FEMP. The effects of the expansion are not being exported elsewhere but are being contained and managed appropriately at the landholding.

The application includes a policy assessment, an assessment of environmental effects and Farm Environmental Management Plan that demonstrate that the expected, actual or potential adverse effects generated by the continuation of the proposed activities on the environment can be avoided, remedied or mitigated to the extent that they are considered to be no more than minor.

The key concern with the expansion and effluent discharge is the potential for the activities to have adverse effects on groundwater and surface water quality, and on soils. Provided any consent conditions imposed by the Council are adhered to, and management practices are implemented in line with the attached Farm

Environmental Management Plan, the activities should have little adverse effect on the environment, including cumulatively.

Overall the proposal is considered consistent with the purpose of the Resource Management Act 1991 and does not conflict with the purpose of the Act, or with Council policy. The adverse effects of the dairy farm activity and the discharge of dairy shed effluent onto land should be no more than minor provided that the applicants adhere to the attached Farm Environmental Management Plan.

11. References

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30 March

John Scandrett
Dairy Green Ltd.
10 Kinloch Street
PO Box 5003
Waikiwi
INVERCARGILL

RE: Maitland Dairies Drop Test, 21-24 March 2017

Dear John

At your request we have reviewed the data collected for the above test, performed between 21 and 24 March 2017. From this review we can confirm that:

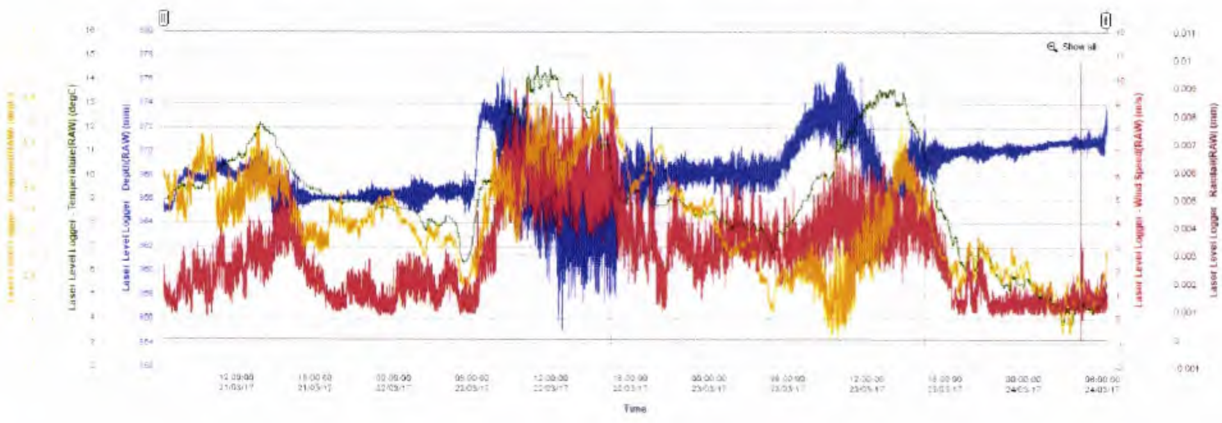
1. The raw data collected via our Neon data collection system is as you have stated.

2. Wind effects are evident, especially in the middle of the test, and this manifests as noise on the level trace corresponding to wave action on the pond.

3. During periods of no wind or rain the pond level appears to be quite stable, albeit with a gradual increase in distance from the level sensor to the pond, indicating a slow decrease in pond level.

4. Were a couple of "lumps" in the level trace, most likely caused by dew on the lens, but the level returned to a consistent value once dew point temperature dropped back again.

5. Subject to the above, the overall conclusions drawn in the report appear sound and reasonable.



Yours faithfully

Rod Mckay
Group Manager
NIWA Instrument Systems

28 March 2017

Grant & Camille Taylor,
Maitland Dairies Ltd,
371 Piako Road,
R D 1
Hamilton 3281

Dear Grant & Camille

Drop Test Results: Maitland Dairies Ltd, Effluent Pond, 20 – 24 March 2017

1. Background
The current discharge consent for the property is 20146428.

As required by Environment Southland, to confirm your effluent pond at Maitland is not leaking, a drop down test was carried out between the 20 and 24 March 2017.

Site and Set Up
The farm is located at Garden Gully Road, Maitland.

Effluent is pumped to sludge beds and then the filtered liquid is pumped to the irrigation pond. The pond was isolated by not allowing any inflow and by not pumping out during the test period.

The dimensions of the storage pond at the water level during the test period were:
North 33.7m
East 33.3m
South 31m
West 30.0m

The dimensions of the storage pond at the top bank level during the test period were:
North 36.0m
East 36.0m
South 34.5m
West 33.5m

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Email: scandrettrural@xtra.co.nz

The total pond surface area was 19 % greater than the wetted area during the test.

The irrigation pond depth was 4.0m including 0.5m freeboard. At the time of the test the liquid level was 1.0m below top bank height, i.e. 86% full.

Below is an aerial photo that shows the sludge bed and pond, dairy shed and yard. The laser drop test unit was installed at the south east corner of the irrigation pond, as marked.

3. Test Methodology

You were notified when the test was to be run and confirmation was received that there would be no liquid inflow or outflow during the test period.
The monitoring equipment was set up at the pond by Evan Sanderson, as described below. The NIWA Neon website was checked to confirm that data was being recorded and sent to the website.

3.1. Water Level Monitoring Unit

A laser distance measuring unit was set up vertically over the pond surface. A reflective disc was placed on the pond surface to ensure constant, repeatable readings.
The laser was set up within a PVC pipe which acts as a stilling well.
Distance readings to the pond surface were taken at 10 second time intervals and sent to NIWA's Neon logging system.

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3.2. Meteorological Station

A Vaisala weather station orientated to the North was also set up and the data it collected sent to NIWA's Neon system at 10 second intervals. It measured:

- Air Temperature
- Wind speed
- Wind direction
- Rainfall

3.3 Evaporation Loss Monitoring

A 10 litre bucket (evaporation pan) with a diameter of 250mm was installed in the pond to measure evaporation. The bucket was rinsed and then accurately filled with 9 litres of effluent and the volume monitored to determine evaporation.

4. Results Recording

Recording of results was carried out to comply with the Appendix P of the Environment Southland Land and Water Plan, recording details are summarised below:

- The minimum test period has to be 48 hours.

- Readings are to be taken every 10 seconds.

- For maximum accuracy the wind velocity has to be less than 1.0m/sec. This limit has been set because wind at the test site has been observed to have two affects, the first being to cause waves and the second to push water to one side of the pond from the other, (a seiche effect). The accuracy of the laser distance recorder is such it will detect changes as small as 0.2mm. To accurately determine the true pond level requires calm conditions at the start and end of the test period.

- Rainfall and the evaporation bucket liquid volume was measured at the start and end of the test period, the measurement cylinder was rinsed prior to the volume being measured.
- When a period of 48 hours or more has elapsed the information is down loaded and the results interpreted.

- The GPS location of the pond and equipment setup is recorded. For this test the equipment was located at **E**1295989, **N**4905611, at the South East corner.

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Laser at the South East corner.

5. Results Summary

The results for the test are summarised in Table 1 and discussed below.

The plot of wind speed and pond height shows that at times wind caused significant waves on the pond surface, particularly during the 22 and 23 March.
However a period was identified at the start and end of the test period when the pond surface was stable and accurate height readings were established.

The start time was assumed to be at 08:10:30 hours on the 21 March 2017.
The distance from the laser to the reflective disc on the pond surface was 365.4mm and the wind speed 0.7m/sec.

The finish time was assumed to be at 07:31:40 hours on the 24 March 2017.
The distance reading was 370.6mm and the wind speed 0.8m/sec.

The total time elapsed was 71 hours and 21 minutes, 10 seconds.

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The laser measured a change in distance to the pond surface of a 5.2mm increase. Therefore the pond surface fell 5.2mm over the test period.

The total rainfall recorded by the Vaisala rain gauge during the test was 0.1mm. While the pond catchment at top bank level was 19% larger than the wetted surface area it was unlikely the rain on the upper batters had any effect on pond level.
The change in level in the evaporation bucket on site for the test period was calculated as 4.7mm decrease in level.

The pond should have gained 0.1mm from rainfall and lost 4.7mm due to evaporation, a net change of 4.6mm. The pond decreased by 5.2mm, so potentially the pond lost 0.6mm to leakage.

TABLE 1 : DROP TEST RESULTS SUMMARY, Maitland Dairies Ltd.

Start Time	21 March, 08:10:30
Finish Time	24 March, 07:31:40
Total Time	71hrs, 21 minutes, 10 seconds
Start Depth (mm)	365.4
Finish depth (mm)	370.6
Change in depth (mm)	5.2
Rainfall (mm)	+0.1
Evaporation (mm)	4.7
Net Change in Depth After	
Rain and Evaporation (mm)	-0.6
Net Change per 24 Hours (mm)	-0.2
Pond Level, % of Design Depth	86
Net Change if Pond at 75% of	
Design Height. (mm/24hrs)	

6. Conclusion

The pond complies with the requirement of the Environment Southland Land and Water Regional Plan for effluent discharge (Rule 35 b. iii.), with a leakage rate of less than 2 mm / day.

The pond is suitable for storing effluent as the infiltration rate from the pond is less than 2.0mm per 24 hours.

Yours faithfully

JOHN SCANDRETT
Agricultural & Engineering Consultant

10 Kinloch Street, PO Box 5003, Waikiwi, Invercargill 9843
Phone 03 215 4381, Fax 03 215 4391
Email: scandrettrural@xtra.co.nz

Appended

Depth and wind speed graph for the test period.
Depth and rain graph for the test period.
Depth and wind speed for the start of the test period.
Depth and wind speed for the end of the test period.

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EFFLUENT POND & SLUDGE BEDS VISUAL INSPECTION

South Pro Maitland Limited
Garden Gully Road
Maitland

4 December 2018

J SCANDRETT
DAIRY GREEN LTD

10 Kinloch Street, PO Box 5003, Waikiwi, Invercargill 9843
Phone Invercargill 03 215 4381, Gore 03 208 8443
Email: scandrettrural@xtra.co.nz

Visual Effluent Storage Structures Inspection

Introduction

This report is to satisfy the permitted activity status described in Environment Southland's decision version of the Water and Land Plan, Rule 32 D, clause (a) (2), which states for existing agricultural effluent storage facilities, "certified by a Suitably Qualified Person in accordance with Appendix P within the last three years as: (a), having no visible cracks, holes or defects that would allow effluent to leak from the effluent storage facility".

Methodology

The methodology used is aimed at detecting obvious physical defects that are causing or could cause leakage.
It involves a physical inspection of the lining material above the liquid height, the pond crest and external batters, if any. It also considers the likely failure mode for the type of containment structure being inspected. If there is a drop test report available, it will be assumed that this report confirms the performance of the pond batters and floor surfaces below liquid level since these surfaces cannot be observed unless the pond is empty.

For synthetically lined ponds, where there is a leak detection drainage system installed the inspection piezo will be checked where possible. The condition of the lining membrane and its anchoring will be recorded. As well the material creating any embankment and its stability will be noted and any items of maintenance that may be required.

A visual inspection cannot record faults that are not observable which could include unsatisfactory material below the liquid level or underneath a synthetic liner or in the core of the bank. It doesn't include an assessment of bank performance in an earthquake or calculated internal and external batter performance under the normal range of operating conditions that a pond has to perform under.

STRUCTURES

An effluent sump, two clay lined sludge beds and a synthetically lined pond manage the dairy shed effluent.

POND

The pond for South Pro Maitland Limited is located north west of the dairy shed at Garden Gully Road and was inspected by request on 31 October 2018 with details recorded as follows:

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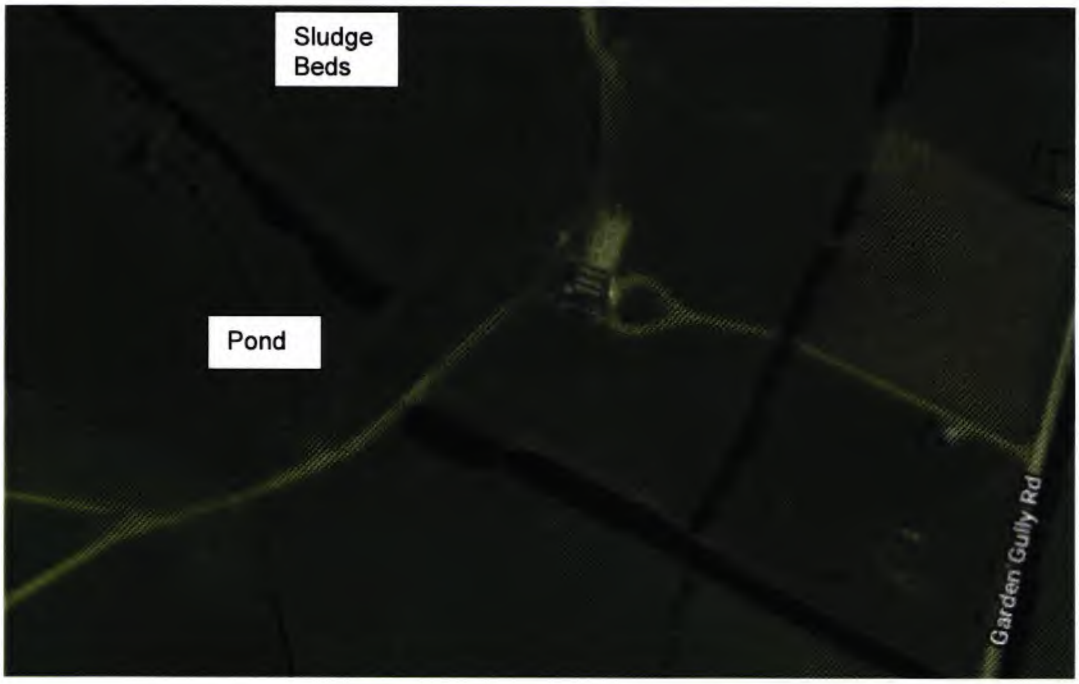
Phone Invercargill 03 215 4381, Gore 03 208 8443
Email: dairygreenltd@xtra.co.nz

Observations
The pond is rectangular with approximate inside top bank dimensions of 35m x 34m. The following aerial view shows the pond and sludge bed layout relative to the dairy shed.



Soils
Topoclimate records the predominant soil in the pond area as the Waikoikoi type. Waikoikoi soils in this area are typically deep and overly gravel at one metre or more depth. For this pond the depth of excavation was set to allow construction of the banks on a cut to fill basis.

Banks
The pond banks are constructed of subsoil and the crest width is 3.6m. The bank crests are stable and are covered in grass. There was no sign of seepage at the outer batters.

Batters
The batter slope is 2H:1V for the internal batters. The pond is synthetically lined so the internal batters would be expected to be stable at this slope. There was no sign of batter slumping.

Liner
A polypropylene synthetic liner was installed, it is 4 years old. It was well anchored.

The internal batter liner surfaces above liquid level were inspected for cracks or holes. No holes were found.

Comments

The pond was drop tested in 2017 and was found to comply with rule 35 (b) (ii) at that time.
The pond appears to meet the condition of having no visible cracks, holes or defects that would allow effluent to leak from it. No defects that would allow leakage were observed during the pond inspection.

Photographs of the pond are appended.

POND PHOTOGRAPHS
South Bank

East Bank

North Bank

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Email: dairygreenltd@xtra.co.nz

West Bank

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SLUDGE BEDS

Banks
The sludge bed banks are constructed of subsoil and the crest width is 3.6m. The bank crests are stable and are covered in grass. There was no sign of seepage at the outer batters.

Batters
The batter slope is 1H:1V for the internal batters. The sludge beds are clay lined. There was no sign of batter slumping.

Liner
The sludge beds were constructed from clay subsoil and so effectively the liner is the full thickness of the banks.

Comments

The sludge beds appear to meet the condition of having no visible cracks, holes or defects that would allow effluent to leak from it. No defects that would allow leakage were observed during the pond inspection within the limits of inspection due to the grass cover.

Photographs of the sludge beds are appended.

SLUDGE BEDS PHOTOGRAPHS
South Bed & Banks

North Bed & Banks

PUMP SUMP

Construction

The pump sump is constructed from reinforced concrete. It was formed by using a precast open top concrete tank and installing it in the ground so that approx. 300mm is above ground level.

The tank has vertical internal walls and will hold 22.5m^3 of effluent.

Comments

There were no signs of corrosion or physical damage to the concrete.
The sump appears to meet the condition of having no visible cracks, holes or defects that would allow effluent to leak from it. No defects that would allow leakage were observed during the sump inspection.

Photographs of the pump sump are appended.

J S Scandrett
Agricultural & Engineering Consultant

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South Pro Maitland Limited

Farm Environmental Management Plan

Version 1.1

(1 June 2018 – 31 May 2019)

Table of Contents

1 Property Details

Entity Name:	South Pro Maitland Limited (formerly Maitland Dairies Limited)
Physical Address	131 Garden Gully Road, Gore
Description of landholding ownership	67% Grant & Camille Taylor, Gordonton 20 % Luke & Sarah Taylor, Otautau 13 % Morris & Joy Storer, Balclutha
Landholding owner's details	Grant Taylor (07) 8243454, (027) 4929700 gctaylor@glenmarie.nz
Contact Person:	Ben Jarvis (contract milker): (027) 777 0919
Legal Description:	Section 4 Block I Glenkenich SD Section 5 Block I Glenkenich SD Lot 1 DP 4553
Land Area:	Total = 205.7 ha Effective = 194.5 ha
Resource Consents:	Existing discharge consent (20146428), expires on 30/3/26

This document is designed to be a living document.

The plan should be updated at least yearly – at the end of the season is advisable.

2 Maps

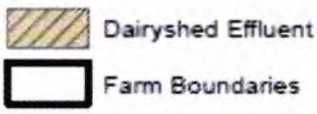
2.1 Accompanying notes to maps

- The dairy farm lies west of Garden Gully Road, approximately 17 km north of Gore Town. The dairy platform includes the entire landholding.
- Topography is easy to rolling, with steeper slopes at the north of the property.
- Soils are well developed, and have subsurface drainage installed in places. The relative depth of subsurface drainage (where known) is c.800 mm.
- CSAs are found at the bottom of slopes close to waterways (see Appendix – map 2).
- Waterways flow through the property in a north to south/southeast direction and are fully fenced off. Riparian buffers are vegetated with either mature vegetation or good grass cover. A planting programme is underway.
- All crossings are culverted; stock do not have access to surface waterways. Locations where lanes cross drains are managed as CSAs to minimise runoff from tracks and lanes into surface waterways (see Appendix – map 1).
- Land is classed in the Gleyed and Oxidising (overland flow variant) physiographic zones.
- Infrastructure includes a dairy shed, effluent storage pond, sludge beds, concrete sump, sand trap, Larall low rate irrigation system and two silage pads. A disused effluent pond will be removed in February 2019.

2.2 Boundaries – property and FDE area

The entire landholding is authorised to receive effluent, excluding standard buffers.

Figure 1. Boundary of dairy platform (source: current Appendix 1 Discharge map).



2.3 Infrastructure

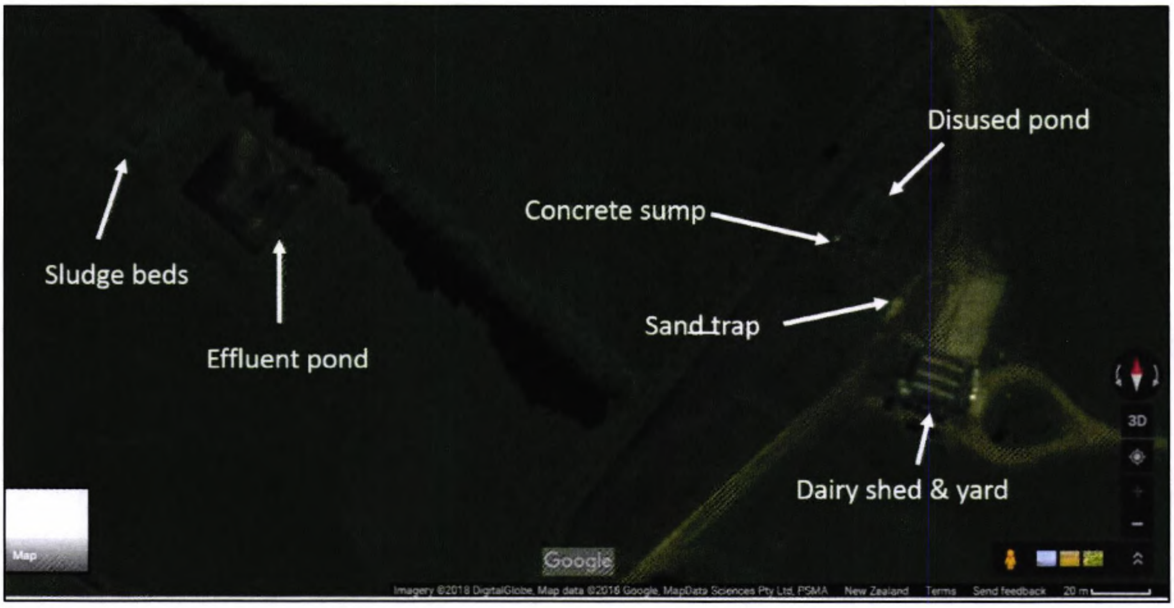


Figure 2. Infrastructure

2.4 Surface waterways

Figure 3. Major surfacewaterways (approximately boundary outlined in red).

2.5 Physiographic zones

Land is classed in the Gleyed and Oxidising (overland flow variant) physiographic zones.

Figure 4. Physiographic zones (approximate boundary outlined in red).

Physiographic Zones

- Alpine - No Variant
- Bedrock/Hill Country - Artificial Drainage
- Bedrock/Hill Country - No Variant
- Bedrock/Hill Country - Overland Flow
- Central Plains - No Variant
- Gleyed - No Variant
- Gleyed - Overland Flow
- Lignite - Marine Terraces - Artificial Drainage
- Lignite - Marine Terraces - No Variant
- Lignite - Marine Terraces - Overland Flow
- Old Mataura - No Variant
- Oxidising - Artificial Drainage
- Oxidising - No Variant
- Oxidising - Overland Flow
- Peat Wetlands - No Variant
- Riverine - No Variant
- Riverine - Overland Flow
- Urban Area

2.6 Topography

Topography is easy to rolling, with steeper slopes at the north.

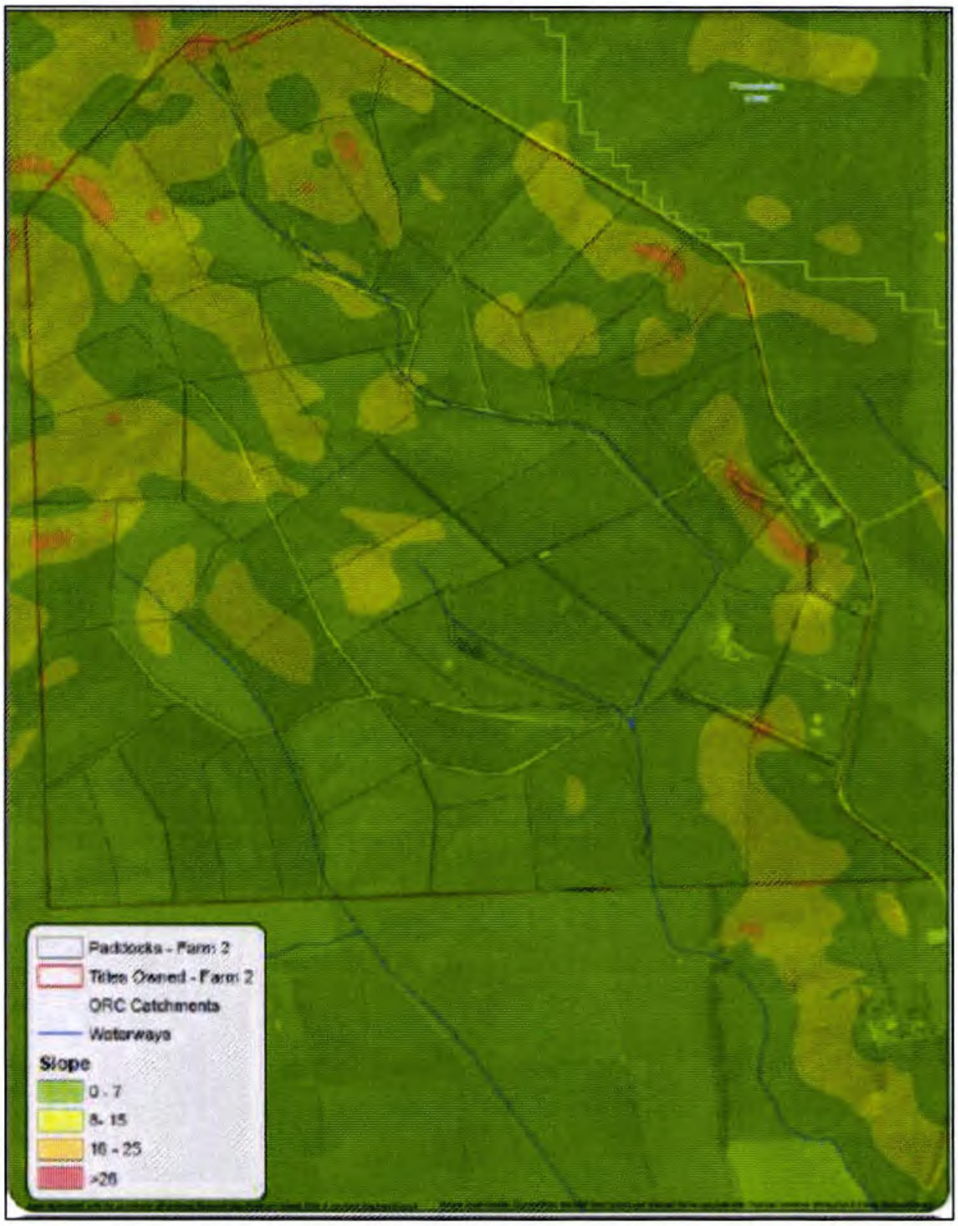


Figure 5. Topography at the dairy farm (source of map: Ravensdown nutrient budget report)

2.7 Heritage

There are no known or recorded heritage sites on the property.

2.8 Significant Indigenous Biodiversity

There are no known or recorded sites of significant indigenous biodiversity on the property.

2.9 Soils

Topoclimate and S-Map soil names differs, although both databases have the same soil map. For example, where Topoclimate maps Catton soils, S-Map maps Waikiwi soils. Table 1 shows soil types from each database.

Nutrient budgets use S-Map soil classification.

Table 1: Classification of soil types in Topoclimate and S-Map

Group	Topoclimate	S-Map
1	Chatton	Waikiwi
2	Waikoikoi	Claremont
3	Jacobstown	Eureka
4	Benio	Benio

Soil vulnerability classifications are shown in Table 2.

Table 2: Vulnerability of soils

Soil type	Structural Compaction	Nutrient Leaching	Waterlogging
Claremont	Very severe	Slight	Severe
Waikiwi	Slight	Moderate	Slight
Benio	Moderate	Severe	Slight
Eureka	Severe	Slight	Severe

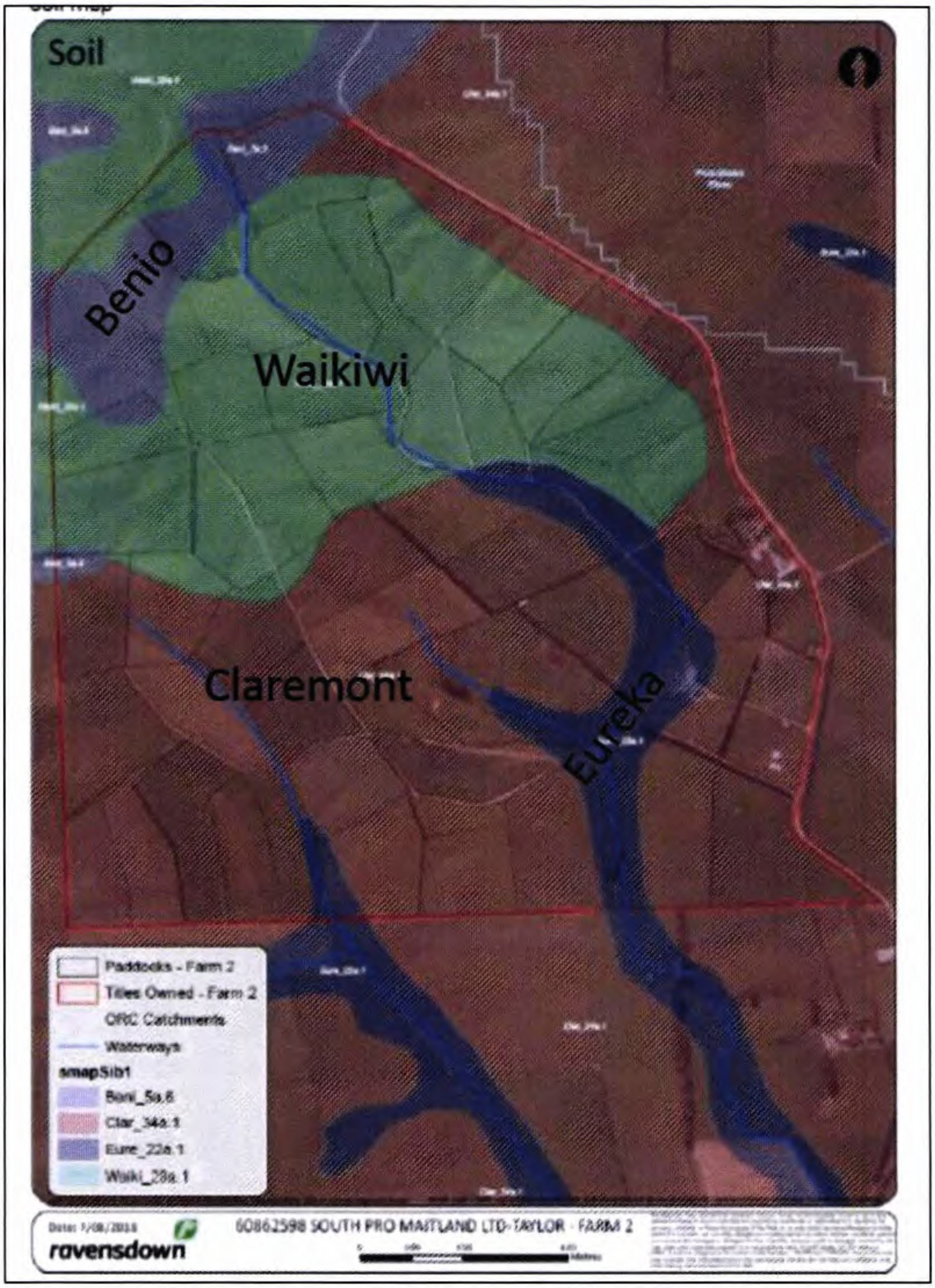


Figure 6. S-map mapping of soils (approximate boundary is outlined in red; map source Ravensdown).

3 Nutrient Management

3.1 Physical properties of soils

Physical properties of dominant soils are shown in table 3.

Table 3. Physical properties of soils.

Soil type	Profile drainage	Plant readily available water	Potential rooting depth	Rooting restriction
Claremont	Poorly drained	Moderately high	Slightly deep	Fragipan
Waikiwi	Well	High	Deep	No major restriction
Benio	Moderately well	Moderate	Moderately deep	Extremely gravelly subsoil
Eureka	Poor	High	Deep	Limited subsoil aeration during sustained wet periods

3.2 Environmental Management Actions Recommended

To mitigate the potential loss of nutrients the following actions will be adopted as far as practical:

i. Soil and herbage testing to monitor soil chemistry and inform on decisions regarding fertiliser and lime application to maintain optimum soil fertility levels. Testing should initially be annually until an understanding and trends have been established;

ii. Fertiliser and lime management plan prepared annually with guidance from Overseer output reports;

iii. Fence off waterways and exclude stock from streams. Implement a riparian planting programme;

iv. Protect CSAs by fencing, excluding stock and maintaining good vegetation cover.

v. Tracks and lanes sited away from streams where possible. Lanes constructed to divert runoff away from potential waterway ingress. Water tables will be designed to shed water to pasture for riparian treatment where practical; and

vi. Manage stock in a placid manner to reduce the collection of effluent at the dairy shed;

3.3 Fertiliser Application Best Management Practices

The following practices are recognised as being most desirable and will be followed as much as is practical.

i. Buffer distances are maintained such that there is no direct contamination of waterways from the application of fertiliser;

ii. Best practice is to have a 20 m buffer between fertiliser placement and waterways;

iii. Fertiliser is not applied to saturated soils;

iv. Nitrogen-containing fertilisers are only applied to actively growing pastures;

v. Fertiliser is not applied when or where air drift can occur beyond the farm boundaries; and

vi. The need for large fertiliser dressings should be achieved through split dressings rather than a single application.

Note: The application of fertilisers is deemed a permitted activity by Environment Southland provided:

- Application must not occur within 30 m of a neighbouring residential unit without approval. Spray drift must also be minimised.
- There must be no direct discharge to water and no discharge when soil moisture exceeds field capacity. For permanently flowing waterbodies (including artificial drains), fertiliser in riparian plantings where stock is excluded can only be applied to establish the planting. If there is no riparian planting, a setback of 10 m is required.

3.4 Effluent Application Best Management Practices

To mitigate the potential effects of the discharge of effluent to land the following practices will be adopted as far as practical:

i. The soil test values for the paddocks receiving effluent will be considered and the depth of application adjusted to suit;

ii. At all times the management of the effluent system will comply with the discharge consent conditions, including annual N loadings per hectare;

iii. Buffer distances as required in the discharge consent will be followed;

iv. 7 -10 days post grazing before effluent application;

v. Application of sludge solids – less than 10 mm depth to suitable ground, with consideration of climate conditions;

vi. Apply maintenance rates of nutrient to as much of the farm as possible rather than load up a smaller area with all the effluent/nutrient, and

vii. Only use the slurry tanker and umbilical system to discharge effluent on flatter areas, including within Category C/sloping classed land. Do not use the slurry tanker when there is risk of soil compaction due to its weight; instead employ the service of an umbilical system contractor.

3.5 Potential Nutrient Loss Effects of Dairying – Overseer nutrient budget

Overview

The nutrient budget was prepared in Overseer® Version 6.3.0 in September 2018 by Mr. Nouman Kyamanywa, Certified Nutrient Management Advisor, in accordance with the latest version of the OVERSEER Best Practice Data Input Standards (March 2018).

A nutrient budget analysis report has been prepared by Mr. Kyamanywa and is available for review. **Please refer to the report for an analysis of nutrient losses, including inputs and outputs.**

Nutrient budget XML file

Ovr-SOUTH PRO MAITLAND LTD-PROPOSED – V2.XML

Input summary

i. Peak milk 600 cows; the stocking rate is 3.1 cows/ha;
ii. 300 cows are wintered off-farm, 150 cows are winter grazed on-farm;
iii. Fodder crop (approx.11 ha of fodder beet) is sown and fed to cows in May, June, July, August and September;
iv. Young stock is grazed off farm from weaning until they return as in-calf R2-heifers for calving;
v. Surplus feed is conserved on farm as baleage. Baleage made is used to supplement cows;
vi. Supplementary feed is imported (80 t silage, 170t barley grain, 130 t PKE and 80 t straw). Imported silage is fed to cows across paddocks, barley grain and PKE are fed in-shed to cows;
vii. Optimum Olsen P values for high producing dairy farms have been used;
viii. A low rate effluent application system is used as the primary effluent irrigation system, along with deferred effluent application using a storage pond;
ix. Fertiliser is applied in accordance with best practice (farm average application rates of N:246, P:25, K:16 and S:38)
x. The milking season is between 1st August and 30th May.

Output summary

Nutrient losses

A summary of the nutrient loss from Overseer calculations is provided in Table 4.

Table 4. Nutrient loss summary

Indices	South Pro Maitland Limited	Average NZ Dairy Farm
N/loss to water (kg/ha/yr)	49	24-42
N conversion efficiency (%)	?	27-35
P loss to water (kg/ha/yr)	1.0	0.5-1.6

Average NZ dairy farms are referenced as losing 24-42 kg N/ha/year. It is very likely that this range is out of date, since version 6.3.0 of Overseer has generally increased N loss for farming activities, particularly dairy farming.

4 Good Management Practices

4.1 Review

Good management practices implemented in the current year are contained in the tables in sections 4.2, 4.3, 4.4 and 4.5. These will be reviewed and updated annually as part of the overall review of the Farm Environmental Management Plan.

4.2 General Good Management Practices

A policy of good management practice will be undertaken while operating the dairy farming activity over the coming 12-month period (see table 5).

Table 5. General good management practices operated June 2018 – 31 May 2019.

Summary of Management Practices
Utilising a nutrient management plan;
Soil testing is carried out each year; soil Olsen P levels are maintained at a biological optimum and no higher;
Trends in soil testing are evaluated and used to inform on decision making regarding soil health, fertiliser and agronomy plans;
Surface waterways are fully fenced and with good grass cover, fencing is maintained, and stock are excluded from the riparian areas;
Wide riparian buffers are maintained;
All surface waterways are culverted;
Sufficient land area is available for the dairy operation;
Good management practice of winter grazing activities is implemented;
Young stock is grazed off farm from weaning;
Tracks and lanes are sited away from streams where contours allow;
Lane runoff diverted to land with remedial work at lane/culvert/bridge crossings carried out as required;
Good management practice of the silage pad is implemented;
Restricted grazing of draining pastures in autumn/spring;
Care in irrigation of FDE, especially when the ground is near or at field capacity;
A large land application area is available to ensure N & K returns are not excessive;
Effluent volumes are minimized at source through efficient water use;

Low rate FDE irrigation (i.e. Larrall system) is used;

Appropriate FDE storage volume to allow for deferred irrigation for effluent;

All data and maps are kept up to date and all staff are trained and informed of any changes;

Programmed maintenance is done in and around FDE, and piping infrastructure around the dairy shed, cow yard etc.;

4.3 Physiographic Zones and Transport Pathways

The physiographic zones (PZs) for the property are shown on a map in section 2 (Gleyed and Oxidising (overland flow variant)). These zones have the potential for contaminant loss to waterways and groundwater through overland flow, artificial drainage and deep drainage as shown in Table 6.

Table 6. Physiographic zones and transport pathways.

Physiographic Zone	Variant	Key Transport Pathway	Soil types
Gleyed	N/A	Artificial drainage, overland flow	Waikiwi, Benio
Oxidising	Overland flow	Overland flow, deep drainage	Clarement, Eureka

Note: Due to the rolling topography underlying Oxidising soils, overland flow is deemed to be of particular risk, especially close to waterways and at CSAs following periods of prolonged, heavy rain.

Gleyed PZ

Gleyed soils may accumulate and store nitrogen during summer and early autumn when soil moisture levels are low. However, some nitrogen will be removed from the soil and aquifers via denitrification, resulting in relatively low groundwater nitrate concentrations. Accumulated nitrogen starts moving with water when soils become wet in late autumn and winter and may be lost via artificial drains or overland flow. Major contaminants (N, P, sediment and microbial contaminants) are lost through artificial drainage to nearby streams during wetter months or following heavy rainfall events. Given the undulating nature of the topography, there is risk of contaminant loss via overland flow/runoff during wetter months also.

Oxidising PZ

Oxidised soils can be very good at absorbing and storing water and any nitrogen it contains. During drier months, nitrogen can 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).

Due to sloping topography there is in fact more risk of contaminant loss from Oxidising soils via overland flow and much less risk to groundwater.

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.

4.4 Good management Practices for Key Transport Pathways (1 June 2018 – 31 May 2019)

Table 7 describes good management practices, which are currently implemented on-farm through the annual cycle to mitigate the risk of contaminant loss to water (N, P, sediment and microbes).

Reference factsheets: Overland flow, artificial drainage, deep drainage

Table 7. Good management practices for key contaminant transport pathways.

Transport Pathway	Mitigation Measure	Summary of Management Practices
Overland flow Artificial drainage	Protect soil structure (especially near streams)	Match stock management to land use capability, e.g. avoid grazing cows on more vulnerable soils, especially when wet. Fence off waterways and protect CSAs. Stock will not graze riparian strips. Riparian strips are large and well vegetated; Young stock is grazed off farm from weaning; Implement good management practice winter grazing; When appropriate use minimum or no-till cultivation practices such as direct drilling; Re-sow areas of bare or damaged soil as soon as is practical;
Overland flow Artificial drainage	Reduce P use or loss	Prepare a nutrient budget; Soil test regularly; Maintain Olsen P values at agronomic optimum and no higher; Apply P fertiliser outside of high-risk months in autumn and winter; Manage CSAs appropriately;
Artificial drainage, Deep drainage	Reduce accumulation of surplus N in the soil, particularly during autumn and winter	Maintain sustainable stocking rate; Reduce inputs of N where possible through optimal fertilizer application on farm, use little and often approach; Young stock is grazed off farm from weaning;

		Optimize timing and amounts of effluent irrigation input applications; Substitute autumn diets with low-N feed when practical; Time N application to meet pasture demand using split applications and when pastures are actively growing (>6 degrees Celsius); Control the duration of grazing pastures; Cut and carry feed where practical;
Artificial Drainage	Avoid preferential flow of effluent through artificial drainage channels	Defer irrigation to effluent storage pond when soil conditions are unsuitable; Low rate and depth effluent application is primarily used; A sufficiently large FDE area is available for effluent; Observe buffer zones and placement guidelines e.g. not over tile drains or at CSAs during high risk periods; Observe discharge consent conditions;
Overland flow	Manage CSAs; low points at the bottom of slopes, gullies and/or overlying tiles	Restrict grazing of pasture CSAs when soils are near saturation; Protect CSAs with fencing and good vegetation cover where appropriate; Avoid working pasture CSAs and their margins; Move troughs and gateways away from water flow paths; Reduce runoff from tracks and races by using cut offs and shaping to direct surface drainage to paddocks, where it can be filtered by pasture plants before reaching waterways; Carry out remedial work to reduce runoff as required;

Figure 7. Fenced off, well vegetated pasture CSA in foreground.

4.5 Key mitigation measures associated with expansion

The nutrient budget analysis predicts an average annual N loss of 49 kg/hectare and an average annual P loss of 1.0 kg/hectare. Key drivers of controlling nutrient losses associated with expansion are regarded as mitigation measures.

Table 8. Key mitigation measures

Key pathway	Key mitigation measure	Effect of measure	Implementation
Overland flow, artificial drainage	A maximum of 11 hectares of fodder crop (beet or brassica) is sown annually.	Less mineralisation of organic N in soils, reduced N, P, sediment and microbial loss from intensive winter grazing of fodder crop	Nov-18
Artificial drainage	Expansion of FDE area to at least 68 hectares	Less N, P, and microbial loss from soils to water	Mar-19
Artificial drainage, overland flow	An average of 246 kg N/ha is applied in fertiliser, fertiliser is not applied from May – July	Less N leaching loss from soils	Oct-18
Overland flow, artificial drainage	No more than 150 cows will be intensively winter grazed on farm	N, P, sediment and microbial loss from intensive winter grazing of fodder crop is limited by cow number	Jun-19

Overland flow, artificial drainage	All young stock is grazed off farm from weaning until they return as in-calf R2-heifers for calving	Less N, P, sediment and microbial loss from animal grazing	Nov-18
Overland flow, artificial drainage	Maintain Olsen P levels at the agronomic and economic optimum and no higher.	P loss is avoided	Nov-18
Overland flow, artificial drainage	Management of CSAs through implementation of an effective FEMP	Contaminants such as P, sediment and microbes are filtered and/or adsorbed onto soil particles	Nov-18

5 Riparian Management

5.1 Streams, Creeks and Drains

i. All waterways are riparian fenced on both sides allowing for large buffer distances to waterways;

ii. A riparian planting programme is underway;

iii. Regular riparian fencing checks are to be completed and any damaged sections or breakages/breaches are to be repaired immediately;

iv. Calves or other stock that are found in the riparian areas are to be removed immediately;

v. Check all crossings are contoured to channel run-off onto pasture;

vi. Carry out weed control as required following best practice methods;

vii. Remove drain cleanings and spread over paddocks to utilize the nutrients and to prevent material returning to the water way; and

viii. Make sure fish have passage through all culverts and underneath bridges.

Figure 8. Fenced-off stream with wide well-vegetated buffer.

5.2 Weeds and Pests

Weeds (e.g. gorse, broom, blackberry, ragwort, thistles etc.) are controlled by manually removing them or by using sprays:

i. When sprays are used to control weeds, care is taken to ensure all sprays are certified to be aquatic safe and that appropriate staff training is given to ensure good health and safety practices are fully implemented;

ii. Spraying is best carried out when there is active growth (e.g. mid/late spring). The aim is to spray plants when they are small as less chemical is required;

6 Cultivation

6.1 Cultivation strategy

Current season

For the 2018/19 season, 11 hectares of fodder crop (fodder beet) have been cultivated. Paddocks #5 and #28 have been sown in fodder beet.

Forage brassica or beet crop

- Paddocks are sprayed off in October;
- Paddocks are direct drilled or fully cultivated into fodder crop from mid-October to mid-November;
- Fodder crop is grazed over winter by cows;
- Paddocks are subsequently re-grassed in October.

Re-grassing

An extensive re-grassing policy has been carried out, with most paddocks having been re-grassed at the time of writing. Approximately 5 - 10% of the farm's effective area will undergo cultivation into new grass each year. Where grass to grass re-grassing occurs, paddocks are sprayed off and direct drilled with grass seed or undergo full cultivation if necessary.

Grass production, soil structure and fertility are the primary factors in paddock selection, with poorly performing pastures targeted for renewal. Soil moisture content is also a factor in the choice of paddock selection and timing of cultivation.

Surplus grass is harvested as baleage when possible.

6.2 Cultivation - Good Management Practices

Good management practices are followed:

i. Where depressions in crop paddocks are likely to channel sediments and nutrients to drainage, these are left uncultivated to act as sediment traps;

ii. Direct drill paddocks where possible;

iii. Plough lines are kept 5 metres back from the top of drain banks. This ensures at least a 5 metre buffer along waterways. Greater set-backs are maintained where topography is sloping, e.g. 10 metre buffers from waterways.

Figure 9. Example of a set-back from waterway and CSA during cultivation.

7 Intensive Winter Grazing

7.1 Stock Grazing Management

The Environment Southland Intensive Winter Grazing Rule covers the period from 1 May until 30 September.

A large proportion of cows are winter grazed off-farm at third-party graziers. Some cows are winter grazed on-farm over June and July (a maximum of 150 cows).

Cows also graze fodder crop on-farm in May, August and September.

In the case of all grazing within the Environment Southland defined winter period, the following good management practices will be implemented.

7.2 GMPs – Intensive winter grazing

Table 10. GMPs- intensive winter grazing

GMPs - intensive winter grazing	
Appropriate paddock selection	Judicious paddock selection based on the soil moisture content is a key tool. This is important not only to avoid overland flow, pugging etc. but to ensure that the pasture and soils are not damaged to any extent that would inhibit spring pasture growth. Drainage is put in place as required prior to paddocks being cultivated and subsequently winter grazed.
Back fence stock	Breaks once eaten off, are back fenced to avoid pugging of soils.
Graze towards any water course(s)	Breaks are sequenced to ensure that grazing is towards the watercourse, leaving a last bite buffer where possible.
Place baleage in paddock when soils are dry	If baleage is used, baleage is placed in the paddock before soil becomes too wet thereby preventing heavy vehicles from damaging the ground. Supplementary feed (baleage/hay) is placed in portable feeders.
Use portable troughs	Where breaks do not encompass a trough, a portable trough will be used to avoid the pugging of lanes between the water troughs and the feed breaks.
Implement wide buffer zones from waterways	A fenced buffer zone of at least 5 metres from all waterways is maintained (see figure 9). Where land is sloping, larger buffer distances will be implemented (e.g. 10 or 15 metres). Higher risk areas over drainage depressions (swales), close to gullies and close to waterways are temporarily fenced off. Paddock CSAs are not grazed.

Avoid pugging of soils close to waterways	In wet weather, where there is risk of pasture and soil damage, care is taken to minimise grazing and avoid supplement feeding and pugging within 10 metres of a waterway.

8 Collected Agricultural Effluent

8.1 Overview of the Proposed Effluent Collection, Storage and Irrigation System

Dairy Shed Effluent System

I. Raw effluent from the dairy shed and yard gravity flows to a sand trap.
II. From the sand trap raw effluent gravity flows to a concrete pump sump.
III. The concrete sump has a float switch, which automatically turns the pump on when the sump is 50% full. Effluent is pumped to the sludge beds sited on the hill to the west south west.
IV. The sludge beds are used alternately.
V. Having passed through a weeping wall, filtered effluent gravity flows to the storage pond.
VI. When soils are below field capacity and have sufficient soil moisture deficit, filtered effluent is pumped to a low rate Larall system and irrigated to land.
VII. When soils are near or at field capacity, effluent is stored in a buffer storage pond; there is enough storage in the pond so that irrigation is not required.
VIII. An off-season diversion is put in place at the dairy shed.

8.2 Effluent System Volumes

Effluent Sources

i. Cowshed, and
ii. Rainwater captured on the yard area and milk vat stand area.

Effluent Volume

The maximum volume of effluent generated <u>per day</u> at the dairy shed is approximately 30 m^3.

Effluent Storage Volume

The existing storage pond has a pumpable volume of approximately 2,420 m^3. The Massey Dairy Effluent Storage Calculator 90% storage probability volume for is 1,946 metres cubed, so the pond has sufficient storage for dairy shed effluent from 600 cows.

8.3 Effluent Application Rate and Depth

The irrigator system's application rates, application depths and uniformities are to be checked annually in accordance with section 4: Land Application "A Farmer's Guide to Managing Farm Dairy Effluent – A Good Practice Guide for Land Application Systems" (2015).

Irrigator

Larall system

The irrigation system comprises a low rate Larrall system, which applies dairy shed effluent to land at a rate of less than 10 mm/hour and at a maximum depth of 10 millimetres per application.

The Larall system is fed by a pump delivering a maximum 18 m^3 of effluent per hour if pumping is continuous. Due to system design and set up, the pump will deliver 18 m^3 of effluent per hour if pumping is continuous.

The Larall system uses pulsed irrigation to a total of 6 sprinklers/pods. The irrigation period is programmable as is the rest period between pumping and the number of cycles this occurs i.e. the total pumping time.

The irrigation system has a safety system, which automatically switches the system off if there is insufficient or excess flow to detect blockages and leaks. Irrigation of effluent only occurs when there is sufficient soil moisture deficit to safely apply effluent to land without risk of drainage to receiving waters.

Slurry tanker

The umbilical system may be used as a contingency irrigation method. The application depth from the slurry wagon is determined by the tractor speed and width of spread. The application depth can be maintained at less than 5 mm by ensuring the tractor operates at an appropriate speed.

Umbilical system

The umbilical system may be used as a contingency irrigation method. The umbilical system will apply effluent at a maximum depth of application of 5 mm for each individual application. Its application depth can be lowered by speeding up travel speed.

Nutrient content of effluent

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

1 mm of irrigated dairy shed effluent depth equals:

2.5 kg per hectare of N

3.0 kg per hectare of K

0.3 kg per hectare of P

If 10 mm depth of effluent is irrigated over 1 hectare, the nutrient application will be:

25.0 kg per hectare of N, 30.0 kg per hectare of K and 3.0 kg per hectare of P

Note: Due potential to animal health issues, it is advised that not more than half the annual potassium requirement be applied per application of effluent i.e. the annual requirement of potassium (is 60 - 80 kg per hectare per annum).

8.4 Effluent Irrigation Records

As each paddock is irrigated the daily pumping time will be recorded. This will also provide an annual record of the total depth of effluent applied.

Application Log book

As each paddock is irrigated the irrigator placement location and date is recorded in a farm diary and on a map. These provide an annual record of when and where effluent has been applied.

The following good management practice measures are consistently used:

- The low rate sprinklers are always at least 40 m apart;
- The Larall system system operates as a low rate pulsing irrigation system to ensure the application rate is less than 10 mm/hour;
- A visual assessment of uniformity and intensity of effluent application is carried out daily to ensure each system is operating properly;
- Care is taken to monitor drainage to ensure there are no adverse effects from effluent application;
- Irrigation records can be used not only in any discussions with compliance authorities, but as data for use in nutrient/fertiliser application planning.

Records can be used not only in any discussions with compliance authorities, but as data for use in nutrient/fertiliser application planning.

Maintenance Log Book

Exercise book with a page for each of the following recording the relevant date, time, person responsible and action taken.

i. Pond levels

ii. Pump servicing and maintenance

iii. Fail safe/controller maintenance

8.5 Effluent irrigation decisions

Drainage monitoring is carried out on an ongoing basis, which helps to inform decision making on effluent discharge.

The following effluent decisions are made on farm prior to the discharge of effluent:

- Check the nearest soil moisture site to determine if the current soil moisture is suitable for irrigation;
- Ensure ground is dry enough to apply effluent without risk of ponding or runoff down slopes;
- Check wind direction to ensure the wind direction is not towards neighbouring houses.

9 Effluent System Management

9.1 Person in Charge

The person in charge of the effluent management system is the contract milker; Ben Jarvis

9.2 Effluent System training

Training

All new staff will be trained in the operation of the effluent system as and when employed. Details are to be recorded in the staff training log.

Resources – Shed Operations Manual.

i. Effluent system operational guidelines - also displayed in the pump house;
ii. Irrigation map marked up with drainage outfalls, irrigation areas etc; and
iii. Copies of Environment Southland consents.

9.3 Effluent Minimisation

There are management practices and operational methodologies that can be used to minimise effluent voided on lanes, tracks and hardstands and around gateways. These include:

i. Allowing the herd to walk in rather than be driven;
ii. Splitting the herd into small herds for faster movement;
iii. Not using tracks and lanes as standoffs;
iv. Do not supplement feed cows on or along the edges of lanes;
v. Wet the yard before the cows arrive;
vi. Minimisation of freshwater shed water use in yard hose down; and
vii. Ensure there are no excessive volumes lost through the D gate platform washer.

9.4 Effluent Pumping

The specified irrigation pump will deliver 18 m^3/hr approximately depending on the distance of the irrigator from there pump and the height above the pond (i.e. static head).

9.5 Discharge Area

The authorised effluent discharge area (c.195 ha) is shown in figure 1, less buffers from dwellings, bores, waterways and boundaries. In practice effluent is discharged to c.70 hectares.

9.6 Paddock Selection

Paddocks will be selected according to their moisture status and grazing management history. A sequence of paddocks can be pre-planned for effluent irrigation. As each area is grazed and then spelled for the required period it can then be irrigated.

Prior to irrigation occurring a visual assessment of the soil will be made along with data from Environment Southland's soils moisture irrigation site at www.es.govt.nz. If paddocks are pugged or are likely to have very low infiltration rates the effluent 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 with effluent when, or where, irrigation will result in the soils reaching field capacity. Field capacity is the point at which drainage starts either by passing down through the soil profile or flowing over the surface.

Effluent irrigation is to be avoided when the soil temperature is less than 5º C.

The following will be marked up on the dairy shed map. These will be updated each year as crop/re-grassing rotations, drainage, fencing changes etc. affect the relative risks.

High risk soils

Due to its undulating topography and presence of subsurface drainage, the property is considered high risk for dairy effluent discharge.

Therefore, the discharge of dairy effluent needs to be carefully managed with irrigation deferred when necessary.

Tile lines

These, where known, are marked on map 1 (see Appendix), and irrigation should not be carried out directly over them if there is any risk of irrigation creating drainage.

Wind

Consideration needs to be given when high winds are predicted for example in the equinox seasons to ensure that spray drift does not end up in unintended places such as within minimum distances from waterways or outside the farm boundary.

9.7 Coverage Area

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

i. 20 metres of any surface watercourse;

ii. 100 metres of any potable water abstraction point;

iii. 20 metres of any property boundary, (unless the adjoining landowner's consent is obtained to do otherwise);

iv. 200 metres of any residential dwelling other than residential dwellings on the property;

v. Effluent shall not be discharged onto any land area that has been grazed within the previous 7 – 10 days; and

vi. Effluent shall not be discharged over tiles/mole drains where the soil is at or near field capacity.

9.8 Effluent Irrigation - Conditions

Field Moisture Conditions

Paddocks to which effluent is to be applied should be visually inspected, prior to irrigation to gain an understanding of an any high traffic areas to be avoided, location of water troughs, tiles, drains etc.

Near Field Capacity

When soils are near field capacity, the depth of application is to be limited to less than the soil moisture deficit. During operation of the system the irrigated area will be checked to ensure there is no ponding. If necessary, irrigation is to be deferred to the storage pond.

9.9 Drainage Monitoring

Map

i. Map 1 in the Appendix shows all known tile lines on the property along with their outfalls (and any open inlets);

ii. This is to be updated as the tile network is expanded, or unknown installations are located; and

iii. It is to be updated when paddocks are re-moled.

Monitoring

i. Tile outfalls should be regularly monitored when effluent irrigation is occurring in their vicinity or when it is possible that there may be moles that run to the tiles when ground moisture conditions plus the proposed irrigation volumes are approaching field capacity; and

ii. If there is any discolouration of drainage water irrigation should stop immediately.

9.10 Solids Removal

Timing

i. De-sludging the sludge beds or storage pond is best done when there are paddocks to be cultivated or lea awaiting cultivation; and

ii. Emptying will only be done when ground conditions are suitable.

Discharge of solids

Solids can either be spread at a depth of less than 10 mm on short pasture or on crop ground where they can be worked in.

9.11 Off Season Water Diversion

All the sources of effluent are fitted with "not in use" clean water/rainwater diversion systems. These are separate from the roof water systems. The areas from which the rainwater is to be diverted should be well washed with clean water and inspected for any effluent residues prior to the diversion being enacted. The location of these diversion points is on the dairy shed plan in the shed office.

10. Effluent system: Monitoring, Maintenance and Operating Procedures

10.1 Daily

i. Minimise water use at the cow shed;

ii. Check the storage and irrigation system for operating faults during and following use;

iii. Evaluate the soil moisture situation and calculate the optimum settings for the next effluent application;

iv. Check any tile outfalls draining from the irrigation area after effluent irrigation;

v. Check any down-slope streams close to irrigation area after effluent irrigation;

vi. Update the effluent irrigation log with settings, location, depth and method of application;

vii. Check lane/track edge cut-outs to ensure they are not blocked and there is no risk of large single point discharges (especially after heavy rainfall events); and

viii. Check the trough in the paddock the cows are leaving to ensure it has not been leaking due to animal activity.

10.2 Weekly

Storage Facilities

i. Check inlet and outlet pipes are clear of blockages;

ii. Check and clean grates and sumps in dairy shed and yard as required; and

iii. Check galleries/floor drainage around storage structures.

Effluent Pump, Motor and Controls

i. Check pump and motor, grease if required;

ii. Check mechanical switch gear is operating efficiently;

iii. Note and follow up any unusual noises when the pump is operating;

iv. Check anti siphon devices for blockages; and

v. Note operating pressure during irrigation and confirm it is in the 'normal' range.

Pipelines

i. Check for leaks and blockages in pipes and joiners; and

ii. Check for hydrant leaks.

Safety

i. Check guards and fittings;

ii. Signage; and

iii. Equipment.

10.3 Annual Maintenance

i. Check pumps and motors and have them serviced by a qualified technician;

ii. Service Larall system as required;

iii. Assess condition of pipeline, repair and replace parts as necessary;

iv. Update irrigation maps for new fences, tiling, moling etc;

v. Training of new staff in system operation; and

vi. Refresher and training of all staff on the property in the, purpose and use of safety equipment and fittings.

10.4 End of Season

i. Ensure the storage pond is pumped down as far as is practical;

ii. Turn on rainwater diversion for dairy shed;

iii. Drain pumps and/or set frost lamps;

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

v. Check the lining of the pond is still intact i.e. not damaged.

10.5 Beginning of Season

i. Turn off rainwater diversion; and

ii. Prime pumps and check their operation.

10.6 Breakdowns

i. 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; and
- Complete repairs or install the back-up pump before the next milking, depending on the storage available. Where necessary arrange for a backup petrol, diesel or PTO driven pump.

ii. In the event of pipe blockages:

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

10.7 General:

i. Under no circumstances are storage facilities to be allowed to overflow;

ii. There shall be no ponding of effluent in the discharge area;

iii. Make full use of the discharge area;

iv. There shall be no discharge of effluent to frozen or snow-covered ground;

v. The discharge will be managed to ensure aerosols, spray drift and odour do not travel past the property boundary; and

vi. The general state of the property is to be monitored, particularly areas where environmental contamination with effluent could be a problem. This includes races, silage storage and feeding areas. Preventative action should be taken before problems arise.

11 Other Management

11.1 Lanes and Races

Run-off from races can in some situations constitute an illegal discharge to land. These can be mitigated by:

i. Ensuring that lanes and races are not used as feed pads, cow yards, or herd holding areas;

ii. Ensuring that riparian buffers and vegetation are adequate to filter runoff;

iii. Checking after heavy rain the lane/track edge cut-outs, to ensure they are not blocked and there is no risk of large single point discharges;

iv. Gateways – to avoid compaction around the gateways and reduce lane edge wear, where possible bring the cows out of the paddock at a different gate to which they were let in; and

v. Ensure that swales away from culverts are kept clear, and discharge is directed away from the waterway.

Annual maintenance to races can often result in the "run back" shaping over culverts and lane edge discharge divot/cutouts not being restored. All lane edges and culverts should be checked after lane maintenance.

11.2 Silage pads

Two silage pads are located on dry sites. There is no water accumulation into either pad from surface or groundwater sources. There is no seepage to any underlying groundwater

Rain falling on the plastic cover of the stacks is shed to the sides and away from the pads, without mixing with silage. The silage is cereal silage and has been wilted such that there is no leachate running from it.

If in use, the stack is opened as required in February/March, late April/May and Aug/Sept. When not in use the entire stack is covered. When open, a tight face is always maintained at the front of the stack minimising exposure of silage to air and rainwater. This minimises the generation of leachate when the face of the stack is open. Any leachate that is generated occasionally is contained within both silage pads and does not drain outside either facility.

The pad areas are also used to store baleage as required.

Due to distance (300 metres and 200 metres respectively), maintenance of pasture cover in paddocks, pad design and management of the silage stack, silage leachate does not reach any surface waterway.

11.4 Cut and Carry

Surplus grass is harvested and is stored as baleage and/or silage. Grass harvesting is carried out according to best practice management. Health and safety protocols are adhered to when operating machinery.

11.4 Animal Pests

i. Rabbits, hares, possums – regular culls using night shooting, poisoning etc.

ii. Magpies – trap, shoot etc.

11.5 Contingency water supply

Water is supplied to the farm for stock drinking water and dairy shed use from the Glenkenich Rural Water Scheme. Water is pumped from the Scheme to five storage tanks located at a high point on the farm. From there water gravity flows to the stock drinking water scheme and to two water storage tanks at the dairy shed.

Contingencies are in place to supply water to the farm if the Glenkenich Scheme shuts down temporarily. If the Scheme shuts down, supply from the hill top storage tanks to the dairy shed is shut down and water in the hill top tanks is used for stock drinking water only. If necessary, stock drinking water is supplemented by a surfacewater take from a stream on farm. Water is pumped from the stream to one of the hill top storage tanks, from where it gravity feeds to the stock drinking water system.

When the Glenkenich Scheme shuts down, water use at the dairy shed is minimised; water is only used for plant wash and no yard wash is carried out. At minimal water use, two storage tanks at the dairy shed have enough supply for 5 days. Water is purchased from a potable water supplier and tanked to the farm for dairy shed use as required.

12 Emergency Response

12.1 Storage Overflow

Where effluent storage is approaching full, and rain events plus continued use could risk overflow, it is recommended that low application rate and depth effluent irrigation be carried out on the driest part of the farm available. Spreading the effluent very thinly over a larger area over a period is preferable to a point source discharge from the pond.

12.2 Ponding

Should light ponding be detected effluent irrigation will immediately stop. Checks should be made to ensure that there is no overland flow or that the ponding is not draining into tile lines etc.

12.3 Drainage

Overland Flow

See Ponding Section 12.2.

Discharge Ex-Tile

See Effluent in Open Drains Section 12.3.3

Effluent in streams

i. 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 the front-end loader, depending on drain size;

ii. Alternately earth and silage wrap can often be used to help seal or form the required plug; and

iii. If possible, pump out and disburse with the vacuum tanker.

12.4 General Procedures

i. Follow consent conditions/notes, mitigate where possible;

ii. Advise Regional Council where the consent requires this;

iii. Seek help; and

iv. Advise authorities.

12.5 Emergency Contacts

Manager – Ben Jarvis – 027 7770919

Environment Southland – 0800 768 845 or 03 2115115

Dairy Green Limited – 03 215 4381

13 Review

Review whole effluent management plan and update by 1 June each year – and complete the version control below.

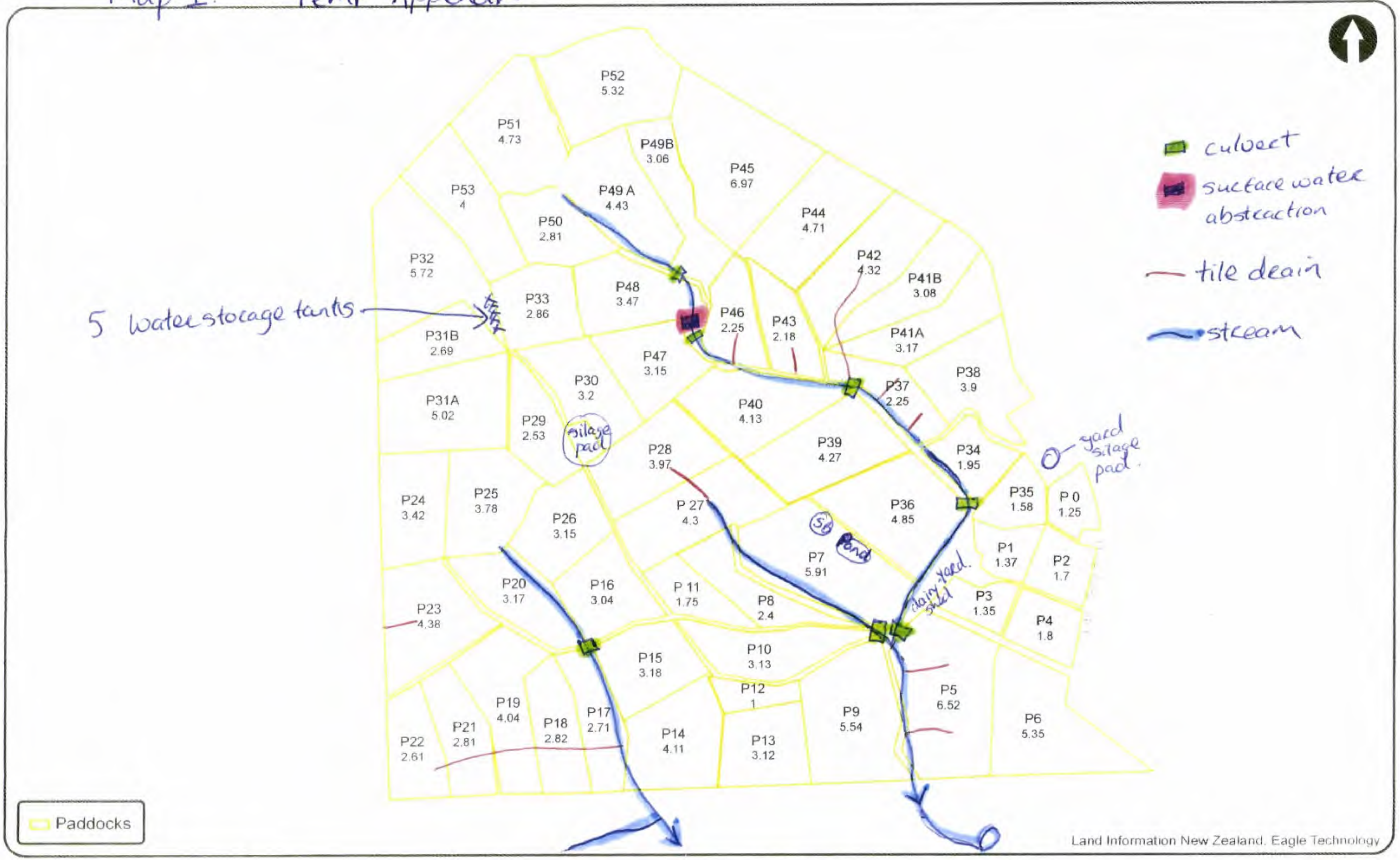
i. Development targets for coming season/plan.
ii. Nutrient Management
   - Overseer Inputs
   - New Overseer report if applicable
iii. Good Management Practices
iv. Cultivation Areas
v. Intensive Winter Grazing
vi. Effluent System
   - High risk effluent irrigation areas due to new tiling etc.;
   - Any developments in infrastructure – i.e. new/more irrigators, extensions to effluent system, fencing changes;
   - Training/retraining, etc.
vii. Emergency Contacts

Version	Date	Reviewed	Distribution List
1.1	15 Nov 2018	Nessa Legg, Dairy Green Limited	Grant Taylor, Luke Taylor
1.2			
1.3			
2.			
3.			

South Pro Maitland Limited

FEMP – Appendix

Map 1. - FEMP Appendix



My Ravensdown Smart Maps
www.myravensdown.co.nz
Note: Areas are in hectares

SOUTH PRO MAITLAND

0 70 140 280 420 560 Metres

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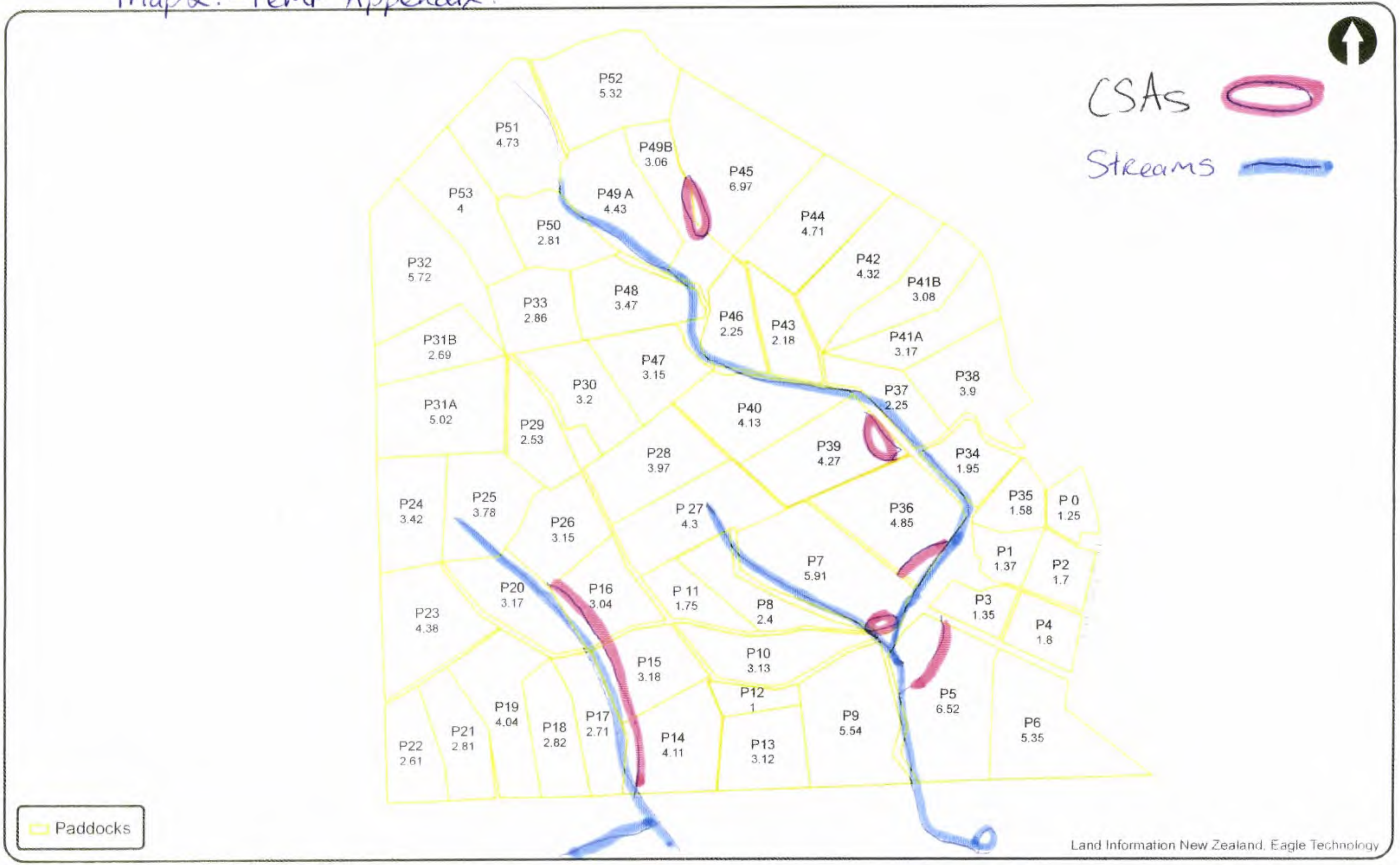
Map 2. - FEMP Appendix.



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Note: Areas are in hectares
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SOUTH PRO MAITLAND

0 70 140 280 420 560 Metres

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South Pro Maitland Limited

Nutrient budget input – production (kgMS)

Party Number: 16473
Supply Number: 33430
Farm Name: Maitland
CSN: 310024775

7 June 2018

Measures for Supply 33430

South Pro Maitland Limited

Supply Measures for the 2018/2019 Season

The supply measures have been calculated from the following production:

Season	Type	kgMS	kgMS
2015/2016	Actual production	201,111	
2016/2017	Actual production	234,862	
2017/2018	Actual production	239,891	
Three Season Average		**675,864**	÷ 3 = **225,288**
2018/2019	Contract supply		- 69,682
			155,606

2018/2019 Season	Measures
Minimum Holding	**155,606**
Maximum Holding	**311,212**

Fonterra Co-operative Group

Party Number: 16473
Supply Number: 33430
Farm Name: Maitland
CSN: 310024775

7 June 2017

Measures for Supply 33430

South Pro Maitland Limited

Supply Measures for the 2017/2018 Season

The supply measures have been calculated from the following production:

Season	Type	kgMS	kgMS
2014/2015	Actual production	197,158	
2015/2016	Actual production	201,111	
2016/2017	Actual production	234,862	
Three Season Average		**633,131**	÷ 3 = **211,043**
2017/2018	Contract supply		- 139,362
			71,681

2017/2018 Season	Measures
Minimum Holding	**71,681**
Maximum Holding	**143,362**

6 June 2013

Measures for Supply 33430 Maitland

Party Number: 16473
CSN: 310024775

Maitland Dairy Ltd

Supply Measures for the 2013/2014 Season

The supply measures have been calculated from the following production:

Season	Type	kgMS	kgMS
2010/2011	Actual production	209,185	
2011/2012	Actual production	186,729	
2012/2013	Actual production	214,705	
Three Season Average		610,619	÷ 3 = 203,539

2013/2014 Season	Measures
Minimum Holding	**203,539**
Maximum Holding	**407,078**

Party Number:	16473
Supply Number:	33430
Farm Name:	Maitland
CSN:	310024775

5 June 2015

Measures for Supply 33430

South Pro Maitland Limited

Supply Measures for the 2015/2016 Season

The supply measures have been calculated from the following production:

Season	Type	kgMS	kgMS
2012/2013	Actual production	214,705	
2013/2014	Actual production	230,954	
2014/2015	Actual production	197,158	
Three Season Average		**642,817**	÷ 3 = **214,272**
2015/2016	Contract supply		- 212,272
			2,000

2015/2016 Season	Measures
Minimum Holding	**2,000**
Maximum Holding	**4,000**

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2013/14 – 2017/18 Nutrient Budgets and Proposed System

SOUTH PRO MAITLAND LTD

Prepared by Nouman Kyamanywa
Farm Environmental Consultant
CNMA
Certified Nutrient Management Adviser

60862598 - SOUTH PRO MAITLAND LTD

C/- L TAYLOR
188 WAICOLA ROAD
RD 1 OTAUTAU

October 23, 2018
Reviewed by Andrée Callaghan (Certified NMA)

optimiser
Environmental analysis and planning

Executive Summary

Grant Taylor, has requested a nutrient budget to reflect the nutrient loss of the 205.7ha dairy farm located at 131 Garden Gully Road, Gore. This nutrient budget is to support an application for a resource consent to farm.

The Proposed Southland Water and Land Plan requires an assessment to show that the annual amount of nitrogen and phosphorus discharged from the property does not exceed that which was discharged annually on average for the five years prior to the application being made. This report details losses estimated by OVERSEER ® over the five year period (2013/14 to 2017/18) in comparison to the proposed activity.

- The modelled N loss for the proposed system was calculated to be **9,979 kg N/year** or **49 kg N/ha/year.** The modelled N loss averaged over the prior five year period was **10,007 kg N/year** or **49 kg N/ha/year.**
- The modelled P loss for the proposed system was calculated to be **199 kg P/year** or **1.0 kg P/ha/year.** The modelled P loss averaged over the prior five year period was **175 kg P/year** or **0.9 kg P/ha/yr.**

Contents

Important Points to Note

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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

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Nouman Kyamanywa

Farm Environmental Consultant

Dated: 23 October 2018

General

OVERSEER® modelling of the systems has been undertaken in accordance with the OVERSEER® 6.3.0 "best practice data input standards" and has been reviewed by a certified Nutrient Management Advisor.

Full input detail can be found in the associated OVERSEER® parameter report. OVERSEER® nutrient budgets Version 6.3.0 has been used to create the nutrient budgets presented in this report. The following report summarises the respective OVERSEER® 6.3.0 nutrient budgets and key assumptions made.

Points to Note with the OVERSEER® modelling

1. OVERSEER® modelling of the systems has been undertaken in accordance with the OVERSEER® 6.3.0 "best practice data input standards.
2. Climate data has been sourced from OVERSEER ® climate tool.
3. The nutrient budgets have been prepared using farm data provided by the client.
4. Year End nutrient budgets have been modelled for the previous five years with data provided by the client. Where data is missing or inadequate, averages have been used as indicated in the report.
5. Actual soil test data has been used where it exists otherwise 'Default' has been used
6. Nitrogen fertiliser usage has been sourced from data provided by the client, fertiliser plans and purchase records. Where detail allows has been averaged for respective Overseer blocks; otherwise averaged across the whole farm.

OVERSEER® Version 6.3.0 has been used to create the nutrient budgets presented in this report. OVERSEER is a continually developing model with several aspects currently being investigated. When OVERSEER is stipulated for use associated with Regional Council rules, the farm systems will need to be re-modelled as the N lost from the root zone may alter with updated OVERSEER versions.

Property Details

Table 1: Property details

Location/address	131 Garden Gully Road, Gore
LINZ Title details	OT11A/535
	Fee Simple, 1/1, Lot 1 Deposited Plan 4553 and Section 4-5 Block I Glenkenich Survey District, 2,056,688 m^2
Farmed area, ha	205.7
Owners	Maitland Dairy Limited
Map reference	-45.936118, 169.081458
Contact details – Owner	Grant Taylor
Phone	(07) 8243454 (027) 4929700
Email	gctaylor@glenmarie.nz

Description of Farm System

Table 2: Land and climate details

Land	Overall farmed area, ha	205.7
	Effective area, ha	194.5
	Non-productive area, ha	11.2
Climate	Rainfall, mm/yr	911
	Temp, °C	9.7
	PET, mm	743

Non-productive areas include lanes, raceways and buildings.

Animals wintered off farm on land not owned by the Applicant.

Climate data sourced from the Overseer Climate Station tool using farm location.

Farm System Details

Table 3: Stock details

Season	2013/14	2014/15	2015/16	2016/17	2017/18	Proposed
Median calving date	25/08/2013	25/08/2014	22/08/2015	26/08/2016	25/08/2017	25/08
Median drying off date	25/05/2014	25/05/2015	24/05/2016	20/05/2017	20/05/2018	20/05
Production kgMS	230,954	197,158	201,111	234,862	239,891	260,000
Replacement rate	25%					
Breed	Friesian Jersey cross					
Av weight kg LW	450					
Once a day	During calving and dry off					
Calves fed milk powder	No					

Table 4: Yearly stock numbers

Year	Stock class	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
2013/14	Dairy cows	30	460	595	595	595	595	595	580	565	500	450	30
	Breeding Bulls Fr.600kg						18	18					
2014/15	Dairy cows	30	460	595	590	600	599	595	580	565	500	450	20
	Breeding Bulls Fr.600kg						18	18					
2015/16	Dairy cows	20	460	580	575	565	550	550	540	520	500	450	115
	Breeding Bulls Fr.600kg						18	18					
2016/17	Dairy cows	115	460	555	550	545	545	540	520	520	500	450	115
	Breeding Bulls Fr.600kg					9	18	18					
2017/18	Dairy cows	115	460	565	555	550	550	550	540	525	500	450	115
	Breeding Bulls Fr.600kg					9	18	18					

All replacement heifers leave at 100kg and return with the dry cow mob as in calf heifers.

Table 5: Proposed Monthly stock numbers

Stock class	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Dairy cows	150	500	610	600	600	590	590	590	580	560	450	150
Breeding Bulls						7	14	14				

Supplements imported and made on farm

Table 6: Supplements imported and fed

Supplements	Source*	2013/14	2014/15	2015/16	2016/17	2017/18	Proposed
Pasture silage, t DM	Storage	300	200	210	128	128	70
	Imported		100	150	114		80
Ryegrass Straw, t DM	Storage					20	
	Imported				34		80
PKE, t DM	Imported		72	84	60	135	130
Barley grain, t DM	Imported		48	56	60	174	170

*From storage includes feed eaten that was carried forward from previous season, whether purchased or made on farm.

Table 7: Supplements made on farm

Supplements	2013/14	2014/15	2015/16	2016/17	2017/18	Proposed
Pasture silage, t DM		300	69	49	69	70

Supplements were harvested mainly off the effluent blocks. Modelling of this has been kept consistent for all seasons. Supplements harvested off the farm have been modelled as stored, and then fed from storage in Table 6.

Table 8: Feeding management in milking shed

2014/15, 15/16, 16/17, 17/18 and Proposed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
% of cows	100	100	100	50				20	60	100	100	100

No milking shed feeding modelled for 2013/14 as the grain feeding system was not installed then.

Table 9: Feeding silage and Hay on crop paddocks, % of supplement

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
2013/14	3	33	37								24	3
2014/15	3	34	38								23	2
2015/16	1	41	41								12	5
2016/17	8	26	32								26	8
2017/18	15	28	24								19	14
Proposed	18	33	18								18	13

Pasture silage and Hay is normally fed out on crop, this has been kept consistent for all seasons. Percentage of silage and hay has been adjusted to allow for 24 hour feeding of cows in crop paddocks in June and July.

Table 10: Average pasture production t DM/ha/year as estimated by OVERSEER ®

Blocks	2013/14	2014/15	2015/16	2016/17	2017/18	Proposed
Effluent	16.1	15.5	13.8	15.6	15.2	16.4
Non - effluent	15.3	14.7	13.1	14.8	14.5	15.5

Cropping on farm

Table 11: Cropping details

Season	2013/14	2014/15	2015/16	2016/17	2017/18	Proposed
Crop	Fodder beet	Fodder beet	Fodder beet	Fodder beet	Fodder beet	Fodder beet
Effective Area, ha	6.0	6.0	13	16	13.5	11.0
Month sown	December	November	November	October	October	November
Yield, TDM/ha	20.0	20.0	25	18	20	25
Cultivation method	Full cultivation	Full cultivation	Full cultivation	Full cultivation	Full cultivation	Full cultivation
Months grazed/harvested	May – Sep	May – Sep	May – Sep	May – Sep	May – Sep	May – Sep
Month: hrs/day	May, Sept: 2 Jun - Aug:24	May, Sept: 2 Jun - Aug:24	May, Sept: 2 Jun - Aug:24	May, Sept: 2 Jun - Aug:24	May, Sept: 2 Jun - Aug:24	May, Sept: 2 Jun - Aug:24
Next crop	Pasture (October)	Pasture (October)	Pasture (October)	Pasture (October)	Pasture (October)	Pasture (October)

Cows are modelled to graze fodder beet for 2 hours in May and September and 24 hours when dry from June to August. Crops are mainly sown on the non-effluent Claremont and Waikiwi flats and rolling blocks. Due to absence of cropped locations, this has been maintained for all seasons with areas distributed proportionally to soil type, that is, 58% of the cropped area to Claremont and 42% to Waikiwi soils. Block history is 10 years in pasture as fodder beet is sown as part of a pasture renewal programme rotating through approximately 143.1ha. Cropping details of 2012/13 season were assumed to be similar to 2013/14.

The proposed scenario is modelled with 11ha of crop grown every year.

Fertiliser on pasture

Table 12: Fertiliser applications on pasture as modelled in OVERSEER®, kg product/ha

Season	Block	Product	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
2013/14	All blocks	Ammo 31		120										
		Urea			66		66	66		66		69		
		10%, 15% Pot super, Super, kcl				440								
2014/15	All blocks	Ammo 36		120										
		Urea			62	66		66	66	66	66		64	
		Superphosphate				233								
2015/16	Effluent	Urea					62	62	62	62	62	62		
		DAP 13S				411								
	Non Effluent	Urea		48		48	80	80	80	80	80	80		
		DAP 13S				411								
2016/17	All blocks	Ammo 31		100										
		Urea					70	140	70	70	140	70		
		Superphosphate								148				
		Ammo 31+Sel+Crop 20				166								
2017/18	All blocks	Ammo 36			100									
		Urea				169	138	166	91	88	91	91		
		Super+Sel								133				
Proposed	Effluent	Ammo 36		100										
		Urea			70	60	60	55	55	55	55	60		
		Superphosphate								250				
	Non Effluent	Ammo 36		120										
		Urea			80	70	60	60	60	60	70	70		
		15% potash super								300				

Table 13: Fertiliser as modelled on Fodder Beet crop

Season	Month	Product	Amount	N kg/ha	P kg/ha	K kg/ha	S kg/ha
2013/14	December	Cropmaster 15	275	41	28	28	21
2014/15	November	Custom mix		51	37	69	24
	February	Custom mix	380	84	0	33	0
2015/16	November	Custom mix	560	43	29	67	22
	February	Urea	180	83	0	0	0
		Potassium chloride	100	0	0	50	0
2016/17	October	Custom mix		46	40	69	35
	February	Urea	150	69	0	0	0
		Potassium chloride	100	0	0	50	0
	January (New grass)	10% Pot Super + Urea + Sel		43	34	21	41
2017/18	October	Cropmaster DAP	100	18	20	0	1
		Custom mix	400	36	24	54	18
	January	Urea	150	69	0	0	0
Proposed	November	Cropmaster DAP	100	18	20	0	1
		Custom mix	400	36	24	54	18
	January	Urea	150	69	0	0	0
	October (New grass)	15% potash super	440	0	34	33	41

Table 14: NPKS (kg/ha/yr) whole farm Nutrient Summary

Season	N	P	K	S
2013/14	174	21	17	41
2014/15	233	20	3	34
2015/16	265	54	8	46
2016/17	278	29	11	46
2017/18	371	13	22	23
Proposed system	246	25	16	38

Effluent management

Table 15: Effluent management details

Storage type	Effluent pond (90+ days)
System	K-line pods
Application area, ha	30.6 ha
Liquid application depth, mm	Low rate application (<2mm)
Months liquid applied	August – May
Solids separated	Yes, weeping wall
Time in storage	24 months
Pond emptied	Yearly
Separated solids and pond sludge, months applied	February
Separated solids and pond sludge applied on	Non-effluent blocks
Average Liquid application rate over 5 seasons (2013/14 – 2017/18) kg N/ha/year	81

Effluent management has been modelled the same for all previous five seasons.

Table 16: Effluent management details for proposed scenario

Application area, ha	68.4 ha
Liquid application rate, kg N/ha/year	36

Effluent area is proposed to be increased as a mitigation.

Soil Tests

Actual soil test values from 2013-18 season have been averaged over the effluent and non-effluent areas. Optimum values are proposed for the proposed activity with Olsen P adjusted for high producing farms.

Table 17: Soil tests as modelled

Season	Block	Olsen P	QTK	QT Ca	QT Mg	QT Na	Org S
2013/14, 2014/15, 2015/16.	Effluent	38	16	11	25	6	9
	Non-Effluent	27	9	11	19	5	8
2016/17, 2017/18	Effluent	33	12	10	21	6	9
	Non-Effluent	25	9	10	18	5	9
Proposed	Effluent	40	10	9	21	8	9
	Non-Effluent	35	7	9	21	8	9
	Easy hill	25	7	9	21	8	9

Overseer blocking

Table 18: Overseer blockings with soils and topography (less cropped areas)

Block name	Area, ha	Proposed Area, ha	Effluent Areas	Mole tiled % of block	Relative pasture productivity
EFF Clar_34a.1 Flat	20.3	49.3	Liquid	40%	1.0
EFF Clar_34a.1 Rolling	1.6	6.6	Liquid		1.0
EFF Eure_22a.1 Flat	4.8	7.0	Liquid		1.0
EFF Waiki_29a.1 Flat	2.8	4.1	Liquid		1.0
EFF Waiki_29a.1 Rolling	1.1	1.4	Liquid		1.0
Non EFF Beni_5a.6 Flat	3.9	3.7	Solids/Sludge		0.95
Non EFF Beni_5a.6 Rolling	8.3	8.6	Solids/Sludge		0.95
Non EFF Clar_34a.1 Easy	1.3	1.1	Solids/Sludge		0.8
Non EFF Clar_34a.1 Flat	67.3	37.3	Solids/Sludge	18%	0.95
Non EFF Clar_34a.1 Rolling	16.4	12.0	Solids/Sludge		0.95
Non EFF Eure_22a.1 Flat	7.3	5.1	Solids/Sludge	50%	0.95
Non EFF Waiki_29a.1 Flat	38.4	37.1	Solids/Sludge		0.95
Non EFF Waiki_29a.1 Rolling	21.0	21.1	Solids/Sludge		0.95
Fodder Beet	-				
Non-productive	11.2	11.2			
Total, ha	**205.7**	**205.7**	**Previous: 30.6** **Proposed: 68.4**		

Fodder beet areas have been adjusted for each season as described in Table 10 and page 9. Relative productivity is an estimate of the differences in pasture productivity (amount of pasture growth) between blocks. Livestock type influences the distribution of animal intake and excreta deposition and hence nutrient cycling and transfers between blocks, which together with other factors, will affect N leaching losses between the blocks.

Soil summary

Table 19: Soil descriptions

Soil type	Area, ha	S-Map family name	Texture	Drainage	PAW (0-60cm)	N leaching vulnerability	Physiographic zones
Beni_5a.6	12.9	Benio	Clay	Mod- Well	Moderate (72 mm)	High	Oxidising – No Variant
Clar_34a.1	111.2	Claremont	Silty Loam	Poor	High (94 mm)	Medium	Gleyed
Eure_22a.1	15.6	Eureka	Silty Loam	Poor	Very high (163 mm)	Very Low	Gleyed - No Variant
Waiki_29a.1	65.9	Waikiwi	Silty Loam	Mod- Well	High (95 mm)	Medium	Oxidising – No Variant
	205.7						

Soils are based off S-Map data (https://smap.landcareresearch.co.nz/app/?m=NDUyZDkxOGZ), see soil maps in Appendices.

Summary of Whole Farm Nutrient Loss Indicators

Table 20: Whole farm Nitrogen and phosphorus losses

Whole Farm Nutrient loss	2013/14	2014/15	2015/16	2016/17	2017/18	Averaged Output	Proposed
Nitrogen leaching (Total kg N/year)	7,841	9,348	8,873	11,504	12,470	10,007	9,979
Nitrogen leaching (kg N/ha/year)	38	45	43	56	61	49	49
Phosphorus loss (Total kg P/year)	170	171	187	183	165	175	199
Phosphorus loss (kg P/ha/year)	0.8	0.8	0.9	0.9	0.8	0.9	1.0

The proposed system in comparison to previous five seasons;

- Increased peak cow numbers
- Increased production
- Increased liquid effluent application area
- Managed nitrogen fertiliser application rates and timing
- Maintained supplements imported
- Decreased crop area from previous 3 seasons.

Table 21: Nitrogen and phosphorus losses on the Oxidising Physiographic Zones

Benio and Waikiwi Soils	2013/14	2014/15	2015/16	2016/17	2017/18	Averaged Output	Proposed
Nitrogen leaching (Total kg N/year)	2,992	3,809	3,483	4,637	4,858	3,956	4,001
Nitrogen leaching (kg N/ha/year)	39.3	50.1	45.8	60.9	63.8	52.0	52.6
Phosphorus loss (Total kg P/year)	17	17	27	34	21	23	24
Phosphorus loss (kg P/ha/year)	0.2	0.2	0.4	0.4	0.3	0.3	0.3

The Oxidising land contains Benio and Waikiwi blocks in Overseer, modelled with an effective area of 78.8 ha.

Discussion of mitigations and key factors influencing nutrient loss

It should be noted that a combination of various factors affect nutrient loss as modelled by OVERSEER ®. However, key factors are included below.

- Fertiliser applications and timings

  Applications of fertiliser nitrogen has been proportioned for the effluent and non-effluent area in the proposed system as compared to previous seasons. The effluent area is proposed to receive approximately 35kgN/ha less than the non-effluent block. Applications of nitrogen in high risk months May, June and July are also not being practiced for the proposed system. Fertiliser N application rates in the previous seasons have been steadily increasing with very high rates applied in the 2017/18 season of up to 371 kgN/ha/year on a whole farm basis. This has been reduced to 246 kgN/ha in the proposed system.

- Increased effluent area for liquid application

  The effluent area is proposed to be increased to 68.4ha in the proposed scenario. This will decrease nitrogen loading from liquid effluent from 81 kgN/ha/year to 36 kgN/ha/year.

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

  Plant Available Water (PAW) is the amount of water potentially available for plant growth that can be stored in the soil to specific soil depths. Nitrate leaching vulnerability of the soils among other properties will be influenced by the soils PAW and the likelihood of denitrification due to drainage characteristics. Lower PAW soils will typically have greater drainage and leaching losses than soils with higher PAW. The majority of the farm is comprised of Claremont and Waikiwi soils which both have high PAWs and poor drainage. The susceptibility to N loss is rated as medium for both these soils. The Eureka soils with a much higher PAW have a very low vulnerability to N loss, and under similar management to the Benio soils (non-effluent), the N loss is only 31 kgN/ha/year compared to 67 kg N/ha/year for the Benio soil in the proposed system.

- Crop cultivation and winter grazing

  Cultivation events increase the mineralisation of carbon and loss of soil organic matter due to the breakdown of soil aggregates, changes in soil temperature and moisture content. Mineralised nitrogen not taken up by plants is susceptible to leaching losses. Winter grazing of crop increases the risks of nitrogen leaching through the increased soil drainage due to the fallow periods post grazing and the cool temperatures that limit uptake of nitrogen by growing plants. The stocking rate and standing animals on bare ground through winter and the feeding of supplements will exacerbate nutrient loss from runoff and leaching. Nitrogen lost from cropping blocks was significantly higher in all seasons when compared with pasture. For the proposed farming system, N loss on the crop blocks averages 61 kgN/ha/year compared to 48 kg N/ha/year on pasture. Cropped area has been reduced from the previous three seasons so as to efficiently utilise the crop grown. Crop grown in previous seasons was in excess and resulted in significant wastage. Although stock numbers have been increased, nutrient loss in the proposed crop blocks remains lower than the previous three seasons. Pasture is modelled as sown the month after grazing, without any fallow period, N loss is therefore minimised as new pasture utilises the nitrogen in the soil.

- Phosphorous

  The risk of P loss from fertiliser ranges from low to medium, in regard to fertiliser and effluent applications, with high losses on soils with steeper topography. Topography, soil characteristics such as Olsen P, phosphate retention and timing and application rate of fertilisers will also affect the magnitude of P loss as modelled by OVERSEER®. OVERSEER® estimates an annual loss of 1.0 kg P/ha which is the equivalent of 199 kg P/year on the proposed farming system. It should however be emphasised that OVERSEER® assumes good management practice and does not take into account scenarios that might occur on farm, such as sediment loss from slips or pasture and soil damage due to pugging. Mitigation of P loss is proposed to be done by planting along farm drains.

Appendices

Whole Farm Nutrient Budget

Version 6.3.0. on 2018-09-25 12:54:23

C/- L TAYLOR

Nouman Kyamanywa
Mahinui Street
Ravensdown Feilding

Client reference: 60862598
Farm name: SOUTH PRO MAITLAND LTD-PROPOSED - V2 (Proposed)

Farm Nutrient Budget - Whole farm

	N	P	K	S	Ca	Mg	Na
				(kg/ha/yr)			
Nutrients added							
Fertiliser, lime & other	246	25	16	38	46	0	0
Rain/clover N fixation	36	0	1	2	1	2	5
Irrigation	0	0	0	0	0	0	0
Supplements imported	41	8	22	5	4	4	2
Nutrients removed							
As products	86	14	21	5	18	2	6
Exported effluent	0	0	0	0	0	0	0
As supplements	1	0	1	0	0	0	0
To atmospheric	79	0	0	0	0	0	0
To water	49	1	13	55	59	3	12
Change in internal pools							
Plant material	-14	-3	-23	-4	-15	-3	-11
Organic pool	118	11	3	-10	1	1	0
Inorganic mineral	0	2	-20	0	-4	-6	-7
Inorganic soil pool	4	6	44	0	-7	9	7

Version 6.3.0. on 2018-09-25 12:54:21

C/- L TAYLOR

Nouman Kyamanywa
Mahinui Street
Ravensdown Feilding

Client reference: 60862598
Farm name: SOUTH PRO MAITLAND LTD-2017/18 (2017/18)

Farm Nutrient Budget - Whole farm

	N	P	K	S	Ca	Mg	Na
				(kg/ha/yr)			
Nutrients added							
Fertiliser, lime & other	371	13	22	23	0	0	0
Rain/clover N fixation	6	0	1	2	1	2	5
Irrigation	0	0	0	0	0	0	0
Supplements imported	33	7	13	4	1	3	1
Nutrients removed							
As products	79	13	19	4	17	2	5
Exported effluent	0	0	0	0	0	0	0
As supplements	0	0	0	0	0	0	0
To atmospheric	89	0	0	0	0	0	0
To water	51	0.8	15	41	77	5	16
Change in internal pools							
Plant material	-18	-4	-26	-5	-17	-3	-12
Organic pool	194	9	2	-11	0	0	0
Inorganic mineral	0	1	-19	0	-4	-6	-7
Inorganic soil pool	4	0	45	0	-71	7	4

Version 6.3.0. on 2018-09-25 12:54:19

C/- L TAYLOR

Nouman Kyamanywa
Mahinui Street
Ravensdown Feilding

Client reference: 60862598
Farm name: SOUTH PRO MAITLAND LTD-2016/17 (2016/17)

Farm Nutrient Budget - Whole farm

	N	P	K	S	Ca	Mg	Na
				(kg/ha/yr)			
Nutrients added							
Fertiliser, lime & other	278	29	11	46	24	0	0
Rain/clover N fixation	20	0	1	2	1	2	5
Irrigation	0	0	0	0	0	0	0
Supplements imported	27	5	17	3	4	2	1
Nutrients removed							
As products	77	13	19	4	17	2	5
Exported effluent	0	0	0	0	0	0	0
As supplements	0	0	0	0	0	0	0
To atmospheric	81	0	0	0	0	0	0
To water	56	0.9	14	65	74	5	16
Change in internal pools							
Plant material	-30	-5	-38	-6	-20	-4	-14
Organic pool	126	8	3	-11	1	0	0
Inorganic mineral	0	1	-25	0	-4	-6	-7
Inorganic soil pool	16	15	56	0	-38	7	6

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C/- L TAYLOR

Nouman Kyamanywa
Mahinui Street
Ravensdown Feilding

Client reference: 60862598
Farm name: SOUTH PRO MAITLAND LTD-2015/16 (2015/16)

Farm Nutrient Budget - Whole farm

	N	P	K	S	Ca	Mg	Na
				(kg/ha/yr)			
Nutrients added							
Fertiliser, lime & other	265	54	8	46	22	0	0
Rain/clover N fixation	18	0	1	2	1	2	5
Irrigation	0	0	0	0	0	0	0
Supplements imported	30	5	19	4	4	3	1
Nutrients removed							
As products	66	11	16	4	14	1	5
Exported effluent	0	0	0	0	0	0	0
As supplements	0	0	0	0	0	0	0
To atmospheric	72	0	0	0	0	0	0
To water	43	0.9	15	61	71	5	15
Change in internal pools							
Plant material	-26	-4	-28	-3	-10	-3	-5
Organic pool	154	10	3	-9	1	0	0
Inorganic mineral	0	2	-20	0	-4	-6	-7
Inorganic soil pool	3	39	42	0	-45	6	-1

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Nouman Kyamanywa
Mahinui Street
Ravensdown Feilding

Client reference: 60862598
Farm name: SOUTH PRO MAITLAND LTD-2014/15 (2014/15)

Farm Nutrient Budget - Whole farm

	N	P	K	S	Ca	Mg	Na
				(kg/ha/yr)			
Nutrients added							
Fertiliser, lime & other	233	20	3	34	41	0	0
Rain/clover N fixation	47	0	1	2	1	2	5
Irrigation	0	0	0	0	0	0	0
Supplements imported	43	7	31	5	7	3	2
Nutrients removed							
As products	65	11	16	4	14	1	5
Exported effluent	0	0	0	0	0	0	0
As supplements	0	0	0	0	0	0	0
To atmospheric	69	0	0	0	0	0	0
To water	45	0.8	15	44	73	5	15
Change in internal pools							
Plant material	31	3	19	1	1	0	-4
Organic pool	108	11	7	-8	2	1	0
Inorganic mineral	0	2	-29	0	-4	-6	-7
Inorganic soil pool	4	-1	7	0	-36	4	-2

Version 6.3.0. on 2018-09-25 12:54:11

C/- L TAYLOR

Nouman Kyamanywa
Mahinui Street
Ravensdown Feilding

Client reference: 60862598
Farm name: SOUTH PRO MAITLAND LTD-2013/14 (2013/14)

Farm Nutrient Budget - Whole farm

	N	P	K	S	Ca	Mg	Na
				(kg/ha/yr)			
Nutrients added							
Fertiliser, lime & other	174	21	17	41	0	0	0
Rain/clover N fixation	83	0	1	2	1	2	5
Irrigation	0	0	0	0	0	0	0
Supplements imported	31	4	26	3	7	2	2
Nutrients removed							
As products	76	13	18	4	16	2	5
Exported effluent	0	0	0	0	0	0	0
As supplements	0	0	0	0	0	0	0
To atmospheric	74	0	0	0	0	0	0
To water	38	0.8	17	52	68	5	15
Change in internal pools							
Plant material	-6	-1	-10	-2	-7	-1	-5
Organic pool	105	11	3	-8	1	0	0
Inorganic mineral	0	2	-22	0	-4	-6	-7
Inorganic soil pool	2	0	37	0	-67	4	-2

N report

Version 6.3.0, on 2018-09-24 04:35:59

C/- L TAYLOR

Nouman Kyamanywa
Mahinui Street
Ravensdown Feilding

Client reference: 60862598
Farm name: SOUTH PRO MAITLAND LTD-PROPOSED - V2 (Proposed)

Block Nitrogen

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)
EFF Clar_34a.1 Flat	2282	46	**15.8**	225	288
EFF Clar_34a.1 Rolling	304	46	**15.8**	224	288
EFF Eure_22a.1 Flat	202	29	**11.7**	216	288
EFF Waiki_29a.1 Flat	188	46	**15.8**	225	288
EFF Waiki_29a.1 Rolling	65	47	**16.1**	229	288
Non EFF Beni_5a.6 Flat	246	66	**21.8**	245	303
Non EFF Beni_5a.6 Rolling	570	66	**22.0**	245	303
Non EFF Clar_34a.1 Easy	47	43	N/A	244	303
Non EFF Clar_34a.1 Flat	1308	48	**16.7**	239	303
Non EFF Clar_34a.1 Rolling	460	48	**16.7**	239	303
Non EFF Eure_22a.1 Flat	156	31	**12.4**	239	303
Non EFF Waiki_29a.1 Flat	1507	48	**16.7**	240	303
Non EFF Waiki_29a.1 Rolling	865	48	**16.7**	240	303
Previous FB Clar_34a.1	528	82	**25.9**	-30	148
Previous FB Waiki_29a.1	384	83	**26.2**	-30	148
Current FB Clar_34a.1	250	39	**12.6**	138	166
Current FB Waiki_29a.1	176	38	**12.4**	137	166
Other farm sources	441				
Whole farm	9979	49			
Less N removed in wetlands	0				
Farm output	9979	49			

Version 6.3.0. on 2018-09-24 04:31:12

C/- L TAYLOR

Nouman Kyamanywa
Mahinui Street
Ravensdown Feilding

Client reference: 60862598
Farm name: SOUTH PRO MAITLAND LTD-2017/18 (2017/18)

Block Nitrogen

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)
EFF Clar_34a.1 Flat	1263	62	**21.2**	358	495
EFF Clar_34a.1 Rolling	98	61	**20.8**	353	495
EFF Eure_22a.1 Flat	179	37	**15.0**	358	495
EFF Waiki_29a.1 Flat	173	62	**21.2**	361	495
EFF Waiki_29a.1 Rolling	69	63	**21.7**	369	495
Non EFF Beni_5a.6 Flat	272	70	**22.9**	351	431
Non EFF Beni_5a.6 Rolling	577	69	**23.1**	351	431
Non EFF Clar_34a.1 Easy	66	51	N/A	366	431
Non EFF Clar_34a.1 Flat	3033	57	**19.6**	351	431
Non EFF Clar_34a.1 Rolling	739	57	**19.6**	351	431
Non EFF Eure_22a.1 Flat	242	33	**13.4**	351	431
Non EFF Waiki_29a.1 Flat	1724	57	**19.5**	351	431
Non EFF Waiki_29a.1 Rolling	944	57	**19.5**	351	431
16/17 Clar_34a.1	1031	110	**34.5**	157	305
16/17 Waiki_29a.1	724	110	**34.4**	158	305
17/18 Clar_34a.1	522	66	**20.6**	135	159
17/18 Waiki_29a.1	375	67	**21.0**	134	159
Other farm sources	438				
Whole farm	12470	61			
Less N removed in wetlands	0				
Farm output	12470	61			

ravensdown

Version 6.3.0, on 2018-09-24 04:31:10

C/- L TAYLOR

Nouman Kyamanywa
Mahinui Street
Ravensdown Feilding

Client reference: 60862598
Farm name: SOUTH PRO MAITLAND LTD-2016/17 (2016/17)

Block Nitrogen

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)
EFF Clar_34a.1 Flat	1168	58	**19.5**	289	394
EFF Clar_34a.1 Rolling	90	56	**19.2**	284	394
EFF Eure_22a.1 Flat	168	35	**14.2**	288	394
EFF Waiki_29a.1 Flat	156	56	**19.2**	286	394
EFF Waiki_29a.1 Rolling	61	56	**19.1**	286	394
Non EFF Beni_5a.6 Flat	261	67	**21.9**	264	329
Non EFF Beni_5a.6 Rolling	553	67	**22.1**	264	329
Non EFF Clar_34a.1 Easy	58	45	N/A	269	329
Non EFF Clar_34a.1 Flat	2744	51	**17.6**	264	329
Non EFF Clar_34a.1 Rolling	670	51	**17.6**	264	329
Non EFF Eure_22a.1 Flat	231	32	**12.8**	264	329
Non EFF Waiki_29a.1 Flat	1546	51	**17.4**	264	329
Non EFF Waiki_29a.1 Rolling	1113	67	**22.1**	264	329
15/16 Clar_34a.1	676	89	**28.0**	1	171
15/16 Waiki_29a.1	481	89	**27.9**	1	171
16/17 Clar_34a.1	655	70	**21.7**	139	146
16/17 Waiki_29a.1	466	71	**22.2**	138	146
Other farm sources	406				
Whole farm	11504	56			
Less N removed in wetlands	0				
Farm output	11504	56			

Version 6.3.0, on 2018-09-24 04:31:08

C/- L TAYLOR

Client reference: 60862598
Farm name: SOUTH PRO MAITLAND LTD-2015/16 (2015/16)

Nouman Kyamanywa
Mahinui Street
Ravensdown Feilding

Block Nitrogen

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)
EFF Clar_34a.1 Flat	791	39	**13.2**	209	285
EFF Clar_34a.1 Rolling	61	38	**12.9**	205	285
EFF Eure_22a.1 Flat	113	24	9.5	204	285
EFF Waiki_29a.1 Flat	107	38	**13.2**	210	285
EFF Waiki_29a.1 Rolling	43	39	**13.5**	215	285
Non EFF Beni_5a.6 Flat	214	55	**18.0**	272	318
Non EFF Beni_5a.6 Rolling	454	55	**18.2**	272	318
Non EFF Clar_34a.1 Easy	52	40	N/A	277	318
Non EFF Clar_34a.1 Flat	2577	44	**15.2**	271	318
Non EFF Clar_34a.1 Rolling	627	44	**15.2**	271	318
Non EFF Eure_22a.1 Flat	197	27	10.9	271	318
Non EFF Waiki_29a.1 Flat	1457	44	**15.1**	272	318
Non EFF Waiki_29a.1 Rolling	796	44	**15.1**	272	318
14/15 Clar_34a.1	315	90	**28.3**	73	210
14/15 Waiki_29a.1	226	90	**28.3**	73	210
15/16 Clar_34a.1	268	35	11.3	146	148
15/16 Waiki_29a.1	186	34	11.2	146	148
Other farm sources	389				
Whole farm	8873	43			
Less N removed in wetlands	0				
Farm output	8873	43			

Version 6.3.0, on 2018-09-24 04:31:06

C/- L TAYLOR

Nouman Kyamanywa
Mahinui Street
Ravensdown Feilding

Client reference: 60862598
Farm name: SOUTH PRO MAITLAND LTD-2014/15 (2014/15)

Block Nitrogen

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)
EFF Clar_34a.1 Flat	560	28	9.2	123	324
EFF Clar_34a.1 Rolling	43	27	9.0	120	324
EFF Eure_22a.1 Flat	84	17	7.0	119	324
EFF Waiki_29a.1 Flat	76	27	9.4	126	324
EFF Waiki_29a.1 Rolling	29	26	9.0	121	324
Non EFF Beni_5a.6 Flat	253	65	**21.2**	232	262
Non EFF Beni_5a.6 Rolling	536	65	**21.4**	232	262
Non EFF Clar_34a.1 Easy	56	43	N/A	216	262
Non EFF Clar_34a.1 Flat	2988	48	**16.7**	222	262
Non EFF Clar_34a.1 Rolling	727	48	**16.7**	222	262
Non EFF Eure_22a.1 Flat	224	31	**12.4**	213	262
Non EFF Waiki_29a.1 Flat	1700	48	**16.7**	222	262
Non EFF Waiki_29a.1 Rolling	927	48	**16.7**	222	262
13/14 Clar_34a.1	278	79	**24.9**	-7	149
13/14 Waiki_29a.1	202	81	**25.4**	-7	149
14/15 Clar_34a.1	119	34	11.2	119	135
14/15 Waiki_29a.1	86	34	11.3	117	135
Other farm sources	460				
Whole farm	9348	45			
Less N removed in wetlands	0				
Farm output	9348	45			

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C/- L TAYLOR

Nouman Kyamanywa
Mahinui Street
Ravensdown Feilding

Client reference: 60862598
Farm name: SOUTH PRO MAITLAND LTD-2013/14 (2013/14)

Block Nitrogen

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)
EFF Clar_34a.1 Flat	914	45	**15.2**	249	269
EFF Clar_34a.1 Rolling	72	45	**15.2**	249	269
EFF Eure_22a.1 Flat	133	28	11.2	240	269
EFF Waiki_29a.1 Flat	124	44	**15.2**	248	269
EFF Waiki_29a.1 Rolling	49	44	**15.2**	248	269
Non EFF Beni_5a.6 Flat	191	49	**16.0**	203	200
Non EFF Beni_5a.6 Rolling	404	49	**16.2**	203	200
Non EFF Clar_34a.1 Easy	42	32	N/A	180	200
Non EFF Clar_34a.1 Flat	2256	37	**12.6**	196	200
Non EFF Clar_34a.1 Rolling	549	37	**12.6**	196	200
Non EFF Eure_22a.1 Flat	174	24	9.6	190	200
Non EFF Waiki_29a.1 Flat	1289	37	**12.6**	196	200
Non EFF Waiki_29a.1 Rolling	703	37	**12.6**	196	200
12/13 Clar_34a.1	222	63	**20.0**	-83	92
12/13 Waiki_29a.1	162	65	**20.3**	-83	92
13/14 Clar_34a.1	98	28	9.2	74	108
13/14 Waiki_29a.1	70	28	9.2	72	108
Other farm sources	392				
Whole farm	7841	38			
Less N removed in wetlands	0				
Farm output	7841	38			

P report

Version 6.3.0, on 2018-09-25 09:11:39

C/- L TAYLOR

Client reference: 60862598

Farm name: SOUTH PRO MAITLAND LTD-PROPOSED - V2 (Proposed)

Nouman Kyamanywa
Mahinui Street
Ravensdown Feilding

Block Phosphorus

Block name	Total P lost (kg P/yr)	P lost (kg P/ha/yr)	P loss categories		
			Soil	Fertiliser	Effluent
EFF Clar_34a.1 Flat	31	0.6	Low	Low	Low
EFF Clar_34a.1 Rolling	12	1.8	High	Medium	Low
EFF Eure_22a.1 Flat	2	0.3	Low	Low	n/a
EFF Waiki_29a.1 Flat	0	0.1	Low	Low	n/a
EFF Waiki_29a.1 Rolling	0	0.3	Low	Low	n/a
Non EFF Beni_5a.6 Flat	2	0.4	Low	Low	Low
Non EFF Beni_5a.6 Rolling	13	1.5	Medium	Medium	Low
Non EFF Clar_34a.1 Easy	2	1.8	High	Medium *	Low
Non EFF Clar_34a.1 Flat	14	0.5	Low	Low	Low
Non EFF Clar_34a.1 Rolling	15	1.6	High	Medium	Low
Non EFF Eure_22a.1 Flat	2	0.4	Low	Low	Low
Non EFF Waiki_29a.1 Flat	2	0.1	Low	Low	Low
Non EFF Waiki_29a.1 Rolling	5	0.3	Low	Low	Low
Previous FB Clar_34a.1	5	0.7	n/a	n/a	n/a
Previous FB Waiki_29a.1	1	0.1	n/a	n/a	n/a
Current FB Clar_34a.1	6	0.9	n/a	n/a	n/a
Current FB Waiki_29a.1	1	0.1	n/a	n/a	n/a
Other farm sources	87				
Whole farm	199	1			

** Fertiliser loss is outside the range for New Zealand data - see comments for each block

ravensdown

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C/- L TAYLOR

Nouman Kyamanywa
Mahinui Street
Ravensdown Feilding

Client reference: 60862598
Farm name: SOUTH PRO MAITLAND LTD-2017/18 (2017/18)

Block Phosphorus

Block name	Total P lost (kg P/yr)	P lost (kg P/ha/yr)	P loss categories		
			Soil	Fertiliser	Effluent
EFF Clar_34a.1 Flat	11	0.5	Low	Low	Low
EFF Clar_34a.1 Rolling	2	1.4	Medium	Low	Low
EFF Eure_22a.1 Flat	1	0.3	Low	Low	n/a
EFF Waiki_29a.1 Flat	0	0.1	Low	Low	n/a
EFF Waiki_29a.1 Rolling	0	0.2	Low	Low	n/a
Non EFF Beni_5a.6 Flat	1	0.3	Low	Low	Low
Non EFF Beni_5a.6 Rolling	9	1.1	Medium	Low	Low
Non EFF Clar_34a.1 Easy	2	1.8	High	Medium	Low
Non EFF Clar_34a.1 Flat	21	0.4	Low	Low	Low
Non EFF Clar_34a.1 Rolling	15	1.1	Medium	Low	Low
Non EFF Eure_22a.1 Flat	2	0.3	Low	Low	Low
Non EFF Waiki_29a.1 Flat	6	0.2	Low	Low	Low
Non EFF Waiki_29a.1 Rolling	3	0.2	Low	Low	Low
16/17 Clar_34a.1	6	0.6	n/a	n/a	n/a
16/17 Waiki_29a.1	1	0.1	n/a	n/a	n/a
17/18 Clar_34a.1	7	0.9	n/a	n/a	n/a
17/18 Waiki_29a.1	1	0.1	n/a	n/a	n/a
Other farm sources	76				
Whole farm	165	0.8			

Version 6.3.0, on 2018-09-25 09:11:45

C/- L TAYLOR

Client reference: 60862598
Farm name: SOUTH PRO MAITLAND LTD-2016/17 (2016/17)

Nouman Kyamanywa
Mahinui Street
Ravensdown Feilding

Block Phosphorus

Block name	Total P lost (kg P/yr)	P lost (kg P/ha/yr)	P loss categories		
			Soil	Fertiliser	Effluent
EFF Clar_34a.1 Flat	11	0.6	Low	Low	Low
EFF Clar_34a.1 Rolling	2	1.5	Medium	Medium	Low
EFF Eure_22a.1 Flat	1	0.3	Low	Low	n/a
EFF Waiki_29a.1 Flat	0	0.1	Low	Low	n/a
EFF Waiki_29a.1 Rolling	0	0.3	Low	Low	n/a
Non EFF Beni_5a.6 Flat	1	0.3	Low	Low	Low
Non EFF Beni_5a.6 Rolling	10	1.2	Medium	Medium	Low
Non EFF Clar_34a.1 Easy	3	2	High	High *	Low
Non EFF Clar_34a.1 Flat	22	0.4	Low	Low	Low
Non EFF Clar_34a.1 Rolling	16	1.2	Medium	Medium	Low
Non EFF Eure_22a.1 Flat	3	0.4	Low	Low	Low
Non EFF Waiki_29a.1 Flat	2	0.1	Low	Low	n/a
Non EFF Waiki_29a.1 Rolling	19	1.2	Medium	Medium	Low
15/16 Clar_34a.1	5	0.7	n/a	n/a	n/a
15/16 Waiki_29a.1	1	0.1	n/a	n/a	n/a
16/17 Clar_34a.1	9	0.9	n/a	n/a	n/a
16/17 Waiki_29a.1	1	0.1	n/a	n/a	n/a
Other farm sources	76				
Whole farm	183	0.9			

** Fertiliser loss is outside the range for New Zealand data - see comments for each block

C/- L TAYLOR

Nouman Kyamanywa
Mahinui Street
Ravensdown Feilding

Client reference: 60862598
Farm name: SOUTH PRO MAITLAND LTD-2015/16 (2015/16)

Block Phosphorus

Block name	Total P lost (kg P/yr)	P lost (kg P/ha/yr)	P loss categories		
			Soil	Fertiliser	Effluent
EFF Clar_34a.1 Flat	14	0.7	Low	Medium	Low
EFF Clar_34a.1 Rolling	3	2	High	High *	Low
EFF Eure_22a.1 Flat	2	0.4	Low	Low	n/a
EFF Waiki_29a.1 Flat	0	0.1	Low	Low	n/a
EFF Waiki_29a.1 Rolling	0	0.3	Low	Low	n/a
Non EFF Beni_5a.6 Flat	2	0.4	Low	Medium	Low
Non EFF Beni_5a.6 Rolling	12	1.4	Medium	High *	Low
Non EFF Clar_34a.1 Easy	3	2.3	High	Extreme *	Low
Non EFF Clar_34a.1 Flat	29	0.5	Low	Medium	Low
Non EFF Clar_34a.1 Rolling	22	1.5	Medium	High *	Low
Non EFF Eure_22a.1 Flat	3	0.4	Low	Low	Low
Non EFF Waiki_29a.1 Flat	8	0.2	Low	Low	Low
Non EFF Waiki_29a.1 Rolling	4	0.2	Low	Low	Low
14/15 Clar_34a.1	2	0.6	n/a	n/a	n/a
14/15 Waiki_29a.1	0	0.1	n/a	n/a	n/a
15/16 Clar_34a.1	6	0.8	n/a	n/a	n/a
15/16 Waiki_29a.1	1	0.1	n/a	n/a	n/a
Other farm sources	75				
Whole farm	187	0.9			

** Fertiliser loss is outside the range for New Zealand data - see comments for each block

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C/- L TAYLOR

Nouman Kyamanywa
Mahinui Street
Ravensdown Feilding

Client reference: 60862598
Farm name: SOUTH PRO MAITLAND LTD-2014/15 (2014/15)

Block Phosphorus

Block name	Total P lost (kg P/yr)	P lost (kg P/ha/yr)	P loss categories		
			Soil	Fertiliser	Effluent
EFF Clar_34a.1 Flat	12	0.6	Low	Low	Low
EFF Clar_34a.1 Rolling	3	1.7	High	Medium	Low
EFF Eure_22a.1 Flat	1	0.3	Low	Low	n/a
EFF Waiki_29a.1 Flat	0	0.1	Low	Low	n/a
EFF Waiki_29a.1 Rolling	0	0.3	Low	Low	n/a
Non EFF Beni_5a.6 Flat	1	0.4	Low	Low	Low
Non EFF Beni_5a.6 Rolling	10	1.2	Medium	Medium	Low
Non EFF Clar_34a.1 Easy	2	1.9	High	Medium	Low
Non EFF Clar_34a.1 Flat	26	0.4	Low	Low	Low
Non EFF Clar_34a.1 Rolling	19	1.3	Medium	Medium	Low
Non EFF Eure_22a.1 Flat	3	0.4	Low	Low	Low
Non EFF Waiki_29a.1 Flat	2	0.1	Low	Low	n/a
Non EFF Waiki_29a.1 Rolling	4	0.2	Low	Low	Low
13/14 Clar_34a.1	2	0.5	n/a	n/a	n/a
13/14 Waiki_29a.1	0	0.1	n/a	n/a	n/a
14/15 Clar_34a.1	3	0.8	n/a	n/a	n/a
14/15 Waiki_29a.1	0	0.1	n/a	n/a	n/a
Other farm sources	81				
Whole farm	171	0.8			

Version 6.3.0, on 2018-09-25 09:11:53

C/- L TAYLOR

Nouman Kyamanywa
Mahinui Street
Ravensdown Feilding

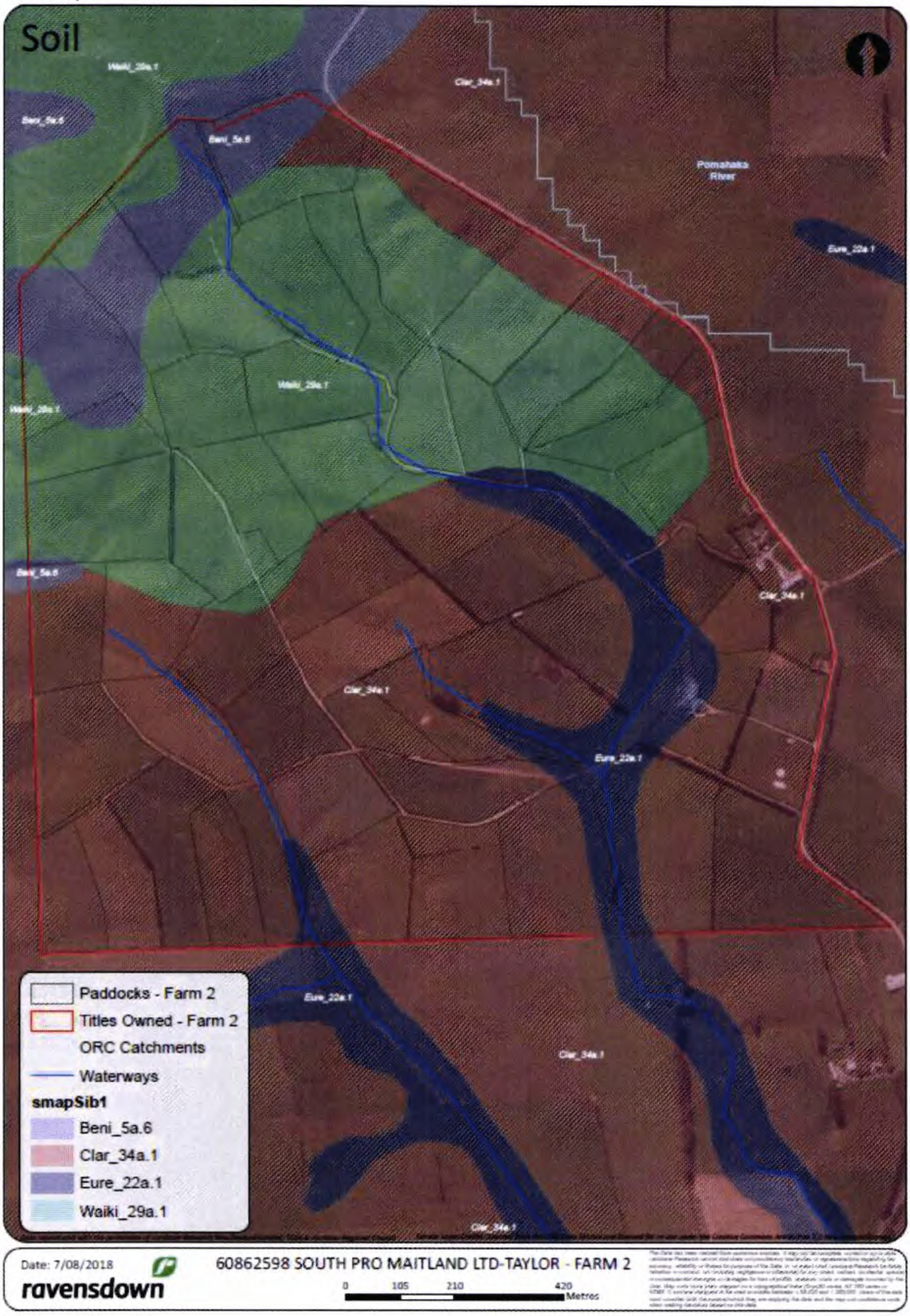
Client reference: 60862598
Farm name: SOUTH PRO MAITLAND LTD-2013/14 (2013/14)

Block Phosphorus

Block name	Total P lost (kg P/yr)	P lost (kg P/ha/yr)	P loss categories		
			Soil	Fertiliser	Effluent
EFF Clar_34a.1 Flat	12	0.6	Low	Low	Low
EFF Clar_34a.1 Rolling	3	1.7	High	Medium	Low
EFF Eure_22a.1 Flat	1	0.3	Low	Low	n/a
EFF Waiki_29a.1 Flat	0	0.1	Low	Low	n/a
EFF Waiki_29a.1 Rolling	0	0.3	Low	Low	n/a
Non EFF Beni_5a.6 Flat	1	0.4	Low	Low	Low
Non EFF Beni_5a.6 Rolling	10	1.2	Medium	Medium	Low
Non EFF Clar_34a.1 Easy	3	1.9	High	Medium **	Low
Non EFF Clar_34a.1 Flat	27	0.4	Low	Low	Low
Non EFF Clar_34a.1 Rolling	19	1.3	Medium	Medium	Low
Non EFF Eure_22a.1 Flat	3	0.4	Low	Low	Low
Non EFF Waiki_29a.1 Flat	2	0.1	Low	Low	n/a
Non EFF Waiki_29a.1 Rolling	4	0.2	Low	Low	Low
12/13 Clar_34a.1	2	0.5	n/a	n/a	n/a
12/13 Waiki_29a.1	0	0.1	n/a	n/a	n/a
13/14 Clar_34a.1	3	0.8	n/a	n/a	n/a
13/14 Waiki_29a.1	0	0.1	n/a	n/a	n/a
Other farm sources	79				
Whole farm	170	0.8			

** Fertiliser loss is outside the range for New Zealand data - see comments for each block

Soil map


Soil
Waiki_29a.1
Clar_34a.1
Beni_5a.6
Pomahaka River
Eure_22a.1
Paddocks - Farm 2
Titles Owned - Farm 2
ORC Catchments
Waterways
smapSib1
Beni_5a.6
Clar_34a.1
Eure_22a.1
Waiki_29a.1
Date: 7/08/2018
ravensdown
60862598 SOUTH PRO MAITLAND LTD-TAYLOR - FARM 2
0 105 210 420
Metres

Physiographic Zones

Slope map


Slope
Pomahaka River
Paddocks - Farm 2
Titles Owned - Farm 2
ORC Catchments
Waterways
Slope
0 - 7
8- 15
16 - 25
>26
Date: 7/08/2018
ravensdown
60862598 SOUTH PRO MAITLAND LTD-TAYLOR - FARM 2
0
105
210
420
Metres

Title map

Date: 7/08/2018 ravensdown

60862598 SOUTH PRO MAITLAND LTD-TAYLOR - FARM 2

0 130 260 520
Metres

Fertiliser purchase records

NPKS sales by 60862598			Product Sale	N	P	K	S
SOUTH PRO MAITLAND LTD-TAYLOR				kg	kg	kg	kg
2017/18				**79,985**	**5,717**	**4,493**	**8,269**
Sep				**6,358**	**324**		**2,120**
	1700000	SERPENTINE SUPER BULK	4.83		324		415
	4380000	AMMO 36 BULK	17.76	6,358			1,705
Oct				**14,811**	**568**	**693**	**250**
	3000000	CROPMASTER DAP BULK	1.30	229	260		13
	4300000	UREA BULK	30.70	14,122			
	9900300	MCNAB FB BASE MIX	5.13	460	308	693	237
Nov				**11,601**			
	4300000	UREA BULK	25.22	11,601			
Dec				**13,805**			
	4300000	UREA BULK	30.01	13,805			
Jan				**7,374**			
	4300000	UREA BULK	16.03	7,374			
Feb				**7,627**	**2,608**	**3,800**	**3,188**
	2000000	POTASSIUM CHLORIDE GRAN BULK	7.60			3,800	
	4300000	UREA BULK	16.58	7,627			
	9534654	Super + Sel	16.93		1,522		1,861
	9534656	Super + Sel1	12.08		1,086		1,327
Mar				**7,590**	**2,218**		**2,711**
	4300000	UREA BULK	16.50	7,590			
	9534656	Super + Sel1	24.68		2,218		2,711
Apr				**7,599**			
	4300000	UREA BULK	16.52	7,599			
May				**3,220**			
	4300000	UREA BULK	7.00	3,220			
2016/17				**61,005**	**6,130**	**3,893**	**10,578**
Aug				**2,487**			**1,166**
	4390000	AMMO 31 BULK	8.10	2,487			1,166
Sep				**4,280**			**2,007**
	4390000	AMMO 31 BULK	13.94	4,280			2,007
Oct				**2,577**	**1,612**	**1,097**	**1,777**
	9470120	FB Base Mix + Extra P	6.00	384	411	579	387
	9470171	Crop 20 + Sel	9.73	1,848	970		1,213
	9900300	MCNAB FB BASE MIX	3.84	344	230	518	177
Nov				**7,634**	**656**		**1,120**
	4300000	UREA BULK	12.49	5,745			

	9470119	Ammo 31 + Sel	2.09	639			300
	9470171	Crop 20 + Sel	6.58	1,250	656		820
Dec				**13,175**	**1,035**		**1,053**
	4300000	UREA BULK	25.03	11,514			
	9470119	Ammo 31 + Sel	0.91	278			130
	9470165	Crop 20 + Triple + Sel	6.05	863	762		581
	9470171	Crop 20 + Sel	2.74	521	273		342
Jan				**7,797**	**439**	**271**	**536**
	4300000	UREA BULK	15.73	7,236			
	9487864	10% Pot Super + Urea + Sel	6.78	561	439	271	536
Feb				**5,755**	**2,388**	**2,525**	**2,918**
	1000000	SUPERPHOSPHATE BULK	26.53		2,388		2,918
	2000000	POTASSIUM CHLORIDE GRAN BULK	5.05			2,525	
	4300000	UREA BULK	12.51	5,755			
Mar				**11,555**			
	4300000	UREA BULK	25.12	11,555			
Apr				**5,745**			
	4300000	UREA BULK	12.49	5,745			
2015/16				**43,917**	**2,478**	**1,466**	**4,645**
Aug				**2,911**			**780**
	4380000	AMMO 36 BULK	8.13	2,911			780
Sep				**3,723**			**998**
	4380000	AMMO 36 BULK	10.40	3,723			998
Oct				**2,728**	**2,118**		**2,588**
	9426961	20% reduction	63.06	2,728	2,118		2,588
Nov				**6,179**	**361**	**841**	**278**
	4300000	UREA BULK	12.26	5,640			
	9437110	Fodder Beet Starter	7.03	539	361	841	278
Dec				**5,750**			
	4300000	UREA BULK	12.50	5,750			
Jan				**5,750**			
	4300000	UREA BULK	12.50	5,750			
Feb				**6,757**		**625**	
	2000000	POTASSIUM CHLORIDE GRAN BULK	1.25			625	
	4300000	UREA BULK	14.69	6,757			
Mar				**5,980**			
	4300000	UREA BULK	13.00	5,980			
May				**4,140**			
	4300000	UREA BULK	9.00	4,140			
2014/15				**49,366**	**4,186**	**613**	**7,133**
Jul				**0**			**0**

	4380000	AMMO 36 BULK	0.00	0			0
Aug				**7,991**			**2,143**
	4380000	AMMO 36 BULK	22.32	7,991			2,143
Sep				**6,684**			
	4300000	UREA BULK	14.53	6,684			
Oct				**4,373**	**3,209**		**3,922**
	9390825	Superphosphate + Urea	45.16	4,373	3,209		3,922
Nov				**307**	**221**	**413**	**143**
	9398988	FODDER BEET STARTER MIX 5.5HA	3.17	307	221	413	143
Dec				**6,551**	**757**		**925**
	4300000	UREA BULK	12.00	5,520			
	9390825	Superphosphate + Urea	10.65	1,031	757		925
Jan				**5,750**			
	4300000	UREA BULK	12.50	5,750			
Feb				**6,256**		**200**	
	4300000	UREA BULK	12.50	5,750			
	9407729	FODDER BEET SIDE DRESSING	1.50	506		200	
Mar				**5,759**			
	4300000	UREA BULK	12.52	5,759			
May				**5,695**			
	4300000	UREA BULK	12.38	5,695			
2013/14				**38,886**	**8,896**	**6,326**	**12,789**
Aug				**7,187**			**3,371**
	4390000	AMMO 31 BULK	23.41	7,187			3,371
Sep				**5,750**			
	4300000	UREA BULK	12.50	5,750			
Oct					**379**	**371**	**463**
	9354178	15% Pot super + Lime	10.46		379	371	463
Nov				**6,144**	**2,199**	**2,628**	**2,462**
	2000000	POTASSIUM CHLORIDE GRAN BULK	2.26			1,130	
	4300000	UREA BULK	12.52	5,759			
	9357864	10% Pot Super + Lime	34.86		1,926	1,189	2,354
	9361280	nas - SILAGE MIX (2.3 HA)	0.92	212		230	
	9361281	nas - KALE MIX (3.2HA)	2.06	173	273	79	108
Dec				**7,058**	**3,797**	**1,832**	**3,529**
	1700000	SERPENTINE SUPER BULK	3.32		222		286
	3000000	CROPMASTER DAP BULK	0.52	92	104		5
	3400000	CROPMASTER 15 BULK	1.66	248	166	166	128
	4300000	UREA BULK	12.51	5,755			
	9357863	Super + Lime	14.95		877		1,072

	9357864	10% Pot Super + Lime	21.01		1,161	716	1,419
	9362270	SWEDES STARTER MIX	10.69	697	1,267	660	620
	9364543	azn - SILAGE MIX	1.16	267		290	
Jan					**2,421**	**1,495**	**2,959**
	9357864	10% Pot Super + Lime	43.83		2,421	1,495	2,959
Feb				**6,997**	**100**		**5**
	3000000	CROPMASTER DAP BULK	0.50	88	100		5
	4300000	UREA BULK	15.02	6,909			
Apr				**5,750**			
	4300000	UREA BULK	12.50	5,750			

Soil Test Results

Name	Test Date	Block	Olsen P	QT K	QT Ca	QT Mg	QT Na	Organic S
40	2/08/2018	EFF	51	15	8	20	5	11
1	2/08/2018	Non-EFF	34	8	11	18	5	10
28	2/08/2018	EFF	21	10	8	14	4	11
5	2/08/2018	Non-EFF	22	5	9	14	3	10
25	2/08/2018	Non-EFF	54	29	11	28	6	14
49	10/10/2017	Non-EFF	25	13	8	19	5	11
18	10/07/2017	Non-EFF	23	5	8	13	4	8
42	10/07/2017	Non-EFF	27	12	10	23	3	8
9	10/07/2017	Non-EFF	31	10	12	21	6	11
52	10/07/2017	Non-EFF	16	8	9	15	3	9
1	10/07/2017	Non-EFF	19	9	11	19	6	6
33	10/07/2017	EFF	32	12	11	25	6	8
25	10/07/2017	Non-EFF	31	11	9	14	2	10
40	10/07/2017	EFF	38	11	9	24	6	7
22	8/06/2016	Non-EFF	13	4	9	14	4	9
18	8/06/2016	Non-EFF	14	7	9	11	5	6
10	8/06/2016	Non-EFF	27	9	10	21	6	6
31B	8/06/2016	Non-EFF	19	6	11	20	5	10
11	8/06/2016	Non-EFF	39	9	11	22	6	10
5	8/06/2016	Non-EFF	16	4	10	14	4	5
41B	8/06/2016	Non-EFF	16	6	12	15	6	9
24	8/06/2016	Non-EFF	15	4	10	15	4	6
34	8/06/2016	Non-EFF	25	4	6	11	3	9
28	8/06/2016	EFF	24	10	8	16	4	8
42	8/06/2016	Non-EFF	21	12	12	26	7	10
37	8/06/2016	Non-EFF	25	8	9	19	5	11
46	8/06/2016	Non-EFF	28	10	10	19		11
52	8/06/2016	Non-EFF	13	6	9	16	4	8
29	8/06/2016	Non-EFF	18	6	10	15	3	8
19	8/06/2016	Non-EFF	27	8	9	12	4	9
44	8/06/2016	Non-EFF	21	9	9	17	8	11
2	8/06/2016	Non-EFF	20	11	10	17	5	6
39	8/06/2016	EFF	56	29	12	35	7	10
6	8/06/2016	Non-EFF	44	8	10	21	5	6
47	8/06/2016	EFF	30	10	12	26	6	9
15	8/06/2016	Non-EFF	16	12	9	14	5	11
49A	8/06/2016	Non-EFF	16	7	12	24	5	11
13	8/06/2016	Non-EFF	32	20	10	23	10	8
36	8/06/2016	EFF	45	13	10	22	7	9
48	8/06/2016	EFF	29	8	8	16	5	10
30	8/06/2016	EFF	17	6	11	17	5	6
38	8/06/2016	Non-EFF	44	13	11	24	5	9
8	8/06/2016	Non-EFF	16	6	10	17	4	7
35	8/06/2016	Non-EFF	25	9	9	21	6	8
40	8/06/2016	EFF	44	18	12	30	8	9
20	8/06/2016	Non-EFF	19	3	10	15	2	6
33	8/06/2016	EFF	23	5	10	16	5	8
50	8/06/2016	Non-EFF	27	7	10	19	6	12

0	8/06/2016	Non-EFF	34	17	5	21	6	3
9	8/06/2016	Non-EFF	28	9	15	19	5	8
32	8/06/2016	Non-EFF	28	8	13	22	6	6
45	8/06/2016	Non-EFF	23	9	10	19	6	10
17	8/06/2016	Non-EFF	22	5	9	13	5	5
12	8/06/2016	Non-EFF	40	17	14	18	5	11
53	8/06/2016	Non-EFF	24	12	13	23	6	14
31A	8/06/2016	Non-EFF	23	5	11	14	4	6
3	8/06/2016	Non-EFF	44	14	14	25	7	7
7	8/06/2016	EFF	28	10	9	19	6	11
21	8/06/2016	Non-EFF	18	5	10	16	4	7
16	8/06/2016	Non-EFF	20	9	11	12	4	9
41A	8/06/2016	Non-EFF	30	11	11	21	5	10
1	8/06/2016	Non-EFF	19	9	10	18	8	4
25	8/06/2016	Non-EFF	28	6	9	14	4	4
49B	8/06/2016	Non-EFF	19	6	13	24	5	10
27	8/06/2016	EFF	18	11	9	13	6	6
43	8/06/2016	Non-EFF	21	6	10	15	5	10
51	8/06/2016	Non-EFF	17	5	12	17	5	10
23	24/07/2014	Non-EFF	16	7	12	17	6	12
14	24/07/2014	Non-EFF	34	12	12	21	6	9
40	24/07/2014	EFF	44	19	12	29	5	9
25	24/07/2014	Non-EFF	34	7	11	18	5	10
42	24/07/2014	Non-EFF	18	8	11	21	5	6
39	24/07/2014	EFF	62	28	12	35	8	13
1	24/07/2014	Non-EFF	33	7	14	19	6	8
33	24/07/2014	EFF	23	9	12	20	6	11
14	9/08/2013	Non-EFF	38	11	10	18	4	5
33	9/08/2013	EFF	21	7	10	16	5	6
42	9/08/2013	Non-EFF	24	11	10	20	5	5
23	9/08/2013	Non-EFF	19	9	10	16	6	5
39	9/08/2013	EFF	39	18	10	26	6	7