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Resource Consent Application
To Southland Regional Council

Prepared for Otama Dairy Ltd

13 February 2019

11 April 2019
Environment Southland
Cnr North Rd & Price St
Invercargill 9810

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Make the most of your land

Attention: Consents Manager

To whom it may concern

Application by Cashmere Bay Dairy Limited for the Use Land for Dairy Farming at 145 Jaffray Road, Gore

Please find enclosed the above consent application for your consideration.

The applicant recently purchased an 80-hectare block of land in June 2018, known as the 'Sheep Block'. This land parcel was not part of the dairy platform as at 3 June 2016. The applicant therefore seeks land use consent to incorporate the new neighbouring block of land into the existing dairy platform, under Rule 20(e) of the PSWLP. The applicant is not proposing to increase cow numbers, and therefore no changes are sought to the current discharge permit AUTH-301811-V2 or water permit AUTH-301812-V1.

A consent duration of 13 years is sought for this consent to assist in achieving common expiry dates with the associated water permit and discharge permit. The attached assessment of effects found that the actual and potential effects of the proposal are insignificant.

The $1,500 consent processing deposit has already be paid via internet banking when the earlier application (Otama Dairy, APP-I-20191134) was lodged.

If you have any questions in relation to this application, please don't hesitate to contact me directly.

Yours Sincerely,

Mike Free

Mike Freeman
Senior Scientist / Planner
13 Pinot Noir Drive | PO Box 302 | Cromwell 9342
P 03 445 9905
mike.freeman@landpro.co.nz | www.landpro.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: Cashmere Bay Dairy Limited

Address: 145 Jaffray Road
RD 7, Gore
9777

Email:

Phone: 027 229 7259 (*Preferred*) ______ (*Additional*) Fax: ______

Consultant contact details *(if different from above)*

Contact name/agent: Landpro Limited

Address: PO Box 302
Cromwell
9342

Email: mike.freeman@landpro.co.nz

Phone: 027 391 3733 (*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

- [ ] Bore/well
- [X] New or expanded dairy farming
- [ ] Effluent storage
- [ ] Cultivation
- [ ] Tree planting
- [ ] Gravel extraction
- [ ] Feed-pad, wintering pad, calving pad or silage pad
- [ ] Riverbed activity
- [ ] Bridges and culverts

Discharge

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

Water

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

Coastal

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

1 Are there any **current** or **expired** consents relating to this proposal? [X] Yes [ ] No

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

Discharge Permit AUTH-301811-V2 and Water Permit AUTH-301812-V1
No changes are proposed to the current discharge permit and water permit

2 Are any other consents required from Environment Southland or **other authorities**? [ ] Yes [X] No

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

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

To use land for a farming activity

4 **Location** of proposed activity

Address: 145 Jaffray Road
RD 7, Gore
9777

Legal Description: See attached AEE

Map Reference (NZTM 2000): See attached AEE E ______ N

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

Name: See attached AEE Phone: ______

Address: ______

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

7 Assessment of effects on the environment (AEE)

Please complete the applicable Part B form(s) for the proposed activities. For those activities where no Part B form is available, please attach a written statement that assesses the effects that your activities may have on the environment. An assessment of effects **must** include the following information:

(a) *if it likely that the activity will result in any significant adverse effect on the environment, a description of any possible alternative locations or methods for undertaking the activity;*
(b) *an assessment of the actual or potential effect on the environment of the activity;*
(c) *if the activity includes the use of hazardous substances and installations, an assessment of any risks to the environment that are likely to arise from such use;*
(d) *if the activity includes the discharge of any contaminant, a description of—*
  (i) *the nature of the discharge and the sensitivity of the receiving environment to adverse effects; and*
  (ii) *any possible alternative methods of discharge, including discharge into any other receiving environment;*
(e) *a description of the mitigation measures (safeguards and contingency plans where relevant) to be undertaken to help or prevent or reduce the actual or potential effect;*
(f) *identification of the persons affected by the activity, any consultation undertaken, and any response to the views of any persons consulted;*
(g) *if the scale and significance of the activity's effects are such that monitoring is required, a description of how and by whom the effects will be monitored if the activity is approved;*
(h) *if the activity will, or is likely to, have adverse effects that are more than minor on the exercise of a protected customary right, a description of possible alternative locations or methods for the exercise of the activity (unless written approval for the activity is given by the protected customary rights group).*

You should also include:

(a) *an assessment of the activity against any relevant provisions of any relevant objectives, policies, or rules;*
(b) *any information specified to be included in the application in accordance with the relevant regional plan;*
(c) *for an application to replace an existing consent, an assessment of the value of the investment of the existing consent holder:*

An assessment of effects **must** address the following matters:

(a) *any effect on those in the neighbourhood and, where relevant, the wider community, including any social, economic, or cultural effects;*
(b) *any physical effect on the locality, including any landscape and visual effects;*
(c) *any effect on ecosystems, including effects on plants or animals and any physical disturbance of habitats in the vicinity;*
(d) *any effect on natural and physical resources having aesthetic, recreational, scientific, historical, spiritual, or cultural value, or other special value, for present or future generations;*
(e) *any discharge of contaminants into the environment, including any unreasonable emission of noise, and options for the treatment and disposal of contaminants;*
(f) *any risk to the neighbourhood, the wider community, or the environment through natural hazards or the use of hazardous substances or hazardous installations.*

8 **Affected Parties**

Please attach written approval from parties who may be affected by your activity. *Written Approval of an Affected Party* forms are available on the Environment Southland website. During the processing of your application, Council may determine that additional approvals are required.

9 **Correspondence from Council when using a consultant**

It is standard practice that both you and your consultant are copied into all correspondence relating to the consent process. This is so that you know what is going on with your application. Please let us know below if you would like us to only contact your consultant. This means you will only hear from us when your application is/is not accepted, when a decision is made or if we feel that you need to be contacted.

I want all correspondence about my application to go to my consultant only ☐ Yes ☒ No

10 **Site visit from the Consents Team**

Consents staff are able to meet with you, visit your site and see what you are proposing to do. We find that this is beneficial to everyone involved. The cost of the visit will be included in the total cost of processing your consent. However, we find that applications that have an on-site visit are processed with less congestion and at a similar or lesser overall cost. Please let us know below if you would like us to come and see your site.

I would like a member of the Consents Team to visit my site ☒ Yes ☐ No

11 **How much will it cost to process my application?**

The cost of a consent depends on the complexity of the activities. Staff time is charged out at a rate of $145/hr and vehicle use for site visits is charged at $0.73/km (inclusive of GST).

The fees shown below under section two are **deposits to be paid at the time of application**. Due to the complexity of these activities, this deposit will not usually cover the full cost of processing the application. **Further costs may be incurred** relating to staff time, disbursements, legal charges, consultation fees, and hearing commissioner fees. Environment Southland's User Charges and Fees document is available at:

www.es.govt.nz/fees-and-charges

When the consent has been processed you will receive an invoice for an additional fee, or for a refund.

The Council's user charges are fixed under Section 36 of the Resource Management Act 1991. Our fee schedule is:

1. Fixed fee:	
Bores and wells	**$290**
Whitebait stand	**$220**
2. Deposit:	
All other non-notified applications including: • Certificates of compliance • Changes to consent conditions (variations) • Change of lapse date	**$1,500**
Applications that require notification or limited notification	**$2,000**

How to pay
Environment Southland accepts payment in the forms of cash, Eftpos, cheque, or electronic transfer. All electronic transfers must include the applicant's name and "consent application" as a reference. Please make electronic payments to: Environment Southland, 01-0961-0018998-00.

User Charges
Please note that additional Annual User Charges will apply to all consents. These are payable in advance on the first day of July each year. Tables 4, 5 and 6 of the Environment Southland User Charges and Fees Schedule outlines the fees associated with Annual Administration Charges and Annual Consent Monitoring and Inspection Charges. Table 7: Annual Research and Monitoring Charges applies only to surface and groundwater takes and comprises the following:

- **Surface water takes (per consent, for volumes up to 50,000 m^3/day):**
  - A charge of **$1.89** per year per cubic metre authorised as a maximum daily take.
  - Minimum of **$138**, maximum of **$7,585**.
- **Surface water takes (per consent, for volumes over 50,000 m^3/day):**
  - **$0.0031** per cubic metre authorised as a maximum daily take.
- **Groundwater takes (per consent):**
  - A charge of **$0.89** per year per cubic metre.
  - Minimum of **$162**, maximum of **$1,782**.

Municipal and stock water discount (of 50%) no longer applies.

12 Checklist: Have you included the following?

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

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

Signature of applicant

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

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

Name (block capitals) MIKE FREEMAN - LANDPRO LTD

Signed Mike Free

Date 11/4/2019

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

Cashmere Bay Dairy Limited

Resource Consent Application to
the Southland Regional Council (Environment Southland)
To Use Land for a Farming Activity

LANDPRO
Make the most of your land

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Prepared For
Cashmere Bay Dairy Ltd

Prepared By
Landpro Ltd
13 Pinot Noir Drive
PO Box 302
Cromwell

Tel +64 3 445 9905

QUALITY INFORMATION

Reference:	L:\18106 - Cashmere Bay Dairy Ltd - Dairy Expansion\Docs\Drafts\20190411 18106 Cashmere Bay Dairy land addition AEE FINAL FINAL FINAL.docx
Date:	11 April 2019
Prepared by:	Mike Freeman (BSc, PhD) & Grace Baldwin (MMAg Systems)
Reviewed by:	Tanya Copeland
Client Review:	George Raymond
Version Number:	Final

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LIST OF ATTACHMENTS

1. INTRODUCTION

1.1 Overview of Proposal

Cashmere Bay Dairy Limited (the applicant) owns a dairy farm located approximately 12 km north-west of Gore. Discharge Permit 301811-V2 authorises the discharge of farm dairy effluent (FDE) of up to 154 ha of land, and Water Permit 301812-V1 authorises the taking of groundwater at this farm. These consents do not expire until 19 December 2022.

In June 2018, the applicant purchased a neighbouring 80-ha sheep block known as the "Sheep Block". The applicant wishes to incorporate this new neighbouring block of land into the existing dairy platform as shown on the attached Plan (Figure 2). The addition of this land to the dairy platform triggers the need to apply for land use consent for the use of land for a farming activity under Rule 20 of the PSWLP.

A land use consent is therefore sought for the following:

- To use land for a farming activity where the land area of the dairy platform would be greater than at 3 June 2016.

Under discharge permit AUTH-301811-V2 and water permit AUTH-301812-V1, the property is consented for a maximum of up to 1,000 cows, and this number will not increase following the expansion of the dairy platform. Therefore, no other changes are proposed to the existing resource consents.

1.2 The Applicant

Applicant Address: Cashmere Bay Dairy Limited
145 Jaffray Road
RD 7, Gore
9777

Address for Service: C/- Landpro Limited
PO Box 302
Cromwell 9342

1.3 Purpose of Documentation

Under s88 of the Resource Management Act 1991 (the RMA), this report provides an assessment of the activities effects on the environment as required by Schedule 4 of the Resource Management Act (RMA).

2. DETAILS OF PROPOSAL

2.1 Location

The figures below show the location of the farm in relation to Gore as well as the proposed farm boundary. Attachment A includes a more detailed farm map which shows each block modelled in the nutrient budgets.

Figure 1: General Property Location

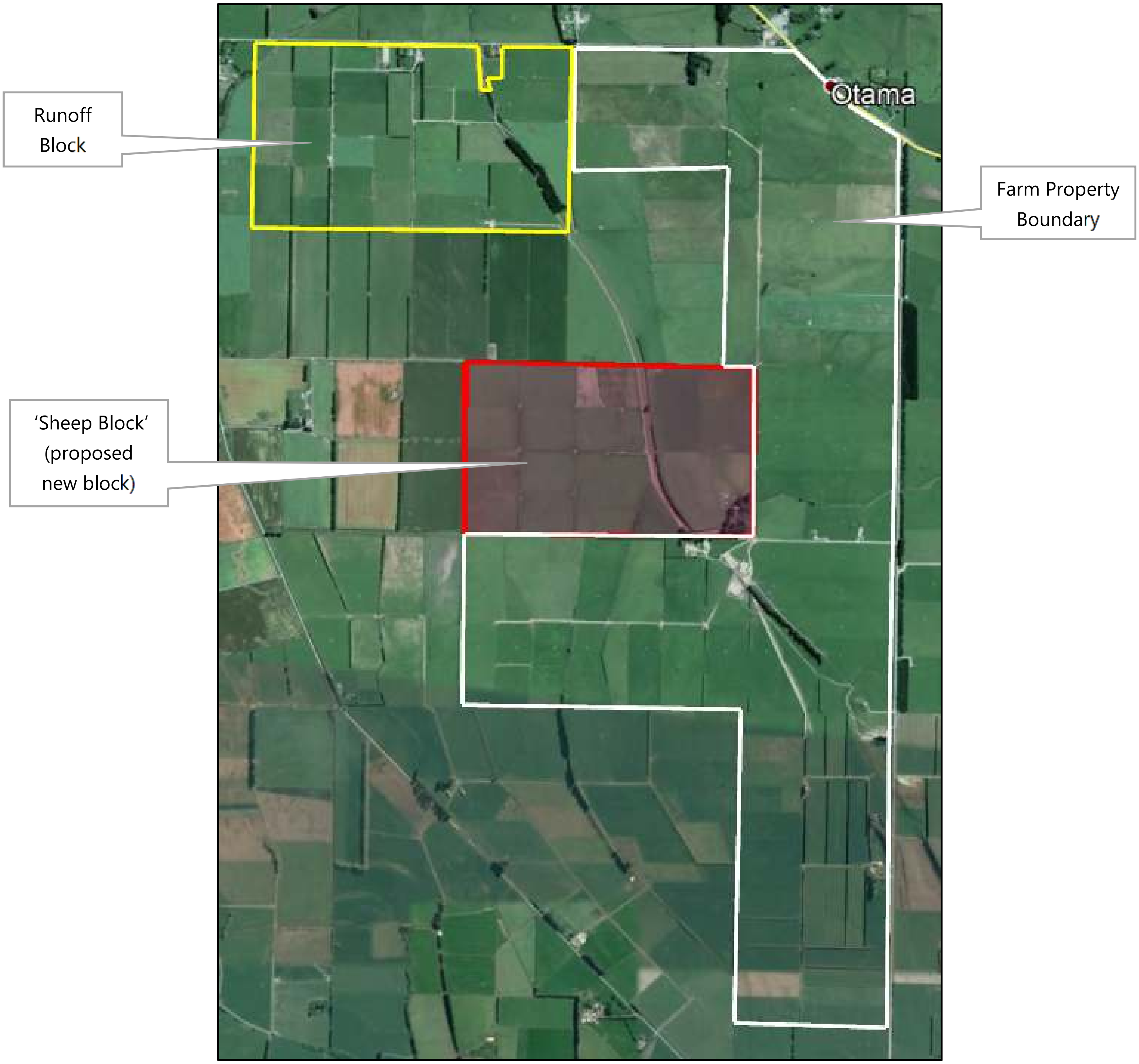

Figure 2: Proposed Farm Boundary, with the new Sheep Block shaded in red. The Runoff Block outlined in yellow was used for grazing young stock and is modelled in the nutrient budgets (Source: Google Maps).

2.2 Details of Dairy Farm

The following provides further details of the proposed farming system.

Table 1: Details of the Dairy Farm

Property Details		
Property address	145 Jaffray Road	
Property owner(s)	Cashmere Bay Dairy Limited	
Legal Description	Existing Property	
	Section 5 BLK II Otama SD	SL43/63
	Section 2 BLK II Otama SD	SL41/274
	Section 4 BLK I Otama SD	SLB3/911
	Pt Section 10 Blk II Otama SD	SL8D/174
	Pt Section 10 Blk II Otama SD	SL8D/173
	Pt Section 10 Blk II Otama SD	SL8D/171
	Closed Road Blk II Otama SD	SL190/88
	Closed Road Blk II Otama SD	No Details Available
	Pt Section 9 Blk II Otama SD	SL8D/175
	Runoff Block	
	Lot 2 DP 12628	97883
	Lot 2 DP 324253	97883
	Sheep Block	
	Section 14 BLK II Otama SD	SL7D/697
Land Use Consent (use land for dairying)		
Area of new sheep block (ha)	80 ha	
Use of land pre-May 2016	Organic sheep farm	
Proposed use of land	Dairy Platform, which includes wintering	
Number of dairy cows	Existing Herd: 1,000 cows	Proposed Herd: 1,000 cows
Farm Area	Existing Area (Including Lease Runoff Block): 443 ha	Proposed Area (Including Sheep Block): 523 ha
Stocking rate (cows/ha)	Existing Stocking Rate: 2.25	Proposed Stocking Rate: 1.91

2.2.1 Existing Land Use

The existing dairy platform consists of the applicant's own property (labelled as 'Farm Property Boundary' in Figure 2 above) which has an effective area of 344.4 ha. Up to 1,000 cows are milked on the existing dairy platform. The applicant also leases a Runoff Block, which is located to the north of the property boundary (labelled as 'Runoff Block'), as depicted in Figure 2 above. The land in the north east of the property is also leased. Long-term lease agreements are in place and can be made available on request. The total land area of the existing dairy platform and lease Runoff Block consists of 442.6 ha.

The Runoff Block, consisting of approximately 90 ha effective, is currently used for grazing heifers and young stock (R1s and R2s) and cut-and-carry baleage which is fed out onto the existing dairy platform. The applicant will continue to utilise the Runoff Block upon the granting of consent. Although the Runoff Block is not part of the existing dairy platform as cows are not milked on this block, it is modelled in the nutrient budgets and therefore included in the assessment of environmental effects. The Runoff Block will continue to be utilised for grazing heifers and young stock (R1s and R2s) and cut-and-carry baleage, as indicated in the attached Overseer report.

The purchase of the 'Sheep Block' will enable significant efficiencies for cows to graze closer to the milking shed and will enable the landholding to be self-contained to the area shown in Figure 2 with no off-site wintering.

2.2.2 Discharge Permit AUTH-301811-V2 and Water Permit AUTH-301812-V2

The applicant is authorised to discharge dairy shed effluent to land and take groundwater for dairy shed and stock drinking water purposes, for up to 1,000 cows. This consented number will not increase following the proposed expansion of the dairy platform, and the applicant will continue to operate under Discharge Permit AUTH-301811-V2 and Water Permit AUTH-301812-V2 upon the granting of the land use consent for farming. The attached nutrient budgets have been modelled using the 'actual lawful use of the land' for the past three years for the dairy platform and runoff, which demonstrates that the applicant has been operating the dairy farm at or near the consented maximum of 1,000 cows. No farm dairy effluent is proposed to be discharged to the Sheep Block. No changes are proposed to the existing discharge and water permits, as the consented maximum number of cows is not changing.

Figure 3: Overview of layout showing dairy shed and effluent treatment system (Source: ES Beacon, 2018).

This application is being made subsequent to the original application not being accepted as complete under Section 88(3A) of the Resource Management Act (RMA). The letter informing Landpro of that decision stated: "A variation is also required to vary the applicants current discharge permit (AUTH-301811-V2) to amend the farm boundary to include the new block." We respectfully disagree with that view for the following reasons:

- The discharge permit specifies that effluent will be applied to defined areas which are not changing.
- Condition 2 of AUTH-301811-V2 refers to the effluent discharge being in accordance with the application submitted for APP-301811-V2 which is not changing in nature, scale or extent under this proposal, as the currently consented disposal area and cow numbers will remain the same.
- Condition 2 refers to the *"discharge of dairy shed effluent onto land … as described in application APP-301811-V2, at the locations described above."* The current Appendix 1 map accurately reflects the 154ha which is being utilised for effluent disposal, and this consented area is not changing under this proposal. Condition 2 does not specifically refer in any way to the farm boundary as having specific relevance or restriction to the consent holder in fulfilling the requirements of Condition 2. The mapping of the farm boundary on the Appendix 1 map therefore only gives context to the discharge area, and does not define the nature, scale and extent of the discharge activity.
- Condition 5 states that "*Effluent may be applied to the land as described in the application and generally as shown in Appendix 1, but the following specific buffers shall be observed*" and "*Where there is conflict between Appendix 1 and these specified buffers, the latter shall apply*." We consider that the imposition of Condition 5 gives a significant amount of clarity that the effluent discharge activity is appropriately outlined and restricted to those specific buffer zones outlined in this condition.
- The reference in the discharge permit to the "legal description of land at the site" is not changing.

2.2.3 Land Use Consent for dairy effluent storage pond

Land use consent was obtained in 2012 for the construction of the dairy effluent storage pond. The design and construction of the effluent pond were overseen by Green Being Limited. The pond was constructed for the storage of effluent from up to 800 cows, which was consistent with cow numbers authorised under the earlier discharge and water permits.

However, upon the granting of consent to vary (in September 2017) the discharge permit to authorise effluent disposal from up to 1,000 cows, the Dairy Effluent Storage Calculations (DESC) was not re-modelled for this increase in cow numbers. Therefore, an updated DESC is summarised in Attachment B to demonstrate that the existing pond storage has capacity to store effluent generated from up to 1,000 cows. The attached DESC shows that the pond is required to have an effective storage volume (90% probability) of 1,175 m^3, in order to effectively store effluent from up to 1,000 cows. The total pond volume of the existing storage pond is 2,223 m^3, meaning that the pond has sufficient capacity to store effluent generated from up to 1,000 cows.

2.2.4 Effluent Pond and Solid Separation System

Effluent generated by up to 1,000 cows is collected from the dairy shed, then gravity-fed to a large concrete wedge and pumped to a concrete stone trap. The concrete stone trap is the original effluent pond which has been converted to store solids and separate liquid FDE. From the stone trap, liquid FDE is then pumped and stored in an effluent pond with a total pond volume of 2,223 m^3 (see attachment B for DESC report). Solids are removed from the stone trap once a month, and either stockpiled or taken off farm. The pond has a stirrer to prevent sludge from accumulating on top of the pond and was constructed with an HDPE synthetic liner and leak detection drain for contingency to prevent leakage and contamination of groundwater. The leak detection drain underlies the entire pond and so is consistent with the guidance note recently circulated by Environment Southland on 7 August[1], which requires that if an existing synthetically lined in-ground effluent pond has a leak detection drain that underlies the entire pond, a pond drop test will not be needed as part of the consent application. Pond design specifications, drawings and photographs are attached to this report.

Effluent is pumped from the pond via an underground mainline and disposed onto land via existing K-line pods, cobra rain gun and two centre pivots. Fresh water irrigation is also used on farm, of which up to 186.41 ha of land is irrigated via two Rotorainers and a centre pivot. The centre pivot irrigates both water and FDE using Variable Rate Irrigation (VRI) and has a backflow prevention system to prevent FDE from flowing back through to the groundwater bore used for irrigation. The applicant also uses an ASR soil moisture probe to monitor soil moisture prior to irrigating FDE.

Therefore, given the age and excellent maintenance of the pond, and that the pond is synthetically lined with a leak detection drain that underlies the entire pond, a pond drop test has not been conducted, nor is it considered necessary as part of this application. The pond design and specifications are adequate and meet the requirements of PSWLP Rule 32D.

2.2.5 Proposed Activity

Consent is sought to incorporate a new 80 ha (approx.) block of land located between Otama Flat Road and Jaffray Road (adjacent to the existing property), to add to the existing farm for dairying and milking of up to a maximum of the currently consented number of 1,000 cows. The applicant purchased the block in June 2018 and is therefore seeking to increase the land area of the dairy platform. This means that the dairy platform would be greater than that that existed at 3 June 2016, which is inconsistent with Condition (a)(6) of Rule 20 of the Proposed Southland Water and Land Plan (PSWLP) Decisions Version and therefore a resource consent is required to authorise this activity. This block has previously been used as an organic sheep farm, but it is proposed that it now be incorporated into the dairy platform and is labelled as the 'Sheep Block' for the purposes of this application. Upon the granting of this consent, the inclusion of the Sheep Block into the dairy platform will enable the landholding to be completely self-contained, as winter grazing is proposed to occur on this property.

The Sheep Block contains relatively flat areas, although there is a steep terrace which dissects through the block of land. Integrating the 80-ha block into the existing dairy platform will allow the dairy farm to operate as a completely self-contained system. The new block is sited very close to the existing dairy shed which will allow significant farm efficiencies and improve cow health by reducing the distance needed to walk to the dairy shed for milking. The Sheep Block will be utilised as part of the dairy platform for grazing of pasture and winter crops. However, the disposal of FDE is *not* proposed to occur on the Sheep Block.

As discussed in the attached Overseer Report, the proposed dairy platform will have peak cow numbers of 1000 cows. Of this peak number, approximately 200 cows would be culled and replaced each year so that

[1] Environment Southland. Advice note to resource management consultants: Leaks from agricultural effluent storage facilities – application of rules 35 and 32D of the PSWLP

up to 800 cows are proposed to be winter grazed on fodder beet crop on the dairy platform and Sheep Block. Up to 440 young stock are proposed to be winter grazed on fodder beet crop on the Runoff Block. The proposed cultivation of fodder beet and subsequent winter grazing of fodder beet in-situ in 2019 are both permitted activities under Rule 20 of the PSWLP 2018, as discussed in section 5.1 below.

Existing and proposed mitigation measures that include good management practices (GMPs) relating to the entire farming activity are provided in the attached Farm Environment Plan (attachment D). This Plan was produced by Brian Goodger of Fonterra and includes all material set out in Part B of Appendix N, in order to meet requirements for the Farm Environmental Management Plan. These mitigation measures are also summarised in Table 9 under section 6.1 below.

2.2.6 Compliance

Based on records provided by Environment Southland (ES), the property has been subject to frequent compliance monitoring inspections. The applicant has demonstrated a record of full compliance for every inspection for the Discharge Permit AUTH-301811-V2. The overall history of compliance strongly indicates that the applicant is ensuring efficient application of FDE at low rates, is demonstrating good compliance with their existing discharge permit and represents a low level of environmental risk.

No compliance monitoring inspections have been undertaken for Water Permit AUTH-301812-V1.

3. DESCRIPTION OF EXISTING ENVIRONMENT

3.1 Land Use, Topography & Climate

The property, located at approximately 130 m above mean sea level, is an existing dairy farm and conventional farming practices are undertaken. Surrounding land use comprises other dairy farms, sheep and beef farms and some rural dwellings.

The attached Dairy Effluent Storage Calculator reports that the property is likely to receive an average of 854 mm of rainfall per year, based on the 30 year Overseer (NIWA) annual average rainfall estimate.

3.2 Water Resources

3.2.1 Surface waterways

Overview of water quality in the general vicinity of the existing dairy platform

The property lies within the Mataura Freshwater Management Unit and is divided between three different catchment boundaries of the Otama Creek, Mataura River, and Okapua Stream. One unnamed tributary flowing into Otama Creek enters the property on the east boundary and exits the property on the west boundary. This unnamed tributary becomes highly modified as it enters the neighbouring property, indicating the tributary is situated in a modified rural environment. Numerous tributaries of Otama Creek also traverse through the west section of the property. Otama Creek then flows into the Mataura River approximately 1.6 km to the west of the property. The Mataura River is also located approximately 1.4 km downstream of the property.

Overview of water quality in the general vicinity of the proposed dairy platform

The new block lies within the Mataura Freshwater Management Unit, and predominately overlies the Mataura River catchment boundary. One unnamed tributary of Otama Creek also traverses through the midsection of the property, at the base of the terrace. Currently on the new block, not all waterways and open drains have been fenced from stock and the applicant proposes to implement an extensive native planting and fencing programme across the entire proposed dairy platform. This is detailed in the attached Farm Environmental Management Plan (FEMP) (Attachment D).

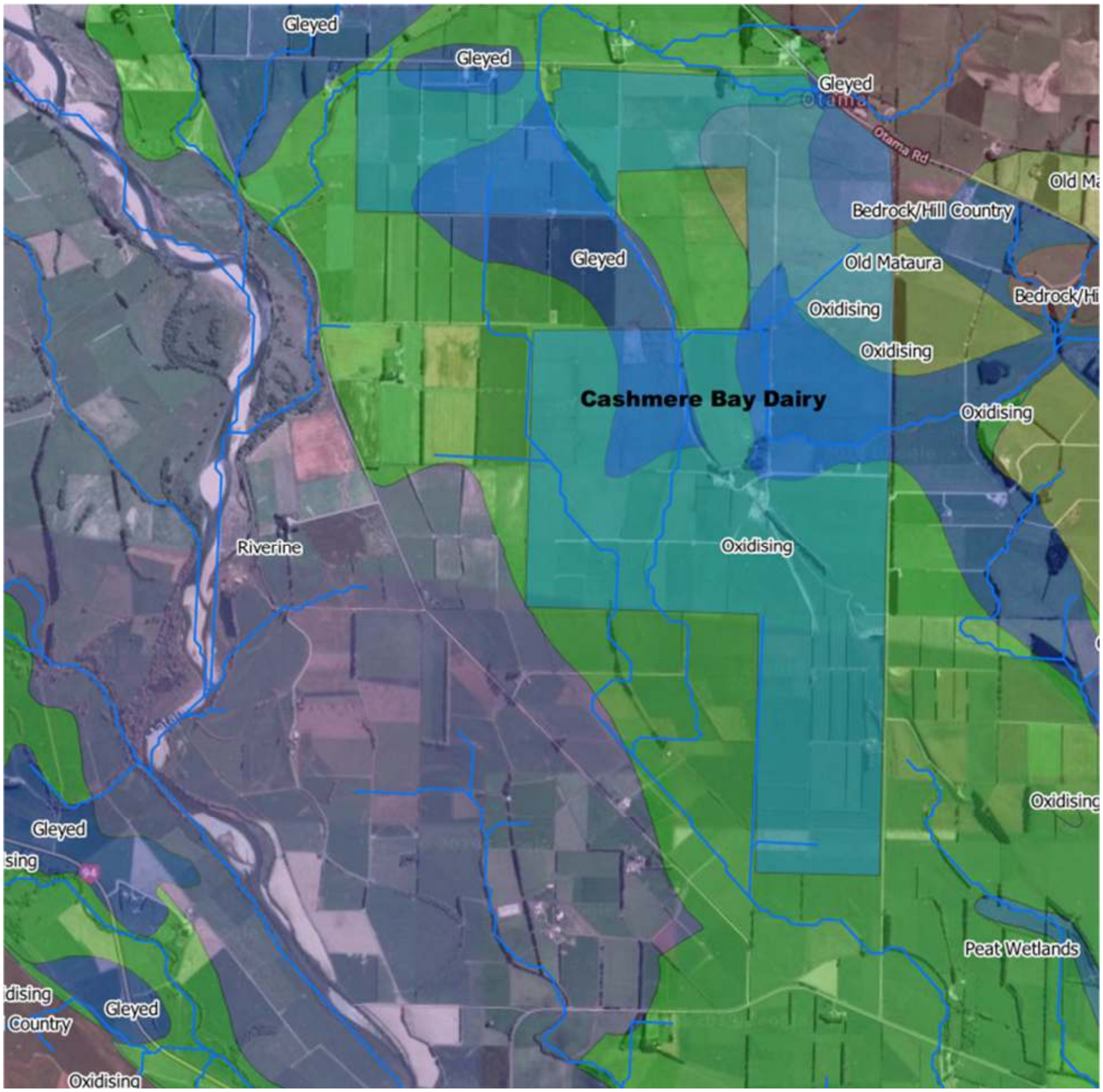

Figure 4 Existing and proposed farm boundary, the location of stream and drains (NIWA stream GIS data) and physiographic zones (ES GIS data).

Under the RWPS, waterbodies on the property are classified as Lowland hard bed and Lowland soft bed. The table below summarises the values associated with this water body type as specified in the RWPS. The Proposed Southland Water and Land Plan (PSWLP) does not use a classification system to establish values for rivers and streams.

Table 2: Values ascribed to waterbody classification in 'Mataura 3' and 'Lowland Soft Bed' (Source: RWPS).

Water Body Classification	Values specified in the RWPS
Lowland Soft Bed, Lowland Hard Bed & Mataura 1, 2 & 3	- Bathing in those sites where bathing is popular; - Trout where present, otherwise native fish; - Stock drinking water; - Ngāi Tahu cultural values, including mahinga kai; - Natural character including aesthetics.

A search of the New Zealand Freshwater Fish Database did not reveal the presence of fish within the tributaries on the property. No presence of fish was identified in the Otama Creek or Mataura River in the vicinity of the property.

Land Air Water Aotearoa (LAWA) is a national database which connects people with New Zealand's environmental monitoring data, enabling communities to access information relating to freshwater resources. The state of water quality presented on the LAWA website compares the median of monitoring result for the last five years at a site with other sites around the country. The median for a site can be compared to all other sites with similar land use and altitude. The data used to calculate trends is the same as used for the regional state. LAWA displays regional trends for the last five to ten years which helps to identify whether a site has improved, degraded or stayed the same. The state of water quality is assessed against the objectives within the National Policy Statement for Freshwater Management (NPS-FM; New Zealand Government 2014) and the trigger values for physical and chemical stressors in New Zealand rivers from the ANZECC guidelines (ANZECC 2000).

Table 3: Summary of State and Trend at the Waikaia River at Waipounamu Bridge Monitoring Site (nearest upstream LAWA monitoring site[2]) and Gore Monitoring Site (nearest downstream LAWA monitoring site). Source: LAWA data – up to December 2017.

	State	NOF Band Annual Median	Trend
Waikaia River at Waipounamu Bridge Road			
E. Coli	In the best 50% of all lowland rural sites	D – For 20-30% of the time, the estimated risk to waders/boaters is >5% 5-year median = 150 n/100 ml	Very Likely Degrading
Clarity (Black disc)	In the best 50% of all lowland rural sites	5-year median = 1.9 metres	Likely Degrading

[2] This site is significantly upstream but was chosen because it is the mainstem of the Mataura River and has full water quality and macroinvertebrate data.

Total Oxidised N	In the worst 50% of all lowland rural sites	A – unlikely to be effects on sensitive species 5-year median = 0.51 g/m^3 Exceeds ANZECC[3] trigger value of ≤0.444 g/m^3	Likely Degrading
Ammoniacal N	In the best 25% of all lowland rural sites	A – 99% species protection level. No observed effect on any species tested. 5 year median = 0.005 g/m^3	Indeterminate
Dissolved Reactive P	In the best 50% of all lowland rural sites	Meets ANZECC[3] criterion of <0.01 g/m^3 5 year median = 0.006 g/m^3	Indeterminate
Macroinvertebrate Community Index	Good. MCI is between 100 - 119.	5-year median = 115	Very Likely Degrading
	State	**NOF Band Annual Median PSWLP Receiving Water Standard Mataura 3**	**Trend**
Mataura River at Gore			
E. Coli	In the worst 25% of all lowland sites	E – For more than 30% of the time, the estimated risk to waders/boaters is >5% 5-year median = 375 n/100ml PSWLP ≤1,000/100ml Faecal coliforms Unlikely to be compliant with PSWLP standard	Likely Degrading
Clarity (Black disc)	In the worst 50% of all lowland sites	5-year median = 1.115 metres No PSWLP quantitative clarity standard	Indeterminate
Total Oxidised N	In the worst 25% of all lowland sites	A – unlikely to be effects on sensitive species 5-year median = 0.89 g/m^3 No PSWLP nitrate N standard Exceeds ANZECC[3] trigger value of ≤0.444 g/m^3	Indeterminate
Ammoniacal N	In the best 25% of all lowland rural sites	A – 99% species protection level. No observed effect on any species tested. 5-year median = 0.005 g/m^3 PSWLP <2.5-0.9 (pH 6.0-8.0)	Indeterminate

[3] ANZECC 2000: Australia and New Zealand guidelines for fresh and marine water quality, Australian and New Zealand Environment and Conservation Council.

		Compliant with PSWLP standard	
Dissolved Reactive P	In the best 25% of all lowland rural sites	Meets ANZECC[3] criterion of <0.01 g/m3 5-year median = 0.006 g/m^3 No PSWLP DRP standard	Indeterminate
Macroinvertebrate Community Index	Fair. MCI is between 80 - 99.	5-year median = 94 No PSWLP MCI standard	Indeterminate

For the upstream site at Waikaia River at Waipounamu Bridge Road monitoring site, the data over the past 10 years indicates that trends are very likely or likely degrading for most key water quality indicators except for ammoniacal nitrogen and dissolved reactive phosphorus.

The monitoring results indicate that water quality on the mainstem of the Mataura River is generally similar between the upstream and downstream and with the exception of microbiological quality, is largely consistent with the regional plan objectives (See Section 6). Most of the variables measured, with the exception of ammoniacal N and dissolved reactive P, have indicated higher concentrations at the downstream site. However, an increase in river nutrient concentrations moving downstream is normally found in lowland New Zealand rivers. At both monitoring sites (Waipounamu Bridge Road and Gore), dissolved reactive phosphorus concentrations are below the relevant ANZECC trigger value of 0.010 g/m^3 while nitrate N concentrations at both sites exceeds the trigger value of 0.444 g/m^3 (for 'slightly disturbed lowland streams', Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000).

Under the National Objectives Framework, an 'A' Band Annual Median is defined as "water quality … considered suitable for the designated use". The microbiological band grading of E is defined as follows: "*For more than 30% of the time, the estimated risk is >=50 in 1000 (>5% risk). The predicted average infection risk is >7%. The predicted average infection risk is the overall average infection to swimmers based on a random exposure on a random day, ignoring any possibility of not swimming during high flows or when a surveillance advisory is in place (assuming that the E. coli concentration follows a lognormal distribution). Actual risk will generally be less if a person does not swim during high flows*."

Very recently we have been provided with the annual and monthly periphyton monitoring data for the Mataura River Gore water quality monitoring site. This data is illustrated in the following figures.

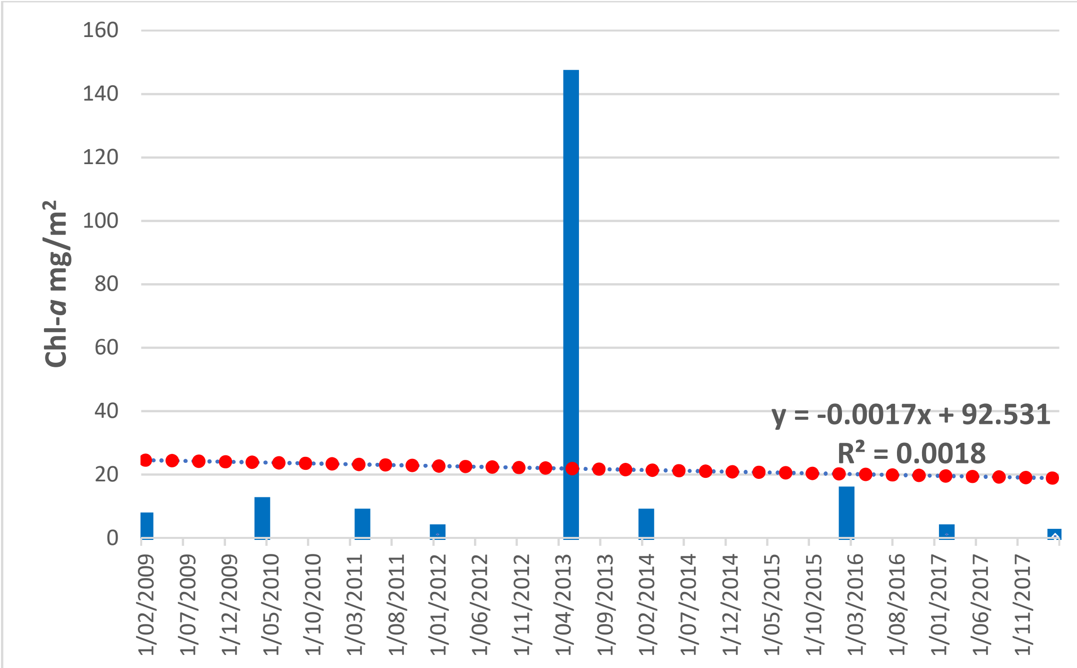

Figure 5a Annual periphyton sampling results for the Mataura River Gore water quality monitoring site, 2009 – 2018 (ES data)

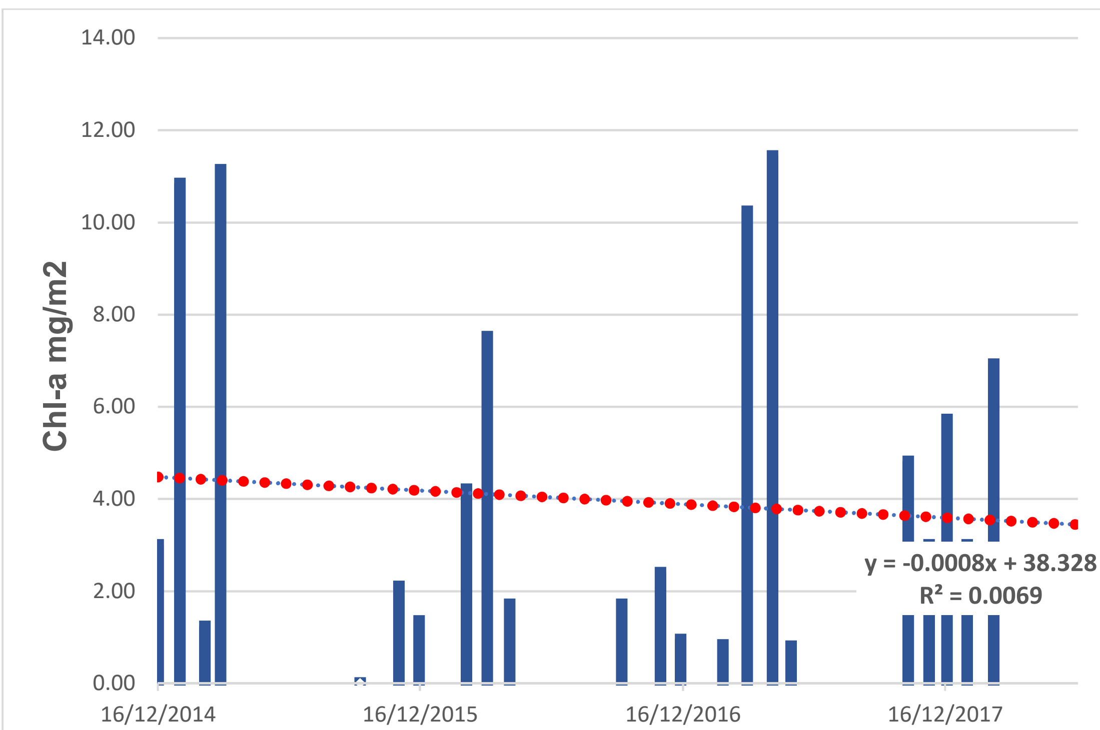

Figure 6b Monthly periphyton sampling results for the Mataura River Gore water quality monitoring site, 2014 – 2018 (ES data)

The monthly periphyton monitoring does appear to have been undertaken as indicated in the NPSFM and undertaken for at least three years. The Mataura River at this location is defined under the REC classification system for the periphyton attribute as the Default Class, and the calculated 92%ile value is 10.9 mg chl-*a* /m^2 and therefore this site has a periphyton Attribute State of 'A' (≤ 50 mg chl-*a* /m^2) or "*Rare blooms reflecting negligible nutrient enrichment and/or alteration of the natural flow regime or habitat.*".

In summary, the surface water quality monitoring data does not indicate a significant deterioration in water quality moving downstream between these two sites in the Mataura River system. However, data is not available for all local tributaries, and information from many land use and water quality investigations in Southland highlight the need to minimise contaminant loss from land into water bodies to ensure that the water quality of rivers remains consistent with the relevant objectives in the relevant statutory planning provisions (See Section 6).

3.2.2 Groundwater

The property is classified as overlying the Knapdale Groundwater Management Zone[4] (RWPS) and the Croydon GMZ (PSWLP). The proposed abstraction for dairy shed use and stock supply is from both of these zones.

The hydrogeological setting of the Knapdale GMZ consists of a thin layer of Quarternary gravels which forms an unconfined aquifer. These gravels have varying permeability, with more recent gravel deposits having higher permeability. Underlying the gravel deposits to an unknown depth are tertiary lignite measures of the Eastern Southland Group and greywacke of the Murihiku Terrane. Depths to groundwater throughout this zone is shallow, with seasonal fluctuations at depths below 2 metres. Groundwater levels increase rapidly in winter months, followed by a gradual decrease in summer and autumn, which is characteristic of Lowland aquifers. Recent aquifer tests undertaken on test bores indicate moderate to high transmissivity values of up to 900 m^2/day, which is potentially high enough for small-scale pasture irrigation. The Knapdale GMZ is recharged by rainfall and flow loss from tributaries and is a lowland aquifer.

However, the PSWLP has delineated a new groundwater management zone for this area based on the hydraulic connection to the Mataura River, and the applicants' property is located in the Croydon GMZ. This new zone is 4,585 ha in area and represents a subdivision of the existing Knapdale GMZ. The subdivision separates lower-lying alluvial terraces along the riparian margin of the Mataura River from higher elevation terraces along the northern margin of the Mataura Valley[5].

For the Knapdale GMZ, the amount currently allocated under the RWPS has reached overallocation, with 110% of the discretionary allocation limit allocated to permit holders under the RWPS. However, under the PSWLP, 75.6% and 55% of the discretionary allocation limit within the Croydon GMZ and Knapdale GMZ, respectively, is allocated to permit holders. These figures are up to date, as of April 2, 2019.

Generally, groundwater quality within the KGMZ complies with limits set in the Drinking Water Standards for New Zealand (DWSNZ). However, it has been established since at least 2012 that areas of groundwater in the KGMZ have significantly elevated nitrate-nitrogen concentrations[6]. Because the Environment

[4] Environment Southland. *Knapdale groundwater zone information sheet.*

[5] Environment Southland. *Croydon groundwater zone information sheet.*

[6] Hughes B (2012) Knapdale Groundwater Zone Technical Report, Report prepared for Environment Southland, June 2012.

Southland public GIS system does not include the results of more recent groundwater quality testing, Landpro requested data which indicated elevated nitrate-nitrogen concentrations, in an area generally to the south of the dairy shed as shown in the following figure.

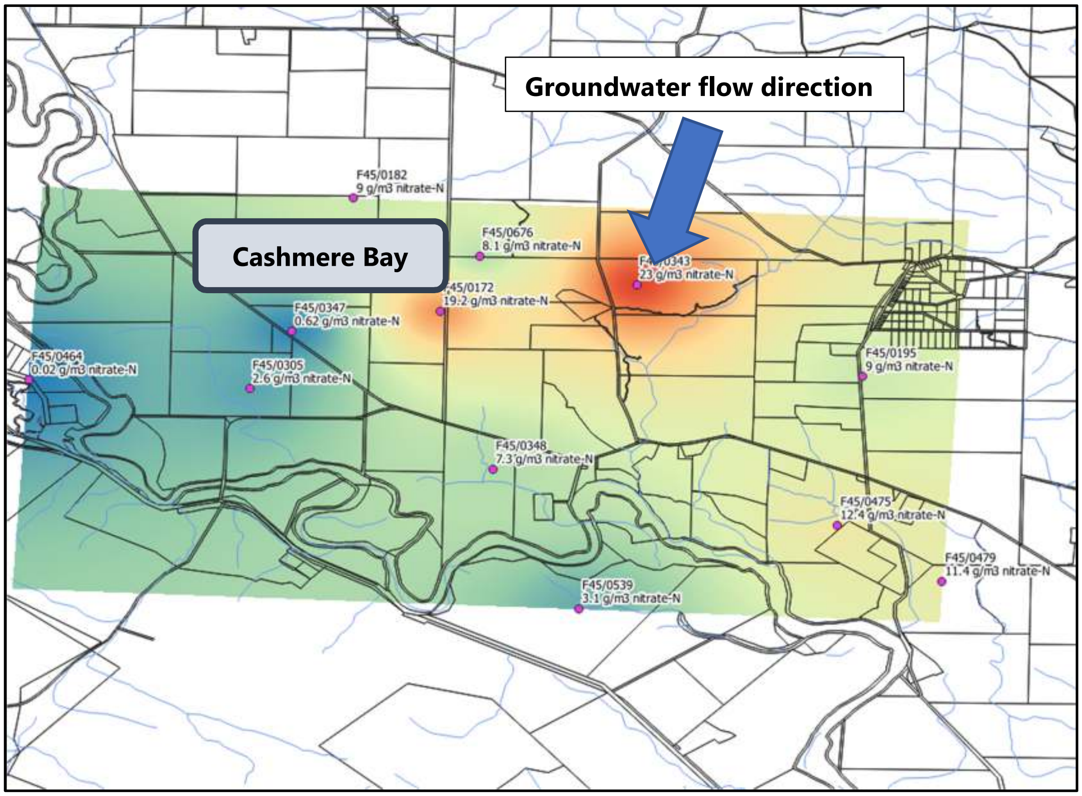

Figure 7 Contour map developed to show groundwater quality results for the wider groundwater area (groundwater quality data provided by ES, maximum for each bore used to generate heat map)

There are six bores in the general location of the elevated nitrate-nitrogen concentrations, F45/0343, F45/0676, F45/0221, F45/0444, F45/0445, and F45/0172. Groundwater quality monitoring undertaken from a number of these bores (particularly F45/0343 and F45/0172) has indicated elevated concentrations of nitrogen (nitrate & nitrite), ranging from 6.2 to 23.00 g/m^3, with samples taken from May 1998 to April 2018.

The most likely reasons for these elevated concentrations are a combination of the pastoral and arable land together with shallow unconfined groundwater with limited saturated aquifer thickness (generally less than 10m), local rainfall as the primary recharge, and the moderate to low permeability of the aquifer. These factors have been identified in a number of reports on groundwater quality in Southland[7,8].

The trend over time for groundwater nitrate nitrogen in the wider area is illustrated in the following figure. This illustrates relatively stable concentrations of nitrate-nitrogen in bores in the area with the exception of groundwater from bore F45/0343.

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[7] Hughes B (2012) Knapdale Groundwater Zone Technical Report, Report prepared for Environment Southland, June 2012.
[8] SKM (2008) Balfour Nitrate Hotspot, Report prepared for Environment Southland, 30 June 2008.

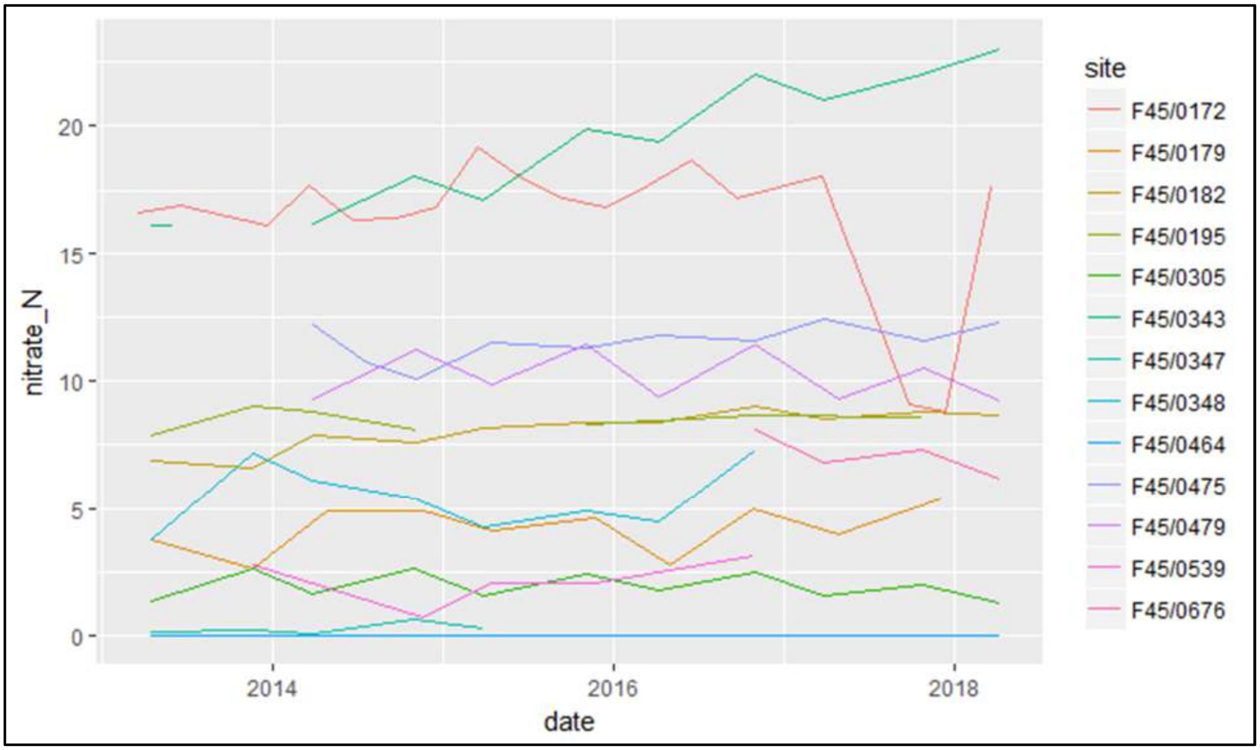

Figure 8 Groundwater quality results from 13 bores in the wider area from 2013 to 2018 (original data provided by ES)

The reason(s) for the increasing trend at location F45/0343 is not clear but we have discussed this issue with staff at ES and we have formed a tentative view that it is likely to be a combination of more intensive arable and pastoral land use in combination with local effluent management practices. Our understanding is that ES staff are continuing to investigate this specific 'hotspot'.

We emphasise that groundwater flow in this area is reported[9] as being primarily south by south-west. And therefore, Cashmere Bay Dairy will definitely not be contributing to the hotspot at F45/0343 and highly unlikely to be contributing to any significant extent to the hotspot at F45/0172.

Site-specific monitoring of water quality

Subsequent to the granting of the existing discharge permit (AUTH-301811-V1), ES have undertaken site inspections and water quality sampling from monitoring bore E45/0182 (an 8 m deep bore, approximately 100 m north-west of the dairy shed) over a fifteen-year period from November 2003 to April 2018. Groundwater quality, in terms of *E. coli* and nitrogen trends (nitrate+nitrite N combined), has been monitored at approximately six monthly intervals.

Nitrate nitrogen

Water quality results indicate that at this location groundwater nitrate-nitrogen concentrations have not exceeded MAV (NZ Drinking Water Standard Maximum Acceptable Value). Over the past seven years of sampling, nitrate-nitrogen concentrations have ranged between 6.6 g/m^3 and 9.0 g/m^3 with no apparent trend. However, it is important to highlight that there were no specific upgradient samples of groundwater taken to attempt to identify wider groundwater quality or trends. This means that it is not possible,

[9] Hughes B (2012) Knapdale Groundwater Zone Technical Report, Report prepared for Environment Southland, June 2012.

particularly in the context of wider agricultural land use, to separate out the specific effects of the effluent discharge or more general land management practices on groundwater quality.

E. Coli (MPN)

Under the Drinking Water Standards for New Zealand (2005), the accepted MAV for *E. Coli* concentrations is less than 1 MPN in 100 mL of sample. Monitoring at Bore F45/0182 between 2003 and 2018 indicates low concentrations of *E. Coli* throughout the majority of the monitoring regime where levels are below 1 MPN/100mL. Within this time period, five samples taken had results at or above 1 MPN/100mL. This is common for relatively shallow unconfined groundwater in an area with significant pastoral land use.

Drinking Water Sites

The nearest drinking water site is approximately 10.3 km down-gradient of the property, near Gore. There are three drinking water sites located in this area, which provide water services for a population between 5,000 to 10,000 people and operated by Gore District Council. Drinking water at these sites is sourced from two bores (Jacobstown Wells and Coopers Wells) and the Mataura River. Under Appendix J of the PSWLP, these sites are located in a Drinking Water Protection Zone, with Coopers Wells also located within a Microbial Health Protection Zone. The subject property is not within these protection zones.

3.2.3 Estuary

The Toetoes/Fortrose Harbour is a shallow tidal river estuary that is about 4.7 km^2 in size and located approximately 74 km downstream of the property. There is SOE monitoring undertaken in Toetoes Harbour in the form of macroalgal monitoring, fine-scale monitoring and broad-scale mapping. This monitoring program shows the estuary is in "good condition" with "the presence of nuisance macroalgal blooms, moderate sediment oxygenation, and a benthic community indicating slightly polluted conditions, suggesting that the estuary is in a mesotrophic or moderately enriched state".

Ecologically, the estuary has diverse habitats with extensive tidal flats and saltmarshes. The estuary provides good habitat for fish, birdlife and tidal flat organisms with the estuary rated as "outstanding" in the Wetlands of National Importance to Fisheries Database.

A coastal risk assessment undertaken by Wriggle Coastal Management in 2016[10] shows that both sediment and eutrophication are ongoing issues within the estuary, as a result of increased muddiness and macroalgal growth which in turn has contributed to reduced sediment oxygenation and poor water clarity, along with recent seagrass losses. This indicates that current inputs of fine sediment and nutrients exceed the assimilative capacity of the estuary. The following table summarises the changes in macroalgal cover from 2003 to 2016.

[10] Stevens, L.M., and Robertson, B.P. 2017. Fortrose (Toetoes) Estuary 2016: Broad Scale Substrate, Macroalgae and Seagrass Mapping. Report prepared by Wriggle Coastal Management for Environment Southland. 28p.

Table 4: Summary of intertidal opportunistic macroalgal cover, Fortrose Estuary, 2003-2016.

Year	% cover (Ha)		Result
	20-50%	>50%	
2003	<1	<1	Very little macroalgal growth present in the estuary.
2009	35	20	Widespread growth in central basin and eastern side of estuary. Little growth in the west and across the lower estuary, but localised concentrations of windblown algae.
2010	4	20	Most macroalgal growth and localised concentrations of windblown algae located on the Eastern Flats. Little growth across the north, west or lower estuary flats.
2011	1	12	Most extensive as windblown deposits on the Eastern Flats. Little growth across the north, west or lower estuary flats. Reduced cover in central basin.
2012	2	8	Little growth across the north, west or lower estuary flats. Low cover in central basin. Most extensive growths near river channel margins.
2013	38	23	Widespread growth in central basin and eastern side of estuary. Little growth in the west and across the lower estuary. Most extensive growths near river channel margins.
2016	38	17	Widespread growth in central basin and eastern side of estuary. Little growth in the west and across the lower estuary. Most extensive growths near river channel margins. Significant establishment of dense raised beds of entrained *Gracilaria* in sheltered areas, particularly near Titiroa Stream which were retaining substantial amounts of soft mud.

Results from the above table show there was very little intertidal growth in 2003, and from 2009 to 2012 macroalgal cover remained relatively consistent. This variation in cover was mostly due to flood-related scouring of growths from the estuary. More recently, between 2013 and 2016, biomass has increased significantly with macroalgae becoming more widespread, particularly near river channel margins. This has resulted in a rapid deterioration of sediment quality in affected areas with the establishment of eutrophic zones not previously present in the estuary.

The report recommends the development and use of catchment nutrient and sediment guideline criteria for each estuary type in Southland to derive thresholds protecting against adverse sediment and nutrient impacts.

3.3 Soils and Physiographic Zones

Soil types and physiographic zones present at the discharge area will guide the choice of which mitigation measures including Good Management Practices (GMPs) the applicant will adopt to ensure that potential adverse effects associated with the proposed activities are managed as far as reasonably practicable.

The following provides a description of the soils, FDE classifications and physiographic zone(s) present as well as the associated risks. The farm has been assessed as a whole, following the addition of the new land (labelled as 'Sheep Block'). For completeness, soil types on the Run-off lease block are also assessed, although the applicant will not discharge FDE to this block.

Table 5: Summary of Soils, Physiographic Zone(s) and Risks at the existing property, Runoff Block and Sheep Block.

Soil Type	Vulnerability Factors			FDE Classification	*Physiographic Zone*
	Structural Compaction	N leaching	Waterlogging		
Existing Property (approx. 344 ha effective)					
Morven	Low (0.50)	Very High	Very Low	Category E Other well-drained but very stony flat land	**Oxidising** No Variant Overland Flow **Old Mataura** No Variant **Bedrock/Hill Country** No Variant Overland Flow
Pyramid	Moderate (0.59)	High	Low	Category C Sloping land	
Eureka	High (0.64)	Very Low	High	Category A Artificial drainage or coarse soil structure	**Gleyed** No Variant
Claremont	Very high (0.72)	Medium	High		
Selwyn	High (0.67)	Low	Very Low		**Oxidising** No Variant
Balmoral	Moderate (0.54)	Very High	Very low		
Dipton	High (0.68)	Medium	High		**Bedrock/Hill Country** Artificial Drainage
Runoff Lease Block (approx. 90 ha effective)					
Selwyn	High (0.67)	Low	Very Low	Category A Artificial drainage or coarse soil structure Category D Well-drained flat land	**Oxidising** No Variant
Claremont	Very high (0.72)	Medium	High	Category A Artificial drainage or coarse soil structure	**Gleyed** No Variant
Morven	Low (0.50)	Very High	Very Low	Category E Other well-drained but very stony flat land	**Oxidising** No Variant

Soil Type	Vulnerability Factors			FDE Classification	*Physiographic Zone*
	Structural Compaction	N leaching	Waterlogging		
Sheep Block (approx. 80 ha)					
Selwyn (Approx. 27 ha)	High (0.67)	Low	Very Low	Category A Artificial drainage or coarse soil structure	**Oxidising** No Variant
Eureka (Approx. 8 ha)	High (0.64)	Very Low	High		**Gleyed** No Variant
Claremont (Approx. 23 ha)	Very high (0.72)	Medium	High		
Morven (Approx. 16 ha)	Low (0.50)	Very High	Very Low	Category E Other well-drained but very stony flat land	**Oxidising** No Variant

3.3.1 Soils

- **Morven soils**
  Morven soils are classified as Cemented Firm Brown soils and are formed in gravely alluvium generally derived from schist greywacke rock. These soils are stone free with loamy to silt loam texture and are well drained. They have deep rooting depth and due to their moderate subsoil permeability, there is very low risk of waterlogging and structural compaction, however N leaching risk is very high. The base saturation and anion storage capacity (or P-retention) of these soils is medium (43%). Morven soils are suitable for a wide range of farming practices but can become dry over summer in northern Southland which can restrict pasture growth.

- **Eureka soils**
  Eureka soils are classified as Acidic Orthic Gley soils and are formed in gravelly alluvium generally derived from schist greywacke rock. These soils are stone free with silt loam texture and are poorly drained. They have extremely gravelly rooting depth and due to their moderate subsoil permeability, there is very low risk of N leaching, however structural compaction risk is high. The base saturation and anion storage capacity (or P-retention) of these soils is medium (38%).

- **Selwyn soils**
  Selwyn soils are classified as Cemented Firm Brown soils and are formed in gravely alluvium generally derived from schist greywacke rock. These soils are stone free with loamy to silt loam texture and are well drained. They have deep rooting depth and due to their moderate subsoil permeability, there is very low risk of waterlogging and structural compaction, however N leaching risk is very high. The base saturation and anion storage capacity (or P-retention) of these soils is medium (43%). Morven soils are suitable for a wide range of farming practices but can become dry over summer in northern Southland which can restrict pasture growth.

- **Balmoral soils**
  Balmoral soils are classified as Acidic Orthic Brown soils and are formed in gravely alluvium generally derived from schist greywacke rock. These soils are moderately stony with silty loam texture and are well drained. They have extremely gravelly rooting barrier and due to their moderate-rapid subsoil permeability, there is very low risk of waterlogging, however N leaching risk is very high with moderate structural compaction. The base saturation and anion storage capacity (or P-retention) of these soils is medium (36%). Morven soils are suitable for a wide range of farming practices but can become dry over summer in northern Southland.

- **Claremont soils**
  Claremont soils are classified as Fragic Perch Gley soils and are formed in gravely alluvium generally derived from schist greywacke rock. These soils are stone free with silty loam texture and are poorly drained. Rooting depth is severely restricted by a fragipan and due to their slow subsoil permeability, there is high risk of waterlogging with very high risk of structural compaction. The base saturation and anion storage capacity (or P-retention) of these soils is low (22%).

- **Pyramid soils**
  Pyramid soils are classified as Typic Argillic Pallic soils. These soils are moderately stony with silty loam texture and are well drained. Rooting depth is affected by fractured rock and due to their moderate subsoil permeability, there is high risk of N leaching. The base saturation and anion storage capacity (or P-retention) of these soils is low (19%).

- **Dipton soils**
  Dipton soils are classified as Argillic Perch-gley Pallic soils. These soils are slightly stony with silty loam texture and are poorly drained. Rooting depth is extremely gravelly and due to their moderate-slow subsoil permeability, there is high risk of waterlogging and structural compaction. The base saturation and anion storage capacity (or P-retention) of these soils is low (22%).

3.3.2 Physiographic Zones

- **Oxidising (No Variant and Overland Flow)**
  The Oxidising physiographic zone is the predominant zone underlying the existing dairy platform (64% of the current 442.6 ha of land), and also underlies the Runoff Block and Sheep Block. Oxidising means well aerated with plenty of oxygen. High levels of oxygen allow nitrogen to build up, and therefore this setting has little to no ability to remove nitrogen (i.e. denitrification). Soils generally have good permeability although some soils in this zone have low subsoil permeability making them susceptible to waterlogging and therefore artificial drainage. Overland flow can also occur when rainfall intensities exceed the soil's ability to absorb water. This is consistent with the Morven, Selwyn and Pyramid soil characteristics.

- **Gleyed**
  The Gleyed physiographic zone comprises predominately flat to undulating land that occurs between major river systems where soils are fine textured and poorly drained. This zone is characterised by soils which have distinctive redoxomphoric features such as mottling and gleying (resulting from extending periods of soil waterlogging). Soils in this zone have some ability to

remove nitrogen from water to the atmosphere via denitrification, however this process can be bypassed when contaminants are flushed to nearby surface water bodies via artificial drains and overland flow following heavy or sustained rainfall events[11].

- **Old Mataura**
  Approximately 16.5% of the existing dairy platform is contained within the Old Mataura physiographic zone. This zone makes a relatively small portion of the overall dairy platform when the Runoff Block and Sheep Block are included in this area. The Old Mataura PZ includes geology found only on older terraces in the Mataura catchment. Soils are highly weathered and well drained, and therefore this setting has little to no ability to remove nitrogen (i.e. denitrification). Soils generally have good permeability with water draining straight down to underlying aquifers. This means that aquifers in this zone are at risk from high nitrogen levels, as a result of nitrogen leaching to groundwater along with slow flow and lack of dilution of groundwater through aquifers. This is consistent with the Morven and Pyramid soil characteristics.

- **Bedrock/Hill Country (Overland Flow, Artificial Drainage and No Variants)**
  Approximately 6% of the existing dairy platform is contained within the Bedrock/Hill Country physiographic zone. This zone makes a relatively small portion of the overall dairy platform when the Runoff Block and Sheep Block are included in this area. The Bedrock/Hill Country PZ comprises predominately undulating to sloping land where soils overlie bedrock or glacial till. This zone occurs across prominent landforms and has no significant areas of groundwater. Contaminant loss to surface water is the main water quality risk associated with this zone. In areas where there are steeper slopes, this predominately occurs as overland flow and in flatter areas, artificial drainage often occurs (particularly around the base of hills). Similar to the Gleyed zone, soils within this zone have some denitrification ability provided there is sufficient residence of drainage water within the soil matrix. Given the generally flat to undulating slopes on this property, overland flow represents the major contaminant pathway.

3.3.3 Summary

The entire property (including the 'Sheep Block' and 'Runoff Lease Block') overlies a variety of Physiographic Zones. As a result, the key contaminant pathways are assessed for each block, as summarised below:

Current Dairy Platform

The existing dairy platform is dominated by flat to sloping land and the key contaminant pathways are via artificial drainage and overland flow. This is consistent with the Oxidising and Bedrock/Hill Country physiographic zones and characteristics of the majority of soil types at this site, of which there is high to very high risk of waterlogging and structural compaction after heavy rainfall. Surface run-off is also an important consideration because of the predominance of relatively heavy soils, especially the Pyramid soil type which has various physiographic zones with Overland Flow variants. A large proportion of the existing farm property consists of Morven and Balmoral soils which are prone to nutrient leaching to groundwater, as characterised by soil/landscape Category E.

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[11] Environment Southland Physiographic Zone Fact Sheets (2015).

Runoff Lease Block

The Runoff Lease Block is dominated by flatter land. Soil types and physiographic zones present at this site are similar to those at the 'Sheep Block' where there is a risk of contamination via artificial drainage and deep drainage. No effluent will be discharged on the Runoff Lease Block, so it is only the grazing of young stock that must be managed in such a way as to prevent transport contamination via artificial drainage. Morven soils are also present at this site, of which the key contaminant pathway is deep drainage. This is characteristic of the Oxidising physiographic zone and soil/landscape Category E classification.

Sheep Block

The Sheep Block is dominated by flatter land, although there is a steep terrace which dissects through the block. Soil types and physiographic zones (i.e., Oxidising and Gleyed physiographic zones) present at this site pose a risk of contamination via artificial drainage and deep drainage. The approximate location of the Sheep Block in relation to the physiographic zones is illustrated in the following figure.

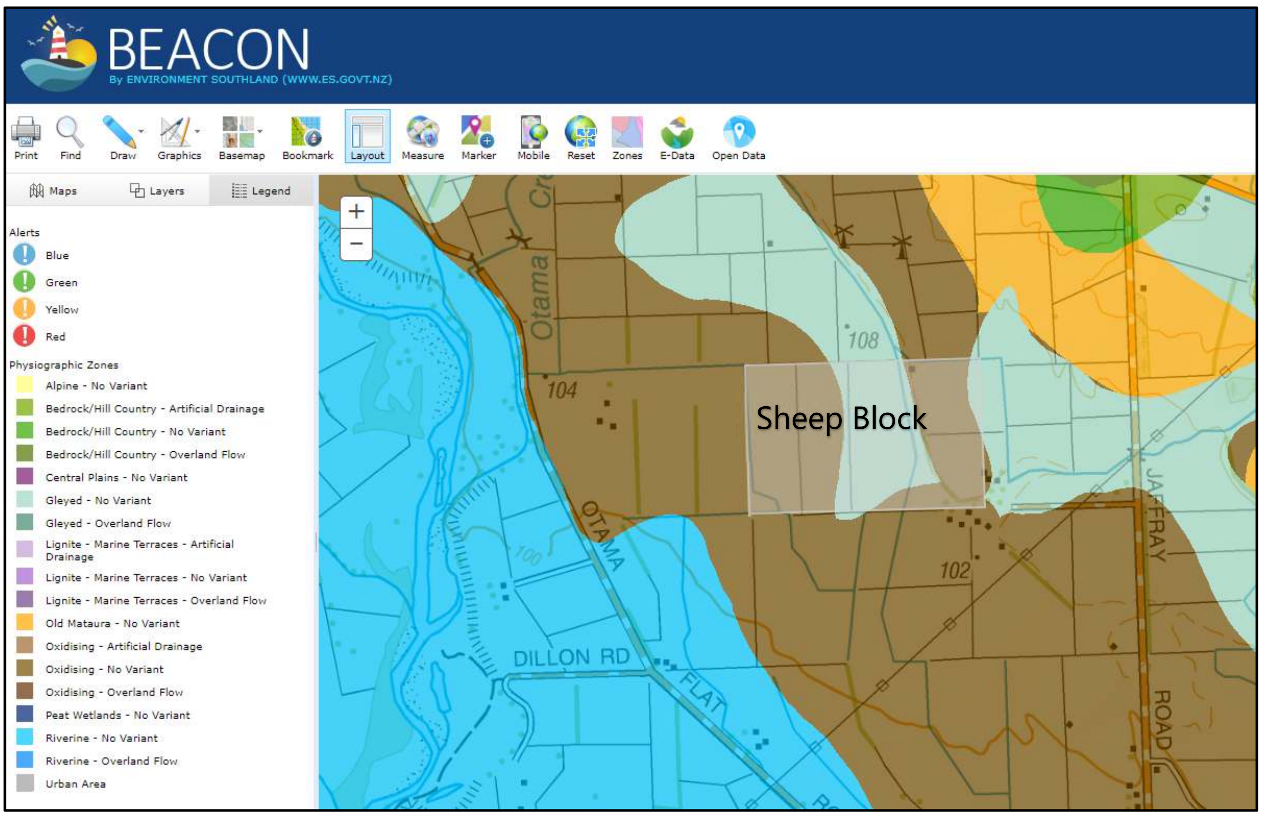

Figure 9 Location of Sheep Block relative to physiographic zones (Source: Beacon GIS)

The Sheep Block is contained within both the Oxidising and Gleyed zones which therefore relates to policies 6 and 10 of the PSWLP. Further assessment of the proposed activity against both policies is provided later in this report.

No effluent will be discharged on the Sheep Block, so it is only the grazing of stock that must be managed in such a way as to minimise contaminant transport via artificial drainage. Morven soils are also present at this site, of which the key contaminant pathway is deep drainage. This is characteristic of the Oxidising physiographic zone and soil/landscape Category E classification.

4. ACTIVITY CLASSIFICATION

4.1 Consents Required

The following resource consents are required under the Regional Water Plan for Southland, 2010 (RWPS) and Proposed Southland Water and Land Plan, 2018 (PSWLP).

Table 6: Applicable Rules

Consent	Plan	Rule	Activity Status
Land Use Consent to use land for a farming activity	RWPS	N/A	N/A
	PSWLP	20(e)	Discretionary

Overall, the proposal is for a ***discretionary*** activity, as discussed in the following table.

Rule 20 of the Proposed Southland Water and Land Plan

No other changes are sought, and the applicant will not be increasing cow numbers following the expansion of the dairy platform. Given that this application relates to Rule 20 of the PSWLP only, Table 2 below describes the proposed farming activity in the context of descriptive conditions in Rule 20, to clarify the proposal in the context of Rule 20 conditions. Details of previous and proposed winter grazing activities are discussed in section 5.1 of this report.

Table 7 Rule 20 of the PSWLP

Rule 20 PSWLP	Proposed Farming Activity
(a) The use of land for a farming activity is a permitted activity provided the following conditions are met:	
(a)(i) The landholding is less than 20 hectares in area	The existing and proposed landholding is not less than 20 hectares, therefore does not meet this condition.
(a)(ii)(1) the dairy platform has a maximum of 20 cows	The dairy platform is authorised for a maximum of 1,000 cows, and therefore does not meet this condition.
(a)(ii)(2) the dairy platform had a dairy effluent discharge permit on 3 June 2016 that specified a maximum number of cows	Discharge Permit AUTH-301811-V2 authorises the discharge of farm dairy effluent from up to 1,000 cows. This number of cows is not proposed to change or increase.
(a)(ii)(3) cow numbers have not increased beyond the maximum number specified in the dairy effluent discharge permit that existed on 3 June 2016	Cow numbers are not proposed to increase.
(a)(ii)(4) from 1 May 2019, a Farm Environmental Management Plan for the landholding is prepared and	The Farm Environmental Management Plan is appended in Attachment D.

implemented in accordance with Appendix N;	
(a)(ii)(5) the landowner provides to the Southland Regional Council on request: (A) a written record of the good management practices, including any newly instigated good management practices in the preceding 12 months, occurring on the landholding; and (B) the Farm Environmental Management Plan prepared in accordance with Appendix N	The applicant is happy to provide on request records of good management practices undertaken on-farm. These are detailed in the attached FEMP.
(6) the land area of the dairy platform is no greater than at 3 June 2016	The applicant proposes to incorporate the 80-ha Sheep Block into the existing dairy platform, thereby increasing the land area beyond the area that existed on 3 June 2016
(7) no part of the dairy platform is at an altitude greater than 800 metres above mean sea level	The dairy platform (existing and proposed) is located at approximately 130 masl.

4.2 Consents Not Required

In accordance with Schedule 4 of the RMA, an application must describe and demonstrate compliance with any permitted activity that is part of the proposal to which the application relates.

Table 8 Activities for which Consent is Not Required

Activity	Compliance with the relevant permitted rules of the RWPS and PSWLP
Use of land for the maintenance and use of an existing agricultural effluent storage facility (Rule 32D of the pSWLP)	The use of land for the maintenance and use of an existing agricultural storage facility (includes ponds, weeping walls, sumps and stone traps etc) that was authorised before 4 April 2018 may continue until six months after the PSWLP becomes fully operative. The construction of the existing effluent storage pond was authorised by resource consent 301813. As the scale of the facility hasn't changed since 4 April 2018 (no proposed increase in cow numbers or water usage in the dairy shed), existing use rights under s.20A of the RMA can be applied in respect of all of the onsite agricultural storage facilities, including the synthetically-lined effluent storage pond with stirrer and concrete stone trap.
Incidental discharges from farming (Rule 24 pSWLP)	The land use associated with this discharge is authorised under Rules 20, 25 or 70.
Establishment of a New Dairy Farm (Rule 17A RWPS)	The proposal is not for a new dairy farm and no new dairy shed is required, so this rule does not apply.
Fertiliser (Rule 10 RWPS & Rule 14 pSWLP)	All practicable measures will be taken to minimise fertiliser drift beyond the target areas. Fertiliser will be applied to selected areas of the farms in accordance with nutrient budget recommendations, and soil tests to avoid excess leaching of

Activity	Compliance with the relevant permitted rules of the RWPS and PSWLP
	nutrients to groundwater. Fertiliser will be applied when a soil water deficit exists, and all waterways will have riparian margins with stock excluded.
Silage storage and silage leachate (Rule 51 of the RWPS, and Rules 40 & 41 of the pSWLP)	All silage storage facilities are located away from sensitive receiving environments, in accordance with permitted rule setbacks and no direct discharge of silage leachate to any waterbody is proposed. The silage pad is not hooked up to the effluent system, and therefore silage leachate is discharged to land in accordance with the rules listed in the column to the left.
Sludge (Rule 38 of the PSWLP)	Solid sludge effluent collected from the stone traps and effluent pond will be laid out to dry before applying to land when conditions are suitable, observing appropriate separation distances, and there will be no disposal of solids to any waterway.
The use of land for feed pads/lots (Rule 35A of the PSWLP)	The use of land for a feed pad/lot is a permitted activity, as the calving pad accommodates no more than 120 adult cattle. The calving pad is sited well away from sensitive receiving environments (i.e., not within 50 metres of artificial water courses, natural wetlands or rivers). The loading pad is constructed with wood-based material at a minimum depth of 500 mm which is scraped and spread to non-effluent blocks in January.
Cleanfill, Farm Landfills and Offal Holes (Rules 53, 54 & 55 of the RWPS, and Rules 42 & 43 of the pSWLP)	No more than 500 m^3 of material will be discharged within cleanfill sites. Stormwater will be directed away from fill areas and no unauthorised material will be placed into proposed fill areas. No naturally formed limestone rock is known to reside within the property. Excavation of fill holes do not intercept springs and are not below the seasonal mean groundwater level in that location. Sensitive areas can be easily avoided when undertaking these associated activities. Offal sites are to be covered and the surfaces to be restored to a similar state as surrounding land upon closing.
Drainage of Land (Rule 9 RWPS & Rule 13 pSWLP)	It is not anticipated that any discharge from subsurface drains would result in a conspicuous change to the colour and/or clarity of the receiving waters at a distance of 20 metres from the point of discharge. The proposed good management practices will significantly reduce the likelihood of any contaminants reaching the subsurface drains.

5. SECTION 88 AND SCHEDULE 4 CHECKLIST

Section 88 of the RMA requires that an application must be made in the prescribed form and manner and must include an assessment of the activity's effects on the environment, to be made in accordance with Schedule 4 of the RMA.

In addition to the application being made in the prescribed forms and manner, Section 88 of the RMA also requires that every application for consent includes an assessment of the effects of the activity on the environment as set out in Schedule 4 of the RMA. The following Assessment of Environmental Effects discusses the effects of the farming activity relevant under Rule 20 of the PSWLP. It includes relevant matters that relate to the discharge permit, water permit and winter grazing practices. Because the proposal relates to the use of land for farming under Rule 20, all relevant aspects of the farming activity have been clearly identified and defined, to provide an accurate representation of the actual farming activity proposed by the applicant.

We have carefully considered the requirements set out in Schedule 4 of the RMA and consider that the application contains all information required by Schedule 4 of the RMA and the relevant regional plans. A checklist is attached to demonstrate that the application fully satisfies those matters set out in s.88 and Schedule 4 of the RMA (Attachment E).

6. ASSESSMENT OF ENVIRONMENTAL EFFECTS

This assessment of environmental effects (AEE) assesses the effects on the environment resulting from the proposal to incorporate the Sheep Block into the existing dairy platform. The assessment is broken down to consider relevant effects from the farming activity, including currently authorised activities, the effects of incorporating the Sheep Block into the dairy platform, and cumulative effects of the proposal.

6.1 Assessment of effects from currently authorised and proposed activities

Section 3 of this report describes the existing environment relating to the subject landholding. A range of activities on the property are currently occurring as either permitted activities or consented activities. Policy 39 of the PSWLP directs that an assessment of <u>all adverse effects on water quality</u> from the activity should be done as a whole, putting aside the permitted baseline.

The assessment below assesses the farming activity in its entirety and doesn't use a permitted baseline approach to the assessment i.e., does not exclude those adverse effects on water quality authorised by permitted activity rules (as indicated by PSWLP Policy 39). The summary table assesses both existing activities and proposed activities after the incorporation of the Sheep Block into the dairy platform. The existing and consented activities will continue to occur and will remain largely unchanged following the proposed expansion of land.

The third column of the summary table describes current and proposed on-farm Good Management Practices (GMPs) and mitigations beyond those GMPs undertaken to ensure that potential effects of the farming activity are adequately avoided or mitigated. The GMPs are those that we understand as the intention of the PSWLP and current Environment Southland GMP Factsheets[12] and are considered the 'bare minimum requirement' for mitigating potential adverse effects. The Mitigations are on-farm practices which demonstrate that the applicant operates above and beyond GMPs.

From this summary table, an assessment of effects from the proposed farming activity is further discussed below in greater detail in terms of Overseer modelling, winter grazing, and cumulative effects. Proposed mitigations which include the industry GMPs are further detailed in the attached FEMP, produced by Brian Goodger of Fonterra.

[12] We note that the PSWLP definition of GMPs: "*Include, but are not limited to, the practices set out in the various Good Management Practices factsheets available on the Southland Regional Council's webpage*". We understand that references to external documents that may change without going through the RMA plan change process have not been accepted by the Environment Court as sufficiently certain and are proscribed by Clause 31 of Schedule 1 of the RMA.

Table 9 Potential effects and mitigation measures (which include many GMPs indicated in ES GMP Factsheets) that will be adopted for the existing and proposed activities

Activity	Potential effects	Current and proposed GMPs and Mitigation measures	Outcome
Activities currently authorised under Discharge Permit 301811-V2 and Water Permit 301812-V1			
Discharge of liquid effluent to land via low rate application, predominantly using existing K-line pods, cobra rain gun and two centre pivots to existing effluent discharge area (existing platform).	Potential for contaminant losses via all three pathways: leaching (N), artificial drainage (N, P, microbials) and overland flow (N, P, microbials) when nutrients in effluent are applied to land. Potential for contaminant losses to cause excess nutrients in surface water and groundwater bodies in the vicinity of the property, particularly via tile drain pathways on the Braxton soils. In general, excess nutrients result in water quality degradation causing ecological stress for plants and animals.	*Good Management Practice* Effluent area receiving liquid FDE is sized to ensure nutrient loadings from the application of effluent are maintained at less than 150 kgN/ha/year to avoid excess nutrient loading. Use of low rate irrigation via Cobra Rain Gun, K-Line and Centre Pivot to ensure efficient disposal of effluent. Utilising low rate and depth of effluent application (<10mm/hr and 10 mm depths) between 1 September and 30 April each year ensures that FDE is only applied when a soil moisture deficit occurs and to avoid losses via artificial drainage by applying effluent in a manner which keeps nutrients in the root zone. Low rate effluent application (1.5mm/hr and 5 mm depths) between 1 May and 31 August each year and ensuring that effluent is not disposed of onto Oreti and Jacobstown soils (marked as 'Area A' on the existing Appendix 1 plan) between 1 May and 31 August each year. This ensures that FDE is only applied when a soil moisture deficit occurs and avoids losses via artificial drainage by applying effluent in a manner which keeps nutrients in the root zone, during the winter period when soil conditions are less likely to be suitable to receive higher rate of effluent irrigation. Use of deferred storage of effluent to allow effluent to be stored when soil conditions are unsuitable to receive effluent. The effluent storage pond is lined with a 1.5 µm HDPE synthetic	Reduced effluent application rates and depths during the winter period, GMPs and the resulting avoidance of effects supported by Policy 42 of the RWPS. The discharge of effluent is governed by the consent conditions in the discharge permit and will continue to be fully compliant with all those conditions. Adverse effects on the environment from the discharge of effluent will continue to be less than minor.

Activity	Potential effects	Current and proposed GMPs and Mitigation measures	Outcome
		liner and has a leak detection drain underlying the entire pond. Use of an umbilical system to discharge larger volumes of effluent to low risk soils when soil moisture deficit levels are appropriate to lower storage volumes. Buffer zones created from effluent application areas to critical source areas and other sensitive receptors such as bores, property boundaries and neighbouring dwellings outside the property boundary. *Mitigations above good practice* The centre pivots irrigate both water and FDE using Variable Rate Irrigation (VRI) and has a backflow prevention system to prevent FDE from flowing back through to the groundwater bore used for irrigation. The applicant also uses an ASR soil moisture probe to monitor soil moisture prior to irrigating FDE. This ensures that effluent is only discharged when there is a soil moisture deficit. The ASR soil moisture monitoring is sited on Eureka soils which is representative of more 'high risk' soils at the property.	
Intensive winter grazing on the existing Dairy Platform and Runoff Lease Block	Potential for significant amounts of contaminants (N, P, sediment and microbials) to be lost to both surface and groundwater bodies as a result of the complete de-vegetation of pasture/crop, treading damage on soil structure and runoff following rainfall events.	*Good Management Practice* Buffer zones maintained between crop cultivation and critical source areas to provide an area where runoff can be filtered and captured, limiting risks of entering water. Grazing direction will be away from buffer zones/critical source areas leaving 'last bite' to provide a buffer zone for nutrient capture through until the end of the fodder grazing period.	The overall nutrient budget and FEMP has taken this high potential contaminant loss activity into account and included appropriate mitigations including grazing from top to bottom of slopes, fencing off CSAs, provision of water troughs, and 5 m buffer margins between winter grazing areas and waterways. These

Activity	Potential effects	Current and proposed GMPs and Mitigation measures	Outcome
	Nutrient losses from this activity occur via deep drainage through the soil profile into the underlying aquifer, most likely to occur in the Oxidising and Old Mataura physiographic zones. Nutrient losses can also occur via artificial drainage and Overland Flow into adjacent waterways (Otama Creek and its tributaries), most likely to occur in the Gleyed and Bedrock/Hill Country physiographic zones. Excessive nutrient losses can cause nutrient accumulation in groundwater and excessive nutrient load in waterways causing water quality degradation and the resulting ecological stress on plants and animals when the life-supporting capacity of the water is compromised by excess nutrients.	Back fencing and portable water troughs to limit treading damage over already de-vegetated ground. Cultivation of paddocks timed to avoid paddocks sitting bare for long periods of time which reduces risks of contaminant losses through leaching and overland flow. Cultivating with land contour rather than up and down the slope. All other GMPs listed in Rule 20 will be implemented by May 2019, as further discussed in section 6.3 below. Bare soils are cultivated using full cultivation to avoid paddocks sitting bare for long periods of time, which reduces risks of losses of excess nutrients remaining from the grazing activity to the environment via overland flow and leaching. *Mitigations above good practice* The applicant proposes to put a 10-metre riparian strip and fencing around the existing pond, located on the dairy platform. The 10-metre strip is more than required to prevent stock access to waterways.	measures will reduce the adverse effects to the minimum practicable. Refer to FEMP for detailed specific GMPs.
Fertiliser application regime across entire landholding	The application of nutrients in fertiliser has the potential to result in direct nutrient losses to the environment if fertiliser is applied either in excess to plant requirements or at a time when it cannot be utilised for pasture/crop production. Nitrogen losses from fertiliser application is most likely to occur via deep drainage. Phosphorus losses from	*Good Management Practice* Time N, P, K and S fertiliser application to meet crop and pasture demand using split applications and avoid high risk times of the year. i.e. when soil temperature is less than 7 degrees, during drought periods and during periods when soils are at field capacity. Reduce use of P fertiliser where Olsen P values are above agronomic optimum. Maintain Olsen P at optimum level of 30.	Adverse effects are both avoided and mitigated with use of GMPs for fertiliser usage and further mitigations to reduce fertiliser across the dairy platform, as specified in the FEMP.

Activity	Potential effects	Current and proposed GMPs and Mitigation measures	Outcome
	fertiliser is most likely to occur via soil loss and/or direct loss through runoff or erosion. Adverse effects of inappropriate fertiliser application or excess application include a loss of excess nutrients to water causing water quality degradation in both groundwater and surface water bodies. Water quality degradation can adversely impact aquatic plant and animal ecosystems and impact on human health.	Use nutrient budgeting and annual soil testing to manage nutrient inputs from fertiliser and outputs to guide farm management decisions which can maintain overall nutrient losses at desired level. Fertiliser is not applied in close proximity to waterways.	
Use of the existing effluent storage facilities on existing dairy platform	If a structure is leaking or not structurally sound these is a risk of contaminant losses directly to shallow groundwater. Contaminant accumulation in groundwater can lead to human health issues from blue baby syndrome or *E. coli* contamination if drinking water is abstracted nearby. Contaminants may also reach surface water bodies if there is a groundwater/surface water connection which can cause water quality degradation effects such as algal blooms, smothering and eutrophication in surface water bodies.	*Good Management Practice* Monthly/frequent effluent system checks will be undertaken in accordance with the farm's maintenance checklist. Leaks will be repaired immediately. Fail-safe systems will be kept in place and kept in good working order i.e. automatic alarm and shut off system. All staff involved in the management of the effluent system are fully trained in its use. Ensure compliance with discharge permit conditions. *Mitigations above good practice* The applicant frequently checks the leak detection drain inspection hatch to monitor groundwater quality. The existing discharge permit does not require the leak detection hatch to be checked, therefore this is considered a mitigation measure above GMP.	Effluent storage facilities are fit for purpose and leaks are identified through regular testing and checking of the effluent storage structures, including the leak detection drain.

Activity	Potential effects	Current and proposed GMPs and Mitigation measures	Outcome
Groundwater abstraction on existing dairy platform.	Groundwater abstractions must be at a rate which doesn't cause drawdown effects on adjacent bores which can compromise the availability and reliability of the resource for other users. Groundwater abstractions must be at a level which does not result in an over-allocation of the resource which can adversely impact on drinking water availability, water availability for commercial and industrial uses. Water use in the dairy shed should be managed to ensure there is little wastage because the more water used, the more effluent generated which needs to be discharged to land.	*Good Management Practice* Ensure compliance with water permit conditions. Treating cows gently to avoid upset and contribute to needing minimal amounts of water for dairy shed washdown.	No adverse effects on aquifer sustainability or the availability and reliability of water for other users.
Pasture irrigation	Following heavy and inefficient irrigation, the volume of water within the soil can increase above field capacity. This is where water can no longer be retained within the soil and deep drainage to groundwater occurs. Whilst this process helps with the recharge of underlying aquifers, it can also result in nutrient leaching of contaminants via deep drainage to groundwater. Overland flow and ponding can also occur as a result of over-watering	*Good Management Practice* All water use on farm is metered, with telemetry records. *Mitigations above good practice* Soil moisture probes and the Harvest monitoring system has been installed to monitor water use and record where and when irrigation occurred, and the volume of water irrigated. This ensures efficient irrigation and water use. Use of low rate irrigation methods, including centre pivot irrigation which has VRI installed. Use of rotorainers for low rate irrigation of groundwater. Current farm policy is that if 10mm of rain occurs then both forms of irrigation are switched off for 2 days.	No adverse effects on aquifer sustainability or the availability and reliability of water for other users. Groundwater usage is reasonable in terms on end use. Adverse effects should be less than minor.

Activity	Potential effects	Current and proposed GMPs and Mitigation measures	Outcome
	from inefficient pasture irrigation. This promotes overland flow of contaminants to surface waterways. Groundwater abstractions must be at a rate which doesn't cause drawdown effects on adjacent bores which can compromise the availability and reliability of the resource for other users.	End guns on the Centre Pivot switch off when approaching laneways and property boundaries.	
Calving Pad	Potential for contaminant losses via all three pathways: leaching (N), artificial drainage (N, P, microbials) and overland flow (N, P, microbials) when cows are grazing and/or calving on pasture during adverse weather conditions which are generally more common during Spring (August/September). Potential for contaminant losses to cause excess nutrients in surface water and groundwater bodies in the vicinity of the property, particularly via tile drain pathways on the Braxton soils. In general, excess nutrients result in water quality degradation causing ecological stress for plants and animals.	*Good Management Practice* Wood bark/chip lined calving pad is only used in August for short periods by less than 120 cows, to reduce pugging on pasture. The calving pad is scraped each year and solids applied to whole farm. The calving pad is located well away from any waterways so no risk runoff from the pad when it is in use.	Adverse effects are both avoided and mitigated with the use of the calving pad and is determined to have a 'low risk rating' in terms of impact and likelihood of contamination, as specified in the FEMP.
Proposed Activities after the incorporation of the Sheep Block			

Activity	Potential effects	Current and proposed GMPs and Mitigation measures	Outcome
Capital fertiliser applications during conversion of 80ha of sheep land to dairy farming land	Capital fertiliser applications will apply larger quantities of N, P, K and S to land in order to increase fertility. These applications of larger quantities of nutrients have the potential to result in losses to the environment if applied at rates which exceed the plant's ability to utilise these applied nutrients. Excess applied N is likely to be lost to water bodies via nutrient leaching on both Morven, Pyramid and Balmoral soils. Excess applied P is likely to be lost to water bodies via overland flow and/or artificial drainage on Eureka, Claremont, and Dipton soils.	*Good Management Practice* Any capital fertiliser application needed would be applied at a time that avoids high drainage periods such as late autumn and winter and periods when soil temperature is less than 7 degrees. More detailed fertiliser GMPs are included in FEMP. Regular soil testing will be undertaken to guide fertiliser requirements.	Capital fertiliser applications are only undertaken where there is a nutrient deficit and are done at a rate which meets this deficit and avoids the application of excess nutrients. There is a low risk of adverse effects eventuating as application will meet pasture demand.
Cultivation of new pastures on new 80ha block	Short term increase in potential sediment, microbial and phosphorus losses to the environment which can cause ecological stresses on plants and animals due to sedimentation, algae blooms and water temperature increases in waterways and estuaries	*Good Management Practice* Re-sow bare paddocks as soon as possible. Use buffer zones around critical source areas and use direct drilling if possible. Cultivation will be undertaken to meet permitted activity criteria in Rule 25(a) of the PSWLP maintaining a 5-meter buffer zone. *Mitigations above good practice* Use of Ecotain or other environmental plantain with 20% pasture mix. This results in large reduction in N leaching from cow urine patches whilst also increasing feed quality during summer and autumn.	Adverse effects will be adequately avoided as this is a low risk activity in this location. GMPs provide adequate mitigation of effects.
Construction of new lanes on new 80ha block	New laneways create high risk areas for sediment, microbial and P losses.	*Good Management Practice* No stockpiling of earthworks material near waterways.	Overseer assumes 30% of dung deposited on lanes is lost directly to

Activity	Potential effects	Current and proposed GMPs and Mitigation measures	Outcome
	Short term increase in potential sediment, microbial and phosphorus losses to the environment which can cause ecological stresses on plants and animals due to sedimentation, algae blooms and water temperature increases in waterways and estuaries	Identification of critical source areas including losses from laneways and high traffic zones. Ensuring that all waterways are fenced off from stock, with buffer strips along the banks of the waterways. The attached FEMP shows existing and proposed. *Mitigations above good practice* A wetland area is proposed on the Sheep Block, with a 10-metre riparian strip along both sides of the waterway. Ensuring lanes over the farm are generally wide enough (approx. 5-7 metres) to facilitate good cow flow which reduces build-up of effluent in laneways. Laneways include camber and contouring to direct runoff to pasture and away from waterways (see attached FEMP for photos).	waterways, regardless of where the waterways are located in relation to the laneways. Overseer will have overestimated P losses (and sediment losses) because it doesn't recognise that the applicant will be implementing GMPs that cannot currently be modelled by Overseer. See section 6.2.1 of this report.
Imported supplementary feed and feed made on-farm and fed during the season across existing platform and new block	Supplementary feed usage has an impact on the pasture production of the farm system and can change the quantity of N particularly in the farm system compared to an all-grass based diet. Low N supplementary feeds can reduce estimated N losses to the environment as less N needs to be supplied to fuel pasture production which in turn can have beneficial effects on water quality by reducing nutrient load in groundwater and surface water bodies.	*Mitigations above good practice* Supplementary feed imported onto the property has reduced by 350 T of barley grain between the 2017/2018 season and proposed scenario. Supplementary feed (baleage) made onsite and fed during the season has increased.	The addition of the Sheep Block will result in a reduced stocking rate, as cow numbers remain unchanged from consented numbers (1,000 cows). The reduced stocking rate has necessitated the reduction in imported supplementary feed to reconcile pasture production between the two systems. Likely to have positive effects on the environment.

Activity	Potential effects	Current and proposed GMPs and Mitigation measures	Outcome
Intensive winter grazing on the Sheep Block	Potential for significant amounts of contaminants (N, P, sediment and microbials) to be lost to both surface and groundwater bodies as a result of the complete de-vegetation of pasture/crop, treading damage on soil structure and runoff following rainfall events. Nutrient losses from this activity occur via deep drainage through the soil profile into the underlying aquifer, most likely to occur in the Oxidising physiographic zone. Nutrient losses can also occur via artificial drainage and Overland Flow into adjacent waterways (Otama Creek and its tributaries), most likely to occur in the Gleyed physiographic zones. Excessive nutrient losses can cause nutrient accumulation in groundwater and excessive nutrient load in waterways causing water quality degradation and the resulting ecological stress on plants and animals when the life-supporting capacity of the water is compromised by excess nutrients. FDE collected from the dairy shed is not proposed to be disposed onto the Sheep Block, so it is only	*Good Management Practice* Buffer zones maintained between crop cultivation and critical source areas to provide an area where runoff can be filtered and captured, limiting risks of entering water. Grazing direction will be away from buffer zones/critical source areas leaving last bite to provide a buffer zone for nutrient capture through until the end of the fodder grazing period. Back fencing and portable water troughs to limit treading damage over already de-vegetated ground. Cultivation of paddocks timed to avoid paddocks sitting bare for long periods of time which reduces risks of contaminant losses through leaching and overland flow. All other GMPs listed in rule 20 will be implemented by May 2019, as further discussed in section 6.3 below and in the attached FEMP. Bare soils are cultivated using full cultivation to avoid paddocks sitting bare for long periods of time, which reduces risks of losses of excess nutrients remaining from the grazing activity to the environment via overland flow and leaching. *Mitigations above good practice* Oats are sown after winter grazing for use as a 'catch crop' to absorb nutrients.	The overall nutrient budget and FEMP has taken this activity into account and provided mitigations and reductions in nutrient loss in other areas and activities across the landholding to reduce overall nutrient to the practicable minimum.

Activity	Potential effects	Current and proposed GMPs and Mitigation measures	Outcome
	the grazing of stock that must be managed in such a way as to prevent transport contamination via artificial drainage and deep drainage.		

6.2 Results from Overseer Modelling

Overseer Version 6.3.0[13] was used to model losses from the property as a whole. The three pre-expansion nutrient budgets are broken down into dairy platform and runoff blocks for 15/16 and 16/17 seasons and dairy platform, runoff and sheep block for the 17/18 season. The data inputs into the model were based on the '**actual** lawful use of the land' for the past three years for the dairy platform and runoff, as opposed to modelling consented maximums. Only one year's inputs were derived for the Sheep Block, as there was limited information for this site. Losses were then compared to the maximum consented stock numbers in the post-expansion scenario. The total N and P losses from the current pre-expansion scenarios for the dairy platform, runoff, and sheep blocks are summarised in a copy of the key table from the Overseer modelling report:

9.1 Pre-Expansion Results

	15/16*	**16/17**	**17/18**	**Average**
Peak Cows	1000 (2.4/ha)	950 (2.2/ha)	960 (2.4/ha)	970 (2.3/ha)
Total N Loss (kg)	20344**	17835**	21087	19757
N Loss/ha (kg)	43	37	40	40
Total P Loss (kg)	297***	290***	310	299
P Loss/ha (kg)	0.6	0.6	0.6	0.6
Pasture Grown Kg/DM/ha/yr (Dairy Platforms)	18,746 (irrigated) 14060 (non-irrigated)	18088 (irrigated) 13567 (non-irrigated)	19229 (irrigated) 14423(non-irrigated)	18687 14016

*See Section 7.1 & 10.1 for the makeup of these results
** Includes 1221kg total N loss from sheep 17/18 added
*** Includes 15kg total P loss from sheep 17/18 added

9.2 Post Expansion Results

	Proposed Dairy Unit
Peak Cows	1000 (2.0/ha)
Total N Loss (kg)	19668
N Loss/ha (kg)	38
Total P Loss (kg)	317
P loss/ha (kg)	0.6
Pasture Grown Kg/DM/ha/yr	17680 (irrigated) 13260 (non-irrigated)

Figure 10: Summarised predicted results from the current and proposed nutrient budgets (Source: Attached Overseer Nutrient Budgets).

[13] Since this modelling was undertaken a new version of Overseer has been released. Version 6.3.1 was released on 18 February 2019. Our understanding is that there have been some changes to the way in which N loss was modelled in fodder crop blocks in well-drained soils. (https://www.overseer.org.nz/files/download/0b2cd6e7988c69e) The Old Mataura physiographic zone is the only area with well-drained soil and that area is approximately 16.5% of the existing dairy platform. Results of re-modelling with Version 6.3.1 show no change in either N or P loss to water estimates. See Attachment F

Nitrogen losses to water are most likely to occur in the Gleyed, Bedrock/Hill Country and Old Mataura Physiographic Zones, via both artificial drainage and overland flow pathways. The results for the whole new property including the Sheep Block indicate a small reduction in the areal nitrogen loss rate from 40 to 38 kg N/ha/yr. This modelling combined with the range of proposed mitigation measures to be implemented means that there is a high level of certainty that the actual loss of N to water will be less with the proposed development compared to the average situation prior to the addition of the 80 ha sheep block. As noted earlier, the predevelopment N modelling did not include N loss to water from earlier wintering off. Therefore, the predevelopment N loss to water estimate under-estimated the total N loss from the full "landholding".

The proposed addition of the Sheep Block results in an Overseer modelled increase in the total amount of P loss to water across the whole farm from 299 kg P/yr to 317 kg P/yr. A very small increase of 18kg. This is a 6% increase in total P loss over the property. As noted for the N loss to water estimates the predevelopment P loss estimate does not include losses associated with off-site wintering. The modelled increase is primarily because Overseer assumes more laneways because of the overall increase in area of 80 ha.

It is important to appreciate that Overseer assumes that all phosphorus loss modelled flows from the property into a surface water body. However, significant parts of this property are separated by over a kilometre and a number of adjacent properties from the nearest downstream surface water body.

The attached Farm Environmental Management Plan (FEMP) contains mitigations which will be implemented on farm to mitigate the actual losses from 'other sources' like laneways. Many of these mitigations are not recognised by Overseer and need to be modelled separately to fully account for the mitigation benefits. This is documented in the following section.

6.2.1 Overseer modelling and inputs

The Overseer modelling has been done on the basis of the proposed farm system including the number of R1s and R2s. However, the applicant does not consider it appropriate for conditions to be imposed that limit anything more than the maximum number of cows. This combined with appropriately worded conditions that limit contaminant losses to those modelled by Overseer and conditions that require the full suite of all mitigations proposed will provide an extremely high level of certainty that the adverse effects will be limited to those specified in the application.

6.2.2 Overseer Modelling Limitations and Additional Phosphorus Loss Modelling

The Overseer nutrient budgets suggest a slight increase in the total P loss of 18kg over the whole farm. The key driver for this increase in P loss is from "other sources". Overseer does not model nutrient loss into final receiving groundwater or surface water bodies. The amount of these nutrients which may end up in these water bodies depends on a wide range of different factors often collectively referred to as attenuation rates. Similarly, the catchment hydrology and characteristics are critical in affecting the resultant concentration and/or mass loadings of nutrients and other contaminants in water bodies.

'Other sources' of P account for 57% of total P losses for the proposed scenario, which are farm scale losses from farm infrastructure, i.e. laneways, silage stacks etc. According to a recent AgResearch report, P losses in 'other sources' are mostly derived from lanes. Overseer assumes 30% of P deposited on a lane is lost to water[14]. Therefore, when a dairy farm is expanded, more lanes generally need to be constructed, and the model then assumes that additional phosphorus is lost from those lanes.

As part of the proposed dairy expansion, the applicant proposes to construct additional laneways and culverts which will allow access from the current dairy platform to the Sheep Block. One unnamed tributary enters the current dairy platform from the east boundary and traverses through the Sheep Block.

The FEMP details a range of additional mitigation that would specifically reduce the loss of P from the property. These mitigations are not modelled within Overseer and therefore P loss reductions are estimated from the best available relevant research. The following table is a summary of the specific mitigation measures and the estimated effects on P loss reduction.

Table 10 Estimates of additional P loss mitigation not modelled by Overseer

Mitigation measure	Comment/references/calculations	Estimated P loss reduction
1. 2.9 km of drains to be fenced with 2 m wide riparian strips either side.	Estimated catchment area minimum = 62 ha. If assume proportional catchment i.e., 62/522 or receives ~38 kg P of the total 317 kg P. Research indicates this would reduce P loss by 10 – 30 %. Assume average, or 0.2 x 38 = **7.6 kg** P reduction.	**7.6 kg**
2. Sheep Block 350 m of defined water way to be fenced with 10 m wide riparian strips either side.	Lower sheep block area estimated at 55 ha. If assume proportional catchment i.e., 55/522 or receives ~33 kg P of the total 317 kg P. Research indicates this would reduce P loss by 10 – 30 %. Assume high range for 10 m wide CF 2 m wide, or 0.3 x 33 = **9.9 kg** P reduction.	**9.9 Kg**
3. Pond (W2 in FEMP) to be fully fenced with riparian buffer.	Pond catchment area estimated at 17 ha. If assume proportional catchment i.e., 17/522 or receives ~10 kg P of the total 317 kg P. Research indicates this would reduce P loss by 10 – 30 %. Assume average range for pond fencing and buffer, or 0.2 x 10 = **2 kg** P reduction.	**2 Kg**
4. Wetland	A new wetland will be constructed on the Sheep Block with a 10 m wide riparian strip. However, because the details of this wetland have not yet been finalised, no P loss reduction has been estimated.	**No reduction estimated.**
5. Re-cambering of lanes running alongside waterways to direct runoff away from waterway.	Estimated 1,200 m of a total of 5,500 m laneways running alongside drains/creeks. Overseer assumes up to ~150 kg lost from lanes (1,000 cows x 10.2 kg x 0.05 x 0.30).	**10 Kg**

[14] Gray et al (2016) Review of the phosphorus loss sub-model in OVERSEER®, Report prepared for OVERSEER® owners under AgResearch core funding contract A21231(A)

	Therefore approximately 33 kg from 1.2 km of laneway. Assume if redirected away would reduce by at least 30% or ~ **10 kg** P reduction.	
6. Culvert repairs and improvements	There will be a reduction in P loss but there is no robust research information to base an estimate on.	**> 0 Kg**
	Total	**> 29.5 Kg**

The combination of these initiatives would come to a total P loss reduction of approximately greater than 29.5 Kg P/year. These estimates include some significant conservative estimates. Even so we acknowledge that these are rough estimates and suggest that to be even more conservative we reduce the overall total estimate to 25 Kg P/year. This would still be significantly greater than the Overseer modelled increase of 18 Kg P/year. This results in an overall estimate of P loss from the property decreasing slightly from 299 Kg P/year to less than 292 Kg P/year.

The uncertainties involved in Overseer modelled estimates of nutrient loss to water are not currently able to be quantified. They are probably greater than 30% for both N and P modelling[15].

There are two significant conclusions from this:

- This uncertainty needs to be carefully considered when simply comparing two Overseer nutrient loss estimates e.g., a relatively small difference in nutrient loss estimates between two scenarios may not reflect an actual difference.
- Overseer modelling should be considered in conjunction with the specific farm systems and mitigation measures that are proposed to provide a reasonable level of certainty about nutrient loss estimates.

In this situation we can be confident that with the range of specific mitigation measures proposed to be included in this proposal to add 80 ha to an existing dairy farm that the amount of P lost to water will decrease.

6.2.3 Conservative Assessment

Using Overseer (version 6.3.0), the attached nutrient budgets have been constructed for the current land use, using the actual cow numbers on the dairy platform (rather than consented) and the proposed nutrient budgets describe the intended farm system on both the current dairy platform and the Sheep Block. The assessment of the "existing environment" has taken into consideration the activities that have been occurring on-site, based on the 'actual lawful use of the land' for the past three years for the dairy platform and Runoff Block.

Only one year of data can be provided for the Sheep Block, which was obtained from Country & Co Realty Limited, who provided stock figures for 160 ha, as described on Page 12 of the attached Overseer Report. These stock figures were re-calculated to take into account the 80ha block being included in the proposed dairy expansion, which were worked out on a per ha basis and then multiplied to 80ha. Fertiliser inputs were also not available for the organic sheep/beef operation and so fertiliser inputs are based on what would

[15] Wheeler D & Shepherd M (2013) Overseer: Answers to commonly asked questions, RE500/2012/027

typically be used on local organic sheep and beef farms in the Eastern Southland district. Therefore, the inputs modelled for the Sheep Block are based on assumptions from local organic sheep and beef farms in the surrounding district, as opposed to 'actual' inputs used at the Sheep Block.

6.3 Winter Grazing Practices and Off-Site Effects

Table 12 summarises the overall cow numbers and crop area for Cashmere Bay Dairy Ltd property. The table shows there is a slight increase in the total cow numbers winter grazed on farm, when comparing between the current and proposed activities. The number of cows grazed on and off farm, along with cultivation areas, are discussed in further detail below.

Table 11 Summary of previous, current and proposed winter grazing and cultivation

	2015/2016 season	2016/2017 season	2017/2018 season	Proposed 2018/2019 season
Peak cow numbers	1000	950	960	1000
Cows wintered on farm	400	720	730	800
Cows wintered off farm	0	0	0	0
Young stock wintered on run-off block	220 R1s 220 R2s	209 R1s 209 R2s	211 R1s 211 R2s	220 R1s 220 R2s
Crop area cultivated and grazed on farm	5 ha fodder beet 14 ha kale	32 ha fodder beet	34 ha fodder beet	34 ha fodder beet
Crop area cultivated and grazed on run-off block	4 ha annual ryegrass to fodder beet 4 ha fodder beet	4 ha annual ryegrass to fodder beet 3.5 ha fodder beet	4 ha fodder beet	4 ha fodder beet

Previous winter grazing

Previous winter grazing from the last three years is described in detail in the attached Overseer Report and summarised in the above table. The cow numbers previously winter grazed on-farm and off-farm are consistent with the nutrient budget attached with the exception that cows previously wintered off-site have not been modelled. Overseer has modelled what has been and will be occurring on the dairy platform, Sheep Block and lease Runoff Block only, and no off-site winter grazing has been taken into account in the modelling. The effect of this will be to under estimate the pre-development nitrogen loss to water from the entire farming activity, as we are comparing N losses from the on-farm activities only. Nutrient budgets have been done using 'actuals' rather than consented numbers.

Proposed winter grazing

The attached FEMP shows the land area of where cultivation is proposed to occur for winter grazing in the 2019 winter period. The applicant proposes to cultivate approximately 38 ha of land for the grazing of fodder beet. This total land area is inclusive of the dairy platform and Runoff Block. The total landholding (including the dairy platform, Runoff Block and Sheep Block) equates to approximately 523 ha, which equates to 7.3% of the area of the landholding and therefore meets the permitted activity requirements under Rule 20(a)(iii) of the PSWLP.

Of the peak number of cows (1000), approximately 200 cows would be culled and replaced each year. This means up to 800 cows are proposed to be winter grazed on the dairy platform on approximately 34 hectares of fodder beet crop. Up to 440 young stock are proposed to be winter grazed on approximately 4 ha of fodder beet crop on the Runoff Block. As a result, the landholding will be self-contained, with all stock proposed to be winter grazed on-farm, including the dairy platform, Sheep Block and lease Runoff Block. This allows the applicant to oversee the winter grazing operation as stock are grazed on-farm as opposed to being grazed off-site. Resource consent is not required for the proposed winter grazing and cultivation activities on-farm, as shown in the following table.

Table 12 Summary of proposed winter grazing relative to relevant PSWLP rule 20 conditions

Rule 20(iii) PSWLP	Proposed Winter Grazing Activity
(iii) where the farming activity includes intensive winter grazing on the landholding, the following conditions are met:	
(1) from 1 May 2019, intensive winter grazing does not occur on more than 15% of the area of the landholding or 100 hectares, whichever is the lesser; and	The applicant proposes to cultivate approximately 38 ha of land for the grazing of fodder beet for the 2019 winter season. This total land area to be winter grazed includes the dairy platform, Sheep Block and lease Runoff Block, as shown on the Land Management Map (page 19) in the attached FEMP. The total landholding (including the dairy platform, Runoff Block and Sheep Block) equates to approximately 523 ha, and therefore the area proposed to be winter grazed is less than 15% of the landholding. Given that the proposed winter grazing area is a permitted activity, the applicant is not proposing that the winter grazing areas be specified in any more detail than already contained in the FEMP.
(2) from 1 May 2019, a Farm Environmental Management Plan for the landholding is prepared and implemented in accordance with Appendix N; and	The Farm Environmental Management Plan is appended in Attachment D below.
(3) from 1 May 2019, all of the following practices are implemented: (A) if the area to be grazed is located on sloping ground, stock are progressively grazed (break-fed or block-fed) from the top of the slope to the bottom, or a 20 metre 'last-bite' strip is left at the base of the slope; and (B) when the area is being break-fed or block-fed, the stock (excluding sheep and deer) are back fenced to prevent stock entering previously grazed areas; and	The applicant will implement the practices as described in the adjacent column. Should winter grazing occur on sloping ground, stock will be break-fed and grazed from the top of the slope to the bottom of the slope. The applicant does not consider that a 20 metre 'last bite' strip is necessary, given that cows will be grazed towards the bottom of the slope. Critical source areas (such as swales) that accumulate runoff will be grazed last. The use of back-fencing will be implemented to prevent stock from entering previously grazed areas.

Rule 20(iii) PSWLP	Proposed Winter Grazing Activity
(C) transportable water trough(s) are provided in or near the area being grazed to prevent stock accessing a lake, river (excluding ephemeral rivers), artificial watercourse, modified watercourse or natural wetland for drinking water; and (D) if supplementary feed (including baleage, straw or hay) is used in the area being grazed it is placed in portable feeders; and (E) if cattle or deer are being grazed the mob size being grazed is no more than 120 cattle or 250 deer; and (F) critical source areas (including swales) within the area being grazed that accumulate runoff from adjacent flats and slopes are grazed last	Transportable water troughs will be provided for stock drinking water, located near the area being grazed. There shall be 5 metre buffer zones around all watercourses in the vicinity of the winter grazing area, and watercourses will be fenced off from stock to prevent stock access. Portable feeders are used when feeding out supplementary feed. Cows will be grazed in mob sizes with no more than 120 cows per mob. Other GMPs over and above those GMPs described in the adjacent column are detailed in the attached FEMP.
(4) from 1 May 2019, a vegetated strip is maintained in, and stock excluded from, the area between the outer edge of the bed of any lake, river (excluding ephemeral rivers where intensive winter grazing is permitted under Rule 20(aa)), artificial watercourse, modified watercourse or natural wetland for a distance of at least 5 metres	5 metre buffer zones will be put in place around all water ways where winter grazing is proposed to occur.
(5) from 1 May 2019, intensive winter grazing does not occur within 20 metres of the outer edge of the bed of any Regionally Significant Wetland or Sensitive Waterbodies listed in Appendix A, estuary or the coastal marine area;	No Regionally Significant Wetlands or Sensitive Waterbodies are identified within the dairy platform; therefore, this rule does not apply.
(6) no intensive winter grazing occurs at an altitude greater than 800 metres above mean sea level	The dairy platform (existing and proposed) is located at approximately 130 masl, and therefore not relevant.
(iv) for all other farming activities, from 1 May 2020 a Farm Environmental Management Plan is prepared and implemented in accordance with Appendix N.	Not applicable to this proposal.

Off-site effects will not occur from winter grazing, as the applicant proposes to winter graze all stock on-farm. Ensuring that the entire farming activity is self-contained enables the applicant to oversee the winter grazing operation and ensure that winter grazing is managed appropriately using a wide range of mitigation measures that include the good management practices highlighted in PSWLP Rule 20 (a)(iii)(3)(A – F). The additional mitigation measures relating to winter grazing are provided in Table 9 above. These mitigations demonstrate that the applicant is operating over and above the 'bare minimum requirements' to ensure that adverse effects from winter grazing are adequately mitigated.

6.4 Specific contaminant loss and cumulative effects on freshwater

A response to the original lodgement of this application stated that certain information would need to be included in an application before it would be considered complete. This stated: "*An assessment, prepared by a suitably qualified person that shows the annual amount of 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 the application being made*." We have carefully considered that request and provided additional information on those matters and receiving environments in this section.

Nitrogen and phosphorus

The background existing nitrate nitrogen concentrations in groundwater are relatively high as indicated earlier in this report. However, the mitigation measures included in the FEMP reflected in the Overseer modelling strongly indicate that the proposed inclusion of the 80ha block in the dairy farm will contribute to a small reduction in the overall nitrogen load in the area. In addition, because wintering off will be brought onto the milking platform N and P losses in locations where wintering was previously undertaken will also be reduced. The effect of this will be an extremely small reduction in the concentrations of nitrate nitrogen in local groundwater and an extremely small reduction in total nitrogen, dissolved inorganic nitrogen, total phosphorus and dissolved reactive phosphorus in surface waters downstream of the property.

The downstream dissolved reactive phosphorus concentrations in the Mataura River already comply with the relevant ANZECC guideline as indicated earlier in this report and the nutrient loss modelling and associated mitigation measures mean that the small reduction in phosphorus loss associated with this proposal will assist to maintain this situation.

As indicated earlier in this report the reductions of N and P loss from this property will be insignificant on the basis of one property within relatively large groundwater and surface water catchments. There would be no measurable change in either local or distant receiving water quality as a consequence of the GMPs and additional mitigation implemented on this property. Measurable enhancements in groundwater and surface water quality N concentrations or surface water quality P concentrations would only be achieved through a broader catchment approach to water quality management. This means that if equivalent measures were undertaken more broadly across the catchments, the suitability of groundwater would improve as a source of drinking water and the nutrient regime in surface waters would be compatible with a reduction in plant biomass e.g., periphyton. The overall effect of the changes in land use on the property would be a small contribution towards a reduction in existing adverse effects associated with nitrogen and phosphorus in water.

Sediment

It has been widely recognised for many years that there are major challenges in quantifying sediment loss from agricultural land. This has been recognised for Southland[16] as well as other parts of New Zealand[17]. A generally accepted approach[18] to estimating comparative sediment loss from agricultural land is to start by considering the Overseer modelling estimates for P loss. This is because the modelling of P loss is based in part on research into runoff associated P as a consequence of a wide range of rainfall and runoff events. Overseer estimates losses of P in soil runoff, fertiliser loss and effluent loss.

In a well-managed dairy farm such as Cashmere Bay Dairy the greatest source of modelled P loss is highly likely to be from soil in major rainfall events. Similarly, the greatest likely source of sediment loss is highly likely to be associated with soil loss in major rainfall events. Therefore, the mitigation measures that will reduce P losses are highly likely to result in a similar reduction in sediment losses.

The s.88 response letter asks for an assessment that shows "annual amount of sediment and microbiological contaminants discharged from the landholding will be no greater than the last 5 years prior to the application being made". It is not practicable to quantify the annual amount of sediment discharged from the property over the last five years, nor is it practicable to quantify the amount of sediment that would result after implementation of all the mitigation measures. However, there are sufficient relevant research and case studies that enable us to conclude that there will be a substantial and, if implemented as part of a catchment-wide programme, significant improvement in relevant water quality variables (e.g., black disc, turbidity and sediment deposition) in receiving waters. The overall effect of the changes in land use on the property would be a reduction in existing adverse effects associated with sediment in water e.g., reduction in smothering of stream bed macroinvertebrate communities.

Microorganisms

Similarly, it is generally accepted that faecal indicator organism loss from agricultural land is frequently associated with sediment loss[19]. Research by AgResearch[20] indicates that late autumn until mid-spring is the high-risk period as this is when surface runoff and mole-pipe drainage is most likely to occur. They also note that "*not all areas of the landscape contribute to flow pathways of loss. Those that do are termed critical source areas and are characterised as being directly "connected" to water bodies*". AgResearch suggest that improved effluent management, stock exclusion and the elimination of stock crossings will have the greatest impact in reducing microbiological contamination from pastoral farms.

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[16] Ledgard G *2013) Nitrogen, Phosphorus and Sediment losses from rural land uses in Southland, Technical Report, Environment Southland.

[17] Dorner Z, Doole G, Bermeo S, & Paterson J (2018) Economic assessment of options to mitigate sediment loss from New Zealand agriculture – in the context of managing freshwater quality, Bay of Plenty Regional Council

[18] Burkitt, L., Bretherton, M., Singh, R., Hedley, M., 2016. Comparing nutrient loss predictions using Overseer and stream water quality in a hill country sub-catchment. In: Integrated nutrient and water management for sustainable farming. (Eds L.D. Currie and R.Singh). http://flrc.massey.ac.nz/publications.html. Occasional Report No. 29. Fertilizer and Lime Research Centre, Massey University, Palmerston North, New Zealand.

[19] McDowell R, Wilcock B & Hamilton D (2013) Assessment of Strategies to Mitigate the Impact or Loss of Contaminants from Agricultural Land to Fresh Waters, Report prepared for MfE, Agresearch, NIWA & University of Waikato.

[20] Monaghan, R. M., Semadeni-Davies, A., Muirhead, R. W., Elliott, S and Shankar, U., 2010. Land use and land management risks to water quality in Southland. Prepared for Environment Southland, April 2010.

These mitigation measures will be adopted on farm through the implementation of the FEMP, which will ensure that the loss of faecal indicator organisms from the property will be significantly reduced. Therefore, adverse effects associated with microbial contamination will be reduced as far as reasonably practicable and will be less than occurring prior to the implementation of the FEMP. This will make an extremely small contribution to enhancing the microbiological quality of water in the downstream Mataura River and underlying groundwater.

With reference to the s.88 response letter above, it is not practicable to quantify the annual amount of "microbiological contaminants" discharged from the property over the last five years, nor is it practicable to quantify the amount of faecal indicator organisms that would result after implementation of all the GMPs. However, as with sediment there are sufficient relevant research and case studies that enables us to conclude that there will be a substantial and, if implemented as part of a catchment-wide programme, significant improvement in the microbiological quality of receiving waters and therefore their suitability for uses such as contact recreation (surface waters) and as a source of water drinking (groundwater).

We highlight the fact that the microbiological quality of the Mataura River at Gore is relatively poor and enhanced good management practices and mitigations at this property alone will not result in a measurable change in downstream microbiological water quality at this site. However, the overall effect of the changes in land use on the property would be a reduction in existing adverse effects associated with the human health risks associated with contact recreation in water with raised concentrations of faecal indicator microorganisms.

6.5 Cumulative effects on the Toetoes/Fortrose Harbour Estuary

The implementation of targeted mitigation measures on-farm will ensure that adverse effects on water quality from activities within the proposal are mitigated to levels that are likely to be consistent with the eventual catchment wide achievement of regional plan water quality objectives whilst still maintaining a viable, efficient farm system.

Nutrient Load to the Toetoes/Fortrose Harbour Estuary

The calculations below are purely an illustration to demonstrate potential nutrient load reductions and are based on significant assumptions and generalised workings and should not be treated as absolute figures in the context of this application.

Total nutrient load within the Toetoes/Fortrose Harbour Estuary catchment have been estimated in the Aqualinc report to assess how much impact the implementation of mitigation measures on farms may reduce N and P load within the estuary at the base of the catchment. The table below estimates three loads:

- the total load from each catchment estimated from catchment models
- the realised load which is based on water quality data and is the load exported from the catchment and includes an attenuation factor
- source load which is the loads delivered to the root zone from the source and doesn't include attenuation.

The table estimates the total source load within the catchment at 6,617 T N/year undergoing attenuation to result in an estimated 4,392 T N/year as a nutrient load within the receiving waters at the Toetoes Harbour Estuary.

Table 13 Estimated loads of nitrogen and phosphorus in the eight study catchments[21]

Catchment	Current catchment agricultural source loads (t/year)		Total catchment source nitrogen load (t/yr)	Estimated realised nitrogen loads (t/yr)	Estimated attenuation (%)
	Nitrogen	Phosphorus			
Bluff_Harbour	19	1	36	29	20
Haldane_Estuary	23	0	39	26	33
Jacobs_River_Estuary	1958	53	2133	1300	39
Lake_Brunton	20	0	20	14	30
New_River_Estuary	4969	139	5513	3718	33
Toetoes_Harbour	6256	142	6617	4392	34
Waiau_River	2714	35	4970	1864	62
Waikawa_Harbour	144	4	176	180	-2
Total/average	16,102	374	19, 404	11,524	31 (average)

The report then estimated how much these loads may reduce if mitigation scenarios are imposed on only dairy farms within the catchment. For the Toetoes Harbour Estuary catchment, N could be reduced by approximately 10% and P reduced by 18% under the full suite of mitigations (M3).

Table 14 Estimated reductions in the agricultural source loads under three levels of mitigation for all dairy farms in the catchment[22]

Catchment	M1			M2			M3		
	Nitrogen	Phosphorus	Overall[1]	N	P	Overall[1]	N	P	Overall[1]
Bluff_Harbour	4	26	2	4	29	2	12	29	6
Haldane_Estuary	0	0	0	0	0	0	0	0	0
Jacobs_River_Estuary	6	28	5	8	31	6	18	31	15
Lake_Brunton	0	0	0	0	0	0	0	0	0
New_River_Estuary	6	29	5	8	32	7	18	32	15
Toetoes_Harbour	3	17	3	4	19	4	10	18	9
Waiau_River	1	9	0	1	9	1	4	9	2
Waikawa_Harbour	1	4	1	1	5	1	2	5	2

The full suite of mitigations assessed by Aqualinc includes:

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[21] Aqualinc, *Assessment of farm mitigation options and land use change on catchment nutrient contamination loads in the Southland region*, 2014

[22] Aqualinc, *Assessment of farm mitigation options and land use change on catchment nutrient contamination loads in the Southland region*, 2014

Table 15: Description of mitigations assumed to apply under each mitigation level[23]

Mitigation level	Name	Sheep & Beef	Dairy
Mitigation level 1	M1	• Optimised nutrient inputs • Low solubility P • Wetlands	• Stock exclusion from streams • Improved nutrient management • Improved farm dairy effluent (FDE) management
Mitigation level 2	M2	• Stock exclusion from streams • Reduced stocking rates, improved productivity	• Wetlands • Improved FDE management • Reduced stocking rates, improved per animal productivity.
Mitigation level 3	M3	• Grass buffer strips • Feed pad for beef cattle	• Restricted grazing strategies • Grass buffer strips • Improved FDE management

In the context of the subject property, and according to the table above, the farm would be effectively operating at the M3 level excluding the provision of wetlands which is not considered necessary for the property. The mitigations proposed in the application are more specific, comprehensive and likely to be more effective at reducing N, P, sediment and microbial contaminant losses compared to the generic M3 level.

All 523 ha of the landholding is contained within the Mataura River catchment which represents 0.15% of the land area of the catchment. The implementation of the proposed GMPs within the application will reduce this contributing load to the upper catchment receiving waters by approximately 89 kg N (0.4% reduction) and by 7 kg P (2% reduction) at the minimum.

The Aqualinc report discussed above concluded that if mitigations were implemented on all farms within the catchment, not just dairy farms, then both N and P loads would decrease significantly to 30% for N and 39% for P.

As the figures above show, the applicant's operation represents a tiny proportion of the total Mataura River catchment area but the implementation of the proposed GMPs would indicate that if this was done as part of a catchment-wide programme there would be a substantial and meaningful reduction in the catchment nutrient loadings.

Currently there is no direct farm scale capping or restriction on the amount of nutrients lost to water. Under the proposal, the applicant volunteers both an ongoing restriction on the level of nitrogen outputs modelled by Overseer and the ongoing implementation of specific GMPs and additional mitigation measures. The result of long-term restrictions on the applicant as an operator is that they will be unable to further increase their N or P loss load.

This illustration shows that the applicants operation contributes extremely small proportions of the total nutrients to the receiving waters. Improvements made under the proposal will reduce total nutrient load

[23] Aqualinc, *Assessment of farm mitigation options and land use change on catchment nutrient contamination loads in the Southland region*, 2014

and nutrient concentration but in isolation from other farms will only have an insignificant impact on long-term water quality. This highlights the importance of catchment wide implementation of water quality mitigation measures to give certainty about the achievement of water quality objectives.

The overall effect of the changes in land use on this one property would be a tiny unmeasurable reduction in existing adverse effects associated with nutrient and other contaminants in the Toetoes/Fortrose Harbour Estuary.

6.6 Adverse effects on and from specific blocks on the property

We have been informed by Environment Southland that before this application will be considered complete under Section 88 of the RMA it must include an "…assessment of effects from the entire landholding on the receiving environment, including an assessment from each block (run-off, dairy platform and sheep block) individually;" and it must include "…an assessment of effects resulting from the proposed change in land use (organic sheep farm to dairy farm) on the new block".

We have examined both the surface water sub-catchments and groundwater flow direction for the area and the relevant planning provisions and cannot identify an effects or statutory/policy basis for attempting to separate out the Sheep Block and estimate contaminant losses from that block in isolation from other blocks. Similarly, we cannot see any effects based reason or robust statutory/policy basis for separating out the runoff block or the balance of the milking platform. If the property contained a catchment boundary, we could see a rationale for separating out an assessment based on those catchments. Rule 20 requires resource consent application to use land for a farming activity and the focus is on the whole landholding. We address the policy matters in Section 7 of this report.

Notwithstanding these concerns, we acknowledge that the change from an organic sheep farm to becoming part of an extended dairy farm is highly likely to increase the losses of nitrogen to groundwater from this block compared to losses that would have occurred while the block was run as an organic sheep block. However, the modelling and mitigation to be applied to the whole property means that we are very confident that for the property as a whole there will be a reduction in nitrogen and all other contaminants losses to water from the whole property. Therefore, it is highly likely that there will be an increase in contaminant loss to water from the sheep block's proposed use compared to its use as an organic sheep farm. However, we are very confident that the proposed range of good management practices and mitigation above and beyond these GMPs will more than offset these adverse effects.

We do not consider that there would be any benefit in analysing the Overseer modelling to try and separate before and after scenarios on the basis of the three components (Sheep Block, Run-off Block & Milking Platform) of the proposed farm.

The assessment of effects outlined above clearly demonstrates that adverse effects associated with the current dairy farm, particularly if the off-site adverse effects are considered, will be reduced as a consequence of extending the dairy farm to the new Sheep Block.

We note that the introduction of cows to the sheep block will have potential adverse effects on soil structure compared to the use of the land for sheep grazing. However, the applicant has received expert advice from

Fonterra staff that the soil is suitable for use as part of the milking platform and there would be no significant long-term adverse effects on soil structure.

6.7 Effects from the farming activity including currently authorised activities and off-site activities

We have been informed by Environment Southland that before this application will be considered complete under Section 88 of the RMA it must "… consider all effects for the entire "farming activity", including currently authorised activities and any off-site activities".

Because the application makes it clear that it involves the stopping of off-site winter grazing the only off-site effects are those that are potentially involved in the transport, manufacture and sale of milk products or potentially the positive economic, cultural and social effects of having a productive dairy farm and family in a community.

Notwithstanding our concerns about the scope and status of this request we have considered the current regional council resource consents. The current ES resource consents are a water permit (AUTH-301812-V2) and a discharge permit (AUTH-301811-V2). These are explained in Section 2.2.2 above. The relevant effects of these activities have been fully included in this AEE. Specifically, all the potential adverse effects of the irrigation of water and the discharge of farm dairy effluent have been taken into account in the Overseer modelling and other parts of the AEE.

We don't consider that the potential effects of taking water are a valid consideration under this resource consent application. Those matters were considered when the water permit was granted in 2012 and again when it was changed in 2013. Matters such as stream depletion, bore interference and allocation were addressed during the resource consent process at the time. We are not aware that anything has changed that would change the conclusions regarding stream depletion and bore interference made at the time. Notwithstanding our reservations about scope, we note that as at April 2, 2019, the Knapdale Groundwater Management Zone was 55.2%, and Croydon GMZ was 75.6% allocated with respect to the discretionary activity allocation threshold identified in the PSWLP.

Any effects relating to water quality related to existing ES resource consents have already been fully considered and addressed in this AEE. While we consider that other effects relating to the take and use of water are beyond the scope of this application, they are less than minor, have already been considered under a separate resource consent process and would not change as a consequence of this proposal.

6.8 Other Assessment Matters

In accordance with Clause 7 of Schedule 4 of the RMA the following provides an assessment of the activity's effects on the environment:

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

The applicant is already consented to abstract groundwater and discharge dairy shed effluent and until April 2018 did not need a resource consent for farming. Therefore, effects associated with these activities already form part of the existing environment. Throughout the duration of the existing consents, there have been no known complaints from neighbours.

The proposed dairy expansion, of which the Sheep Block is proposed to form part of the dairy platform, will result in a continuation of positive social and economic benefits. More generally, the dairy sector continues to contribute greatly to the New Zealand economy in many ways including gross domestic productivity, employment, community growth and resilience and reinvestment capacity via tax revenues. The ability for the applicant to continue to operate their dairying operation in an efficient manner will enable them to provide for their own social, economic and cultural wellbeing.

In terms of the potential effects on cultural values, an assessment of the proposal against the Te Tangi a Tairua is the Iwi Environmental Management Plan (applicable to the Southland Region), is made below. The proposal is considered to be wholly consistent with the relevant policies of the Iwi Management Plan.

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

In terms of landscape and visual effects, the presence of farming equipment, additional laneways and cows on the Sheep Block will not have adverse effects on the rural locality. The Sheep Block is located adjacent to the existing property boundary and is accessed via a right of way from Otama Flat Road. The addition of laneways, cows and infrastructure on this block of land will not have any adverse effects on landscape or have any negative visual effects.

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

The dairy farm is located within a highly modified ecological landscape and the proposal will not have any significant adverse effects on ecosystems above that which has been occurring for many decades. The applicant proposes riparian planting and fencing to prevent stock access to waterways flowing through the Sheep Block, which will have positive effects on ecosystems in the vicinity of the property.

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

The activities will not have any effect on any of these values, as the land in this area is historically known for farming activity.

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

Effluent disposal is an existing and authorised activity and is proposed to continue to be treated and discharged to land in accordance with the conditions outlined in the discharge permit/permitted activity. No FDE is proposed to be discharged to the Sheep Block. The activity is in keeping with the rural nature of the area, therefore it is not considered there will be any unreasonable emission of noise or odour.

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

All hazardous materials carried and used onsite will comply with the relevant rules of the Part operative Southland District Plan 2012, and the Hazardous Substances and New Organisms Act 1996. As such, there will be no risk to the neighbourhood, wider community or the environment due to natural hazards or the use of hazardous substances or hazardous installations

6.9 Assessment of Alternatives

Schedule 4 of the RMA requires that an assessment of environmental effects must include a description of any possible alternative locations or methods for undertaking the activity if it is likely that the activity will result in any significant adverse effect on the environment and/or if the activity includes the discharge of contaminants. The proposed dairy expansion activity as described in this report will not result in significant adverse effects on the environment. However, for completeness, an assessment of alternatives is provided.

Alternative Location

The applicant proposes to incorporate the Sheep Block as part of the existing dairy platform, thereby extending land area of the existing dairy platform. The dairy expansion enables the applicant to utilise this block of land for the grazing of cows, of which will not increase in numbers upon the granting of consent. The location of the Sheep Block is suitable for the proposed activity, as it is adjacent to the applicant's existing dairy platform and is sited very close to the dairy shed. This will improve the health and wellbeing of livestock, as cows would have less distance to walk to the dairy shed for milking.

The location of the Sheep Block is also not sited next to the road and is accessed via right of way. Therefore, the addition of laneways, cows and infrastructure on the Sheep Block will have insignificant visual effects as the Sheep Block is not easily seen by the public from the road. The above assessment of the receiving environment also confirms that soil types at this site are suited for the grazing of dairy cows, as there is less risk of N leaching to groundwater.

The Sheep Block is the most suitable location for undertaking the proposed activity. When comparing the suitability of the Sheep Block to other sites, there are no other possible alternative locations identified that would be available or more appropriate for the proposed dairy development.

7. STATUTORY CONSIDERATIONS

Schedule 4 of the RMA requires that an assessment of the activity against the matters set out in Part 2 and any relevant provisions of a document referred to in Section 104 of the RMA is provided when applying for a resource consent for any activity. These matters are assessed as follows.

7.1 Part 2 of the RMA

The proposal is consistent with the purpose and principles of the RMA, as outlined in Section 5. The proposal will have less than minor effect on the environment's ability to meet the reasonably foreseeable needs of future generations, or on the life-supporting capacity of the environment and any ecosystems associated with it. The proposal ensures that adverse effects on the environment are avoided or mitigated.

There are no matters of national importance under Section 6 of the RMA that will be affected by the proposal. In regard to Section 7 of the RMA, particular regard has been given to the efficient use and development of natural resources, and the maintenance and enhancement of the quality of the environment. Regarding Section 8, the proposed activity is not inconsistent with the principles of the Treaty of Waitangi.

Overall, the activity is considered to be consistent with Part 2 of the RMA, given the minor nature of the activity and the proposed mitigations.

7.2 Section 104(1)(b) of the RMA

In accordance with Schedule 4 of the RMA, an assessment of the activity against the relevant provisions of a document referred to in 104(1)(b) of the RMA must be included in an application for resource consent. Relevant documentation covered by this section are:

- National Environmental Standard for Sources of Human Drinking Water, 2007
- National Policy Statement for Freshwater Management, 2014
- Te Tangi a Tauira - The Cry of the People, Ngai Tahu Ki Murihiku, Natural Resource and Environmental Iwi Management Plan, 2008
- Regional Policy Statement for Southland, 2017
- Regional Water Plan for Southland, 2010
- Proposed Southland Water and Land Plan, 2018

Under the RMA, regional plans need to give effect to NPSs, NESs and RPSs. For an application of this scale, an assessment of the application against the regional plans is adequate as these plans ultimately give effect to the higher order statutory instruments.

The following policies from the RWPS, and the pSWLP, which give effect to the plans' objectives, are relevant to this application for Land Use Consent to use land for dairy farming.

Table 16 Applicable policies from the RWPS 2010

	Policy	Comment
1A	Any assessment of an activity covered by this plan must take into account any relevant Iwi Management Plan.	Te Tangi a Tauira is considered below.
13A	Transitional policy relating to the establishment of new dairy farms. (a) Recognise that the establishment of new dairy farms poses risks to water quality, including the quality of water in coastal lakes, lagoons, tidal estuaries, salt marshes and coastal wetlands, that need to be addressed when establishing a new dairy farm. (b) Manage the risk posed by the establishment of new dairy farms by requiring resource consent and requiring the documentation of risks and measures to avoid or mitigate them in a Conversion Environmental Plan. (c) Consideration should be given to, but not be limited to, the following matters; (i) the assimilative capacity and drainage characteristics of the soil and consequential effects on water quality;	Policy 13A relates to the *establishment of new dairy farms,* but the proposed activity is for expanded dairying on land that was not part of the dairy platform as at 3 June 2016. However, this policy is assessed for completeness to this application. The establishment of the Sheep Block as part of the existing dairy platform is highly likely to reduce adverse effects on water quality. This is because the overall

	(ii) the risks posed by the establishment of a new dairy farm to the water quality of water bodies, coastal lakes, lagoons, tidal estuaries, salt marshes and coastal wetlands; (iii) the extent to which those risks can be avoided or mitigated through measures proposed in the Conversion Environmental Plan; (iv) the likely effectiveness of the measures contained in the Conversion Environmental Plan; (v) how, and within what timeframe, those measures will be implemented. (d) Where the risks to the water quality of water bodies, coastal lakes, lagoons, tidal estuaries, salt marshes and coastal wetlands cannot be avoided or mitigated, the Council may decline consent for the establishment of a new dairy farm.	nitrogen loading is modelled to decrease in the proposed scenario. The Sheep Block is also suitable for the grazing of dairy cows given that the drainage characteristics of soil types underlying this block generally have very low to moderate risk of N leaching to groundwater. The potential risks to water quality as a result of the proposed dairy land expansion have also been considered in this report. The applicant proposes a range of mitigation measures, of which some are already implemented on-farm such as the use of ASR soil moisture monitoring and VRI irrigation for efficient FDE disposal. These mitigations (as specified in the attached FEMP) demonstrate that the applicant is operating over and above the 'bare minimum GMPs required' to ensure that the establishment of the Sheep Block to dairy farming will not result in adverse effects to the receiving environment that are more than minor.
25	To avoid, remedy or mitigate the adverse effects arising from point source and non-point source discharges so that there is no deterioration in groundwater quality after reasonable mixing, unless it is consistent with the promotion of the sustainable management of natural and physical resources, as set out in Part 2 of the Resource Management Act 1991, to do so.	The proposal is to extend the area of land by adding 80 ha. The actual number of cows will not increase. GMPs and mitigation measures as described in the FEMP will be implemented to mitigate adverse effects of non-point source discharges from the existing dairy platform, Runoff Block and Sheep Block. Therefore, overall the adverse effects will be appropriately mitigated.

35	Stock access to surface water (a) Encourage the exclusion of all stock from surface water bodies and artificial watercourses where practicable. (b) Ensure that when stock access to surface water bodies and artificial watercourses occurs, this is managed in a manner that avoids significant adverse effects on: (i) water quality; (ii) bed and bank integrity and stability; (iii) aquatic, riverine and riparian ecosystems and habitats.	All waterways on the property will be fully fenced from stock, complete with minimum two metre wide riparian buffer zones consisting of grass vegetation on both sides of drain and stream banks. For the Sheep Block, the applicant also proposes a wetland area with 10 metre buffer zones and fencing along both sides of the waterway. This mitigation measure is considered over and above GMPs.

Table 17 Applicable policies from the PSWLP

	Policy	Comment
1	Enable papatipu rūnanga to effectively undertake their kaitiaki (guardian/steward) responsibilities in freshwater and land management through the Southland Regional Council: 1. providing copies of all applications that may affect a Statutory Acknowledgement area, tōpuni (landscape features of special importance or value), nohoanga, mātaitai or taiāpure to Te Rūnanga o Ngāi Tahu and the relevant papatipu rūnanga; 2. identifying Ngāi Tahu interests in freshwater and associated ecosystems in Murihiku (includes the Southland Region); and 3. reflecting Ngāi Tahu values and interests in the management of and decision-making on freshwater and freshwater ecosystems in Murihiku (includes the Southland Region), consistent with the Charter of Understanding.	Te Tangi a Tauira is considered below.
2	Any assessment of an activity covered by this Plan must: 1. take into account any relevant iwi management plan; and 2. assess water quality and quantity, taking into account Ngāi Tahu indicators of health.	Te Tangi a Tauira is considered below.
6	In the Gleyed, Bedrock/Hill Country and Lignite-Marine Terraces physiographic zone, avoid, remedy,	The property overlies four physiographic zones (Gleyed, Bedrock/Hill Country, Old

<table>
<tr><td></td><td>or mitigate adverse effects on water quality from contaminants, by:
1. requiring implementation of good management practices to manage adverse effects on water quality from contaminants transported via artificial drainage, and overland flow where relevant; and
2. having particular regard to adverse effects on water quality from contaminants transported via artificial drainage, and overland flow where relevant when assessing resource consent applications and preparing or considering Farm Environmental Management Plans.</td><td rowspan="3">Mataura, and Oxidising) as illustrated in Figure 4. Contaminant transport pathways include deep drainage, overland flow and artificial drainage.
The Overseer nutrient loss modelling has not been developed on the basis of physiographic zones.
Mitigation measures have not been developed solely on the basis of physiographic zones and are applied broadly as required across the whole farm.
Therefore, it is not practicable to develop an assessment of effects on the basis of individual physiographic zones. Similarly, it is not practicable to assess the level of consistency with individual physiographic zone policies in isolation.
This AEE has been developed to consider the property as a whole rather than to assess contaminant loss from specific physiographic zones.

The proposal will result in an overall reduction in contaminant losses to water. This will be assured by implementation of the extensive mitigation measures specified in the FEMP. Therefore, the proposal is consistent with the overall intent of these three policies.</td></tr>
<tr><td>9</td><td>In the Old Mataura physiographic zone, avoid, remedy, or mitigate adverse effects on water quality from contaminants, by:
1. requiring implementation of good management practices to manage adverse effects on water quality from contaminants transported via deep drainage;
2. having particular regard to adverse effects on water quality from contaminants transported via deep drainage when assessing resource consent applications and preparing or considering Farm Environmental Management Plans; and
3. decision makers generally not granting resource consents for additional dairy farming of cows or additional intensive winter grazing where contaminant losses will increase as a result of the proposed activity</td></tr>
<tr><td>10</td><td>In the Oxidising physiographic zone, avoid, remedy, or mitigate adverse effects on water quality from contaminants, by:
1. requiring implementation of good management practices to manage adverse effects on water quality from contaminants transported via deep drainage, and overland flow and artificial drainage where relevant;
2. having particular regard to adverse effects on water quality from contaminants transported via deep drainage, and overland flow and artificial drainage where relevant when assessing resource consent applications and preparing or considering Farm Environmental Management Plans; and
3. decision makers generally not granting resource consents for additional dairy farming of cows or</td></tr>
</table>

	additional intensive winter grazing where contaminant losses will increase as a result of the proposed activity.	
13	1. Recognise that the use and development of Southland's land and water resources, including for primary production, enables people and communities to provide for their social, economic and cultural wellbeing. 2. Manage land use activities and discharges (point source and non-point source) to enable the achievement of Policies 15A, 15B and 15C.	Granting of the land use consent sought will enable people and communities to provide for their social, economic and cultural wellbeing, as discussed earlier in this report.
16	1. Minimising the adverse environmental effects (including on the quality of water in lakes, rivers, artificial watercourses, modified watercourses, wetlands, tidal estuaries and salt marshes, and groundwater) from farming activities by: (a) discouraging the establishment of new dairy farming of cows or new intensive winter grazing activities in close proximity to Regionally Significant Wetlands and Sensitive Waterbodies identified in Appendix A; and (b) ensuring that, in the interim period prior to the development of freshwater objectives under Freshwater Management Unit processes, applications to establish new, or further intensify existing, dairy farming of cows or intensive winter grazing activities will generally not be granted where: (i) the adverse effects, including cumulatively, on the quality of groundwater, or water in lakes, rivers, artificial watercourses, modified watercourses, wetlands, tidal estuaries and salt marshes cannot be avoided or mitigated; or (ii) existing water quality is already degraded to the point of being overallocated; or (iii) water quality does not meet the Appendix E Water Quality Standards or bed sediments do not meet the Appendix C ANZECC sediment guidelines; and (c) ensuring that, after the development of freshwater objectives under Freshwater Management Unit processes, applications to establish new, or further intensify existing, dairy farming of cows or intensive winter grazing activities: (i) will generally not be granted where freshwater objectives are not being met; and	The proposal does not involve new or further intensification of dairy farming of cows. This policy is only applicable to new intensive winter grazing on the property that was previously carried out off-site. The application for resource consent is only required because Rule 20 applies to any increase of the extent of the dairy platform beyond that that existed on 3 June 2016. The contaminant losses to water associated with the purchase of more land and cessation of off-site winter grazing will be less than are currently occurring. This will be assured by implementation of the Good Management Practices and mitigation measures specified in the FEMP. The proposed additional land purchase, cessation of off-site grazing, and no increase in actual cow numbers will be accompanied by a comprehensive suite of GMPs and mitigation measures that will ensure that contaminant losses in the location of the dairy platform and where off-site winter grazing was previously carried out will be significantly reduced. These will ensure that all the requirements of Policy 16 will be met. There is one downstream PSWLP water quality standard, faecal coliforms, that is currently unlikely to be met (See Table 4). However, this proposal will make a small contribution to improving microbiological water quality.

	(ii) where freshwater objectives are being met, will generally not be granted unless the proposed activity (allowing for any offsetting effects) will maintain the overall quality of groundwater and water in lakes, rivers, artificial watercourses, modified watercourses, wetlands, tidal estuaries and salt marshes 2. Requiring all farming activities, including existing activities, to: (a) implement a Farm Environmental Management Plan, as set out in Appendix N; and (b) actively manage sediment run-off risk from farming and hill country development by identifying critical source areas and implementing practices including setbacks from waterbodies, sediment traps, riparian planting, limits on areas or duration of exposed soils and the prevention of stock entering the beds of surface waterbodies; and (c) manage collected and diffuse run-off and leaching of nutrients, microbial contaminants and sediment through the identification and management of critical source areas within individual properties. 3. When considering a resource consent application for farming activities, consideration should be given to the following matters: (a) whether multiple farming activities (such as cultivation, riparian setbacks, and winter grazing) can be addressed in a single resource consent; and (b) granting a consent duration of at least 5 years.	
39	When considering any application for resource consent for the use of land for a farming activity, the Southland Regional Council should consider all adverse effects of the proposed activity on water quality, whether or not this Plan permits an activity with that effect.	Policy 39 of the PSWLP directs an assessment of the adverse effects from the activity as a whole <u>on water quality</u>, where the permitted baseline cannot be used to justify an existing level of effects or used to justify the effects of a proposal. This application does not rely on making an assessment using the permitted baseline. Instead, all possible and actual effects are considered, including cumulative effects. The assessment has concluded there would be a very small reduction in existing adverse effects on water quality from incorporating the Sheep Block into the existing dairy platform in conjunction with all the proposed mitigation measures. Increasing

		the landholding area only will reduce the overall environmental footprint from that which is currently consented (discharge of effluent and abstraction of groundwater from up to 1000 cows, with a land area of 523 ha).
39A	When considering the cumulative effects of land use and discharge activities within whole catchments, consider: 1. the integrated management of freshwater and the use and development of land including the interactions between freshwater, land and associated ecosystems (including estuaries); and 2. through the Freshwater Management Unit process, facilitating the collective management of nutrient losses, including through initiatives such as nutrient user groups and catchment management groups.	Cumulative effects of the proposed land use are discussed in section 5 of this report.
40	When determining the term of a resource consent consideration will be given, but not limited, to: 1. granting a shorter duration than that sought by the applicant when there is uncertainty regarding the nature, scale, duration and frequency of adverse effects from the activity or the capacity of the resource; 2. relevant tangata whenua values and Ngāi Tahu indicators of health; 3. the duration sought by the applicant and reasons for the duration sought; 4. the permanence and economic life of any capital investment; 5. the desirability of applying a common expiry date for water permits that allocate water from the same resource or land use and discharges that may affect the quality of the same resource; 6. the applicant's compliance with the conditions of any previous resource consent, and the applicant's adoption, particularly voluntarily, of good management practices; and 7. the timing of development of FMU sections of this Plan, and whether granting a shorter or longer duration will better enable implementation of the revised frameworks established in those sections.	The consent duration sought is discussed later in this report.

Overall, the proposal is consistent with the policies of the RWPS and the PSWLP.

Other Documentation

Te Tangi a Tauira is the Iwi Environmental Management Plan for the Murihiku area. This plan replaces Te Whakatau Kaupapa O Murihiku which is recognised in Policy 1.2 of the RPS. The application is not contrary to the relevant policies of Te Tangi a Tauira, particularly for this specific application because;

- Surface water bodies on the property will be fenced and have two metre wide riparian strips. provision of buffer zones to water abstraction sites and waterways;
- An extensive range of mitigation measures will be continued, and new ones implemented;
- There will be a reduction in contaminant losses to water from the property compared to what has been occurring;
- The system and management practices are considered appropriate for the risks associated with the receiving environment; and
- The consent duration sought proposed is significantly less than 25 years.

8. PROPOSED CONSENT CONDITIONS

The applicant proposes that conditions be imposed to:

a) require the implementation of the mitigation measures specified in the FEMP in accordance with the specified timeframes, and
b) require that N and P loss be limited to less than or equal to the baseline amounts estimated using Overseer and for P incorporate additional modelling required for mitigation not modelled by Overseer.

We would be available to assist in developing robust conditions that would provide certainty for both the consent authority and the consent holder.

The applicant is not proposing 'farm input' conditions beyond the maximum number of cows because any additional input controls would inappropriately restrict operational flexibility and we consider that baseline output conditions have been developed in other parts of New Zealand that provide adequate levels of control. For example, we don't consider that there would be any benefit is specifying the number of R1 or R2 stock to be on the runoff block at any one time.

9. NOTIFICATION AND CONSULTATION

A consent authority has the discretion whether to publicly notify an application unless a rule or National Environmental Standard (NES) precludes public notification or section 95A(2) applies.

The effects of the proposed activity will be no more than minor, the applicant does not request public notification and there are no rules or NES' which require the public notification of the application. In addition, there are no special circumstances relating to the application. As such, notification of the application is not necessary.

We understand that Environment Southland has notified some recent applications for land use consent under Rule 20 of the PSWLP. However, we emphasise that this application is simply to provide for an additional 80 has of land for an existing dairy farm, a wide range of significant new contaminant loss mitigation measures are incorporated into the application, and these matters should be taken into account when considering the adverse effects under Section 95D of the RMA. We consider that a clear case has been made that demonstrates that any adverse effects that could arise as a consequence of the proposed land use are insignificant and certainly less than minor as we understand the relevant case law.

Clause 6(1)(f) of Schedule 4 of the RMA requires the identification of, and any consultation undertaken with, persons affected by the activity. The assessment of environmental effects demonstrates that no persons will be adversely affected by the proposal to a degree that is minor or greater. Overall, it is considered that this application should be processed non-notified and without the need for written approvals.

10. CONSENT DURATION, REVIEW AND LAPSE

With regard to consent duration, special consideration has been given to Policy 40 of the PSWLP, as discussed below.

Certainty of the nature, scale, duration and frequency of effects

Potential effects of the proposed farming activities are well understood, and these will be managed using mitigation measures. Council's level of knowledge regarding the underlying aquifer, the receiving soils and surface water management zone is also improving, with continued knowledge and research of Southland and the site being achieved in the form of the proposed physiographic units and future catchment specific studies.

Potential adverse effects have in the first instance been mitigated by appropriate management techniques on farm followed by contingency planning, ongoing monitoring and reporting in an auditable format. Whilst the potential effects are reasonably well understood, the advances in research and development suggest that there is still a lot to be understood. It is because of this that a 35-year term is not proposed.

Matching consent duration to the level of risk of adverse effects

The extent and nature of the actual and potential adverse effects of the proposed activity on the existing environment (which includes the current dairy farm) were assessed in this document and concluded to be no more than minor, with potential for improvement following the implementation of the FEMP.

Relevant Tangata Whenua values and Ngai Tahu Indicators of Health

The application has been assessed as consistent with the relevant tangata whenua values as outlined in the iwi management plan, with particular regard to the proposed consent duration being less than 25 years.

Duration sought by the applicant and supporting information

We understand that Environment Southland has significant concerns about granting resource consents associated with dairy farming for a duration longer than 10 years. We consider that there is strong evidence to support a considerably longer duration than 10 years. We note that there is a discharge permit and water permit that both expire in December 2022. Therefore, taking into account the benefits in considering related resource consents at the same time, the applicant applies for a 13 year duration resource consent so that all three resource consents can be considered together in 2032, assuming that the water permit and discharge permit are granted for a further 10 years.

In support of this we also note the following:

- The level of certainty about potential effects for this specific application is high, largely because the proposal does not involve any additional dairy cows, and because a comprehensive suite of mitigation measures is proposed. The mitigation proposed goes far beyond what could be defined as the current industry GMPs.

- While there are concerns about the apparent trend of deteriorating microbiological quality in the Mataura River at the Gore monitoring site, the applicant's initiatives if adopted catchment-wide would likely reverse that trend. Similarly, while there are broad concerns about nitrate-nitrogen concentrations in groundwater in the general area, the applicant's initiatives if adopted more broadly would result in measurable reductions in nitrate-nitrogen concentrations in groundwater.

- Dissolved nutrient concentrations in the Mataura River at the Gore monitoring site appear to be relatively low compared to ANZECC trigger values and some other rivers in Southland. Periphyton coverage at the Gore site is also low. Therefore, it is unlikely that within 13 years that any significant further nutrient load reductions would be required.

The permanence and economic life of any investment

Significant investment has been required just to get to the point of making application with expenditure on professional services, including business feasibility studies, nutrient advice, effluent system review, water quality and policy and planning assessments.

The economic life of the farm is dependent on the granting of the relevant consents. The dairy farm is a long-term multi-generational business that is an essential part of this rural community and economy.

The dairy farm can be described as a million-dollar operation, with an approximate market value of the land at around $16 million based on 2018 dairy farm sales[24].

Common expiry date for permits that affect the same resource

See above comments. The application is made for a duration of 13 years to assist in considering all related resource consents together.

Applicant's compliance history

The applicant has demonstrated an overall good compliance history with the existing resource consents and there is no evidence to suggest that future compliance will not continue to be good, and water records will be provided to Council on time in future.

Timing and development of FMUs

[24]https://www.colliers.co.nz/~/media/new%20zealand%20website/images/find%20research/rural/04_2018%20colliers%20southland%20dairy%20sales%20map.ashx/

Environment Southland has established five freshwater management units (FMUs). Any relevant matter would need to be incorporated into a regional plan to have relevance to consent duration.

Review and Lapse
The applicant is happy for ES to impose standard review conditions in accordance with Sections 128 and 129 of the RMA. In accordance with Section 125 of the RMA, the applicant seeks a 5-year lapse period.

11. CONCLUSION

A decision to grant the land use consent application under Section 104B of the RMA can be made on the basis that:

a) The adverse effects on the environment will be insignificant.
b) The proposal meets the non-notification requirements of Section 95A of the RMA.
c) The proposal is consistent with the requirements of the RMA, relevant regional plan policies and other relevant matters.

Granting the consent application will be consistent with the purpose of the RMA for the reasons explained within this report. The proposed activities will not result in degradation of water quality and potential adverse effects will be managed in a manner that is consistent with all relevant RMA requirements.

Attachment A: Overseer Nutrient Budgets Technical Report (Fonterra)

Executive Summary

This analysis has been prepared as part of a land use consent application to increase the land area of the dairy platform of Cashmere Bay Dairy Ltd, while the consented cow numbers of 1000 cows will remain the same.

The property is located at Otama in Eastern Southland and is currently comprised of 442.6ha of total land with 434 effective made up of dairy platform effective 344.4ha and a runoff block effective 89.6ha. The farm is predominately flat with the majority of the farm underlying the Oxidising, Gleyed and Old Mataura Physiographic Zones and a smaller area under Bedrock/Hill country.

Fresh water irrigation is used on farm, 2015/16, 2016/17 season nutrient budgets have 148.9ha of area irrigated with large and small Rotorainers and for the 17/18 season a center pivot was added to increase irrigated area to 186.41ha

The nutrient budgets have been developed using Overseer 6.3 and the "Overseer Best Practice Data Input Standards, March 2018". Three pre-expansion nutrient budgets (2015/16, 2016/17 and 2017/18) and a proposed post-expansion nutrient budget have been completed to inform the land use consent application to increase land area.

Modelled results from the 4 scenarios are presented below:

	15/16*	**16/17**	**17/18**	**Average**
Peak Cows	1000 (2.4/ha)	950 (2.2/ha)	960 (2.4/ha)	970 (2.3/ha)
Total N Loss (kg)	20344**	17835**	21087	19757
N Loss/ha (kg)	43	37	40	40
Total P Loss (kg)	297***	290***	310	299
P Loss/ha (kg)	0.6	0.6	0.6	0.6
Pasture Grown Kg/DM/ha/yr (Dairy Platforms)	18,746 (irrigated) 14060 (non-irrigated)	18088 (irrigated) 13567 (non-irrigated)	19229 (irrigated) 14423(non-irrigated)	18687 14016

*See Section 7.1 & 10.1 for the makeup of these results

** Includes 1221kg total N loss from sheep 17/18 added

*** Includes 15kg total P loss from sheep 17/18 added

	Proposed Dairy Unit
Peak Cows	1000 (2.0/ha)
Total N Loss (kg)	19668
N Loss/ha (kg)	38
Total P Loss (kg)	317
P loss/ha (kg)	0.6
Pasture Grown Kg/DM/ha/yr	17680 (irrigated) 13260 (non-irrigated)

Using Overseer, combined nutrient budgets have been developed for Cashmere Bay Dairy Ltd and the Runoff Block, comparing the nutrient loss of the pre-expansion farm systems against the proposed farm system. Overseer has predicted that the nitrogen total loss has decreased and phosphorus total loss has increased by 18kg P over the whole farm area but P loss/ha has remained constant at 0.6kg P/ha/yr over all blocks.

Key drivers for the reduction in nitrogen loss are:

- More efficient use of nitrogen fertiliser, less N fertiliser added to the effluent areas to take into account N from effluent.
- A decrease in peak cows/ha grazed

Key drivers for P loss increase over the whole farm with/ha loss the same as pre-expansion are:

- Increase in land area through Overseer will add increased P to whole farm, related to increased land area not through fertiliser inputs, P loss mitigation best addressed outside of Overseer through good management practices for winter crops/grazing, riparian management, maintaining optimum Olsen P levels and form and timing of P fertilisers.

Table of Contents

- **Proposal Overview**

This analysis has been prepared as part of a proposal to increase the land area to be added to Cashmere Bay Dairy Ltd and maintain current consented cow numbers.

The current total land area of Cashmere Bay Dairy Ltd is 442.6 ha (effective 434 ha) with total consented cow numbers of 1000. It is proposed to increase the land area of Cashmere Bay Dairy Ltd to 522.9 ha (510.5 ha effective).

The property is currently run as two blocks with the dairy platform and a leased runoff block used for young stock. The dairy farms current discharge consent (AUTH-301811-V2) and groundwater take (AUTH-301812-V1) expiry 19/12/2022.

Modelling has been carried out using Overseer Version 6.3 based on the property as a whole, however at a block level the three pre-expansion budgets are broken down into dairy platform and runoff for 15/16 and 16/17 seasons and dairy platform, runoff and sheep block for the 17/18 season, three year's inputs for the dairy platform and runoff and one year's inputs for the sheep block to reflect the different fertiliser, feed and cropping regimes.

The proposed budget blocks are for the dairy platform which includes the sheep area incorporated into the dairy platform and the runoff.

The pre-expansion average losses have been derived by modelling the actual lawful use of the land (not consented maximums) from August 2015 through to May 2018 and comparing those losses to the proposed long term use of the land going forward using maximum consented stock numbers.

Evidence of milk production has been obtained from Fonterra Co-Operative Group Ltd; fertiliser information from Ravensdown and Ballance (unless indicated otherwise); and cow numbers, concentrates fed and baleage eaten and made on the dairy platforms from the farm owner G Raymond.

- **Property Overview**

The current 442.6ha of land is located across six soil types (farm scale soil mapping provided by ES Beacon website map & Fonterra's GIS software land area – Appendix 1) comprised of Mataura (185.3ha), Oreti (158.9ha), Fleming (49ha), Jacobstown (26.5ha), Gore (20.4ha) and Pyramid soils (12.3ha).

The farm is predominately flat and sits within the Oxidising (64%), Gleyed (19%), Old Mataura (13%) and Bedrock/Hill Country (4%) Physiographic Zones (PZ).

The predominant risk to water quality within the PZ located on the property are contaminant losses (predominately nitrogen) to underlying groundwater. Within the Oxidising Zone this occurs via the movement of nutrient laden soil water during the late autumn and winter drainage period, into underlying aquifers.

The denitrifying ability of the soils in the Gleyed PZ result in low levels of nitrogen contamination in groundwater but loss of nutrients, sediments and microbes via artificial drains following heavy rainfall are a key feature of this zone.

Water quality in the Old Mataura PZ is significantly influenced by the oxidising nature of the highly weathered soils and underlying alluvial materials, through flow of groundwater from this zone containing elevated nitrate concentrations may comprise a significant component of the water balance in lower lying unconfined aquifers and contribute to base flow in adjacent rivers and streams. The leaching of soil nitrate during the winter months presents the primary water quality issues for this unit.

The main water quality implications where land is more developed in the Bedrock/Hill Country PZ is contaminant loss of nitrogen, phosphorus, microbes and sediment via overland flow and lateral flow to surface waterways in response to heavy rainfall events

Key infrastructure on the property, which has been included as a mitigation for nutrient loss within the Overseer modelling are the farms two effluent storage ponds (one solids and one liquid pond), which allow for the deferred irrigation of farm dairy effluent; the use of low depth irrigation through a Cobra Rain Gun and effluent applied through the center pivot.

- **Key Applicable Regulations**

The Decisions Version of the Proposed Southland Water and Land Plan (pSWLP) was notified by Environment Southland on the 4th April 2018.

Policy direction for the expansion of an existing dairy farm is provided for under Policy 5 (Central Plains), Policy 10 (Oxidising) and Policy 16 (Farming activities that affect water quality), of the pSWLP.

Policies 5 and 10 both require decision makers to generally not grant resource consents for additional dairy farming of cows where contaminant losses will increase as a result of the proposed activity. These policies also require the implementation of good management practices to manage the adverse effects on water quality and for these to be considered when assessing resource consent applications or developing farm environment plans.

Policy 16 in its current form requires the following:

- In the interim period, prior to the development of freshwater objectives under the Fresh Water Management Unit Process, applications to further intensify existing dairy farming of cows will generally not be granted where:

  (i) The adverse effects, including cumulatively, on ground and surface water cannot be avoided or mitigated; or

  (ii) Existing water quality is already degraded to the point of being over allocated; or

  (iii) Water quality does not met the Appendix E Water Quality Standards or bed sediments do not meet the Appendix C ANZECC sediment guidelines.

Rule 20(d)(ii) of the pSWLP seek to give effect to these policies by requiring an assessment that shows that the annual amount of nitrogen, phosphorus, 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 the application being made. If this can be shown then the proposed expanded dairy farm is a restricted discretionary activity.

Rule 20(e) applies if the criteria above cannot be met, resulting in the proposed expanded dairy farm being a discretionary activity. The consent application will need to show how Policies 5, 10 and 16 will be given effect to.

Pre-expansion Overseer modelling has only been able to be carried out for 3 of the years prior to this application being made as accurate data is not available prior to the 15/16 season and for the sheep block only one year's data has been provided as no further information was available.

On this basis the land use consent for the expanded dairy farm is a discretionary activity under Rule 20(e).

Despite being a discretionary activity the Overseer modelling presented in this report shows that total modelled nitrogen from the increase in land area are fully mitigated and met the aims of Policy 16. There is no modelled increase in total nitrogen losses compared to the pre-expansion 3 year average losses.

Phosphorus losses have only increased by 18kg P over the whole pro-posed land area, this is solely due to the increased land area, P loss /ha has remained the same at 0.6kg P/ha/yr.

As stated early P loss mitigation is best achieved outside of Overseer by the use of good management practices on farm

- **Overseer Version and Protocols**

The nutrient budgets have been developed using Overseer 6.3 and the "Overseer Best Practice Data Input Standards, March 2018". No deviations have been made from the protocol.

Overseer Assumptions

- Long term annual average model - the model uses annual average input and produces annual average outputs
- Near equilibrium conditions -model assumes that the farm is at a state where there is minimal change each year
- Actual and reasonable inputs - it is assumed that input data is reasonable and a reflection of the actual farm system. If any parameter changes, it is assumed that all other parameters affected will also be changed.

- Good management practices are followed - Overseer assumes the property is managed is line with accepted industry good management practice.

- **Overseer Limitations**

Key limitations of the Overseer model are:

- Overseer does not predict transformations, attenuation or dilution of nutrients between the root zone or farm boundary and the eventual receiving water body.

- Overseer uses long term average climate data and therefore doesn't account for climatic extremes.

- Overseer does not calculate the impacts of a conversion process, rather it predicts the long-term annual average nutrient budgets for the changed land use.

- Overseer is not spatially explicit beyond the level of defined blocks

- Not all management practices or activities that have an impact on nutrient losses are captured in the Overseer model

Further information on Overseer can be found in the following reports:

Technical Description of OVERSEER for Regional Councils, September 2015

Review of the phosphorus loss submodel in OVERSEER®, September 2016

- **Pre-Expansion Land Use and Pro-posed Scenario Inputs**

Three pre-expansion nutrient budgets have been produced covering the period from June 2015 to May 2018. An overview of each of the pre-expansion files is provided below with full details of the inputs used contained within Section 9.

All files have the following common input factors:

a) Default irrigation data has been used for the three pre-expansion budgets and the pro-posed scenario for both irrigation types, Center Pivot and Rotorainer irrigation.

b) Attached Runoff Block = 89.6ha

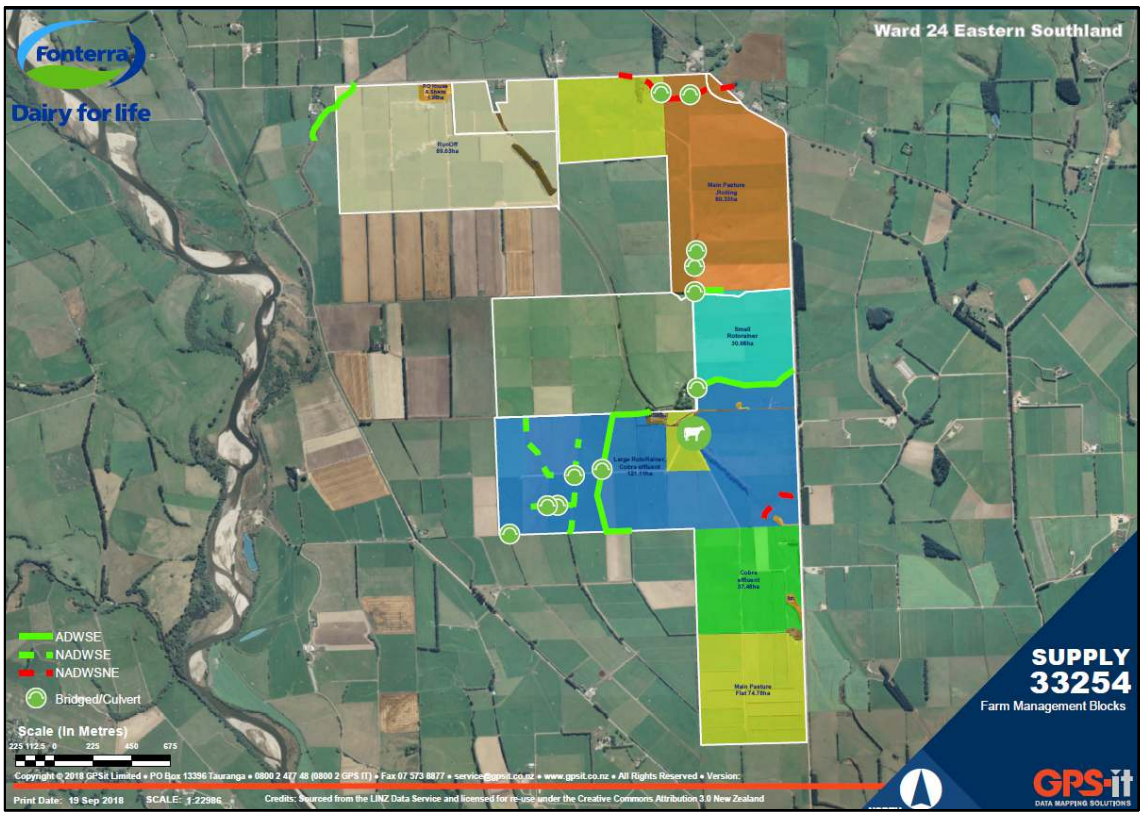
c) Runoff Block used for young stock (R1 and R2) only with 3.5 to 4ha of crop grown annually.

d) Typical soil test values have been used for the three pre-expansion budgets and the pro-posed scenario.

e) Calving Date – A mean calving date of the 26th August and a drying off date of 31st May has been used for the pre-expansion files and pro-posed scenario. This reflects the typical calving and drying off pattern over this time period.

f) Dairy effluent system and loafing pad the same for all nutrient budgets

- *June 2015 – May 2016*



Farm Map 1- Farm Management Blocks for the 15/16 and 16/17 seasons

In the 2015/16 season the farming enterprises occupied an area of 442.6 ha of which 434ha is effective, peak cow numbers were 1000 cows/ha grazed with 400 cows wintered on the dairy platform and 220 R1 and 220 R2 on the runoff block.

5ha of fodder beet and 14ha of kale were grazed in the 15/16 winter on the dairy platform and 4ha of annual ryegrass to fodder beet plus a sowing event of 4ha of fodder beet on the runoff block

150t DW of baleage was made off the dairy platform and 150t DW baleage made off the runoff block, this supplement was all carried over

Milk production for the season was 407656kg/MS across the dairy platform, or an average of 407.7kg/MS/cow. In order to achieve this level of production cows were fed 1085t DM from molasses, straw, baleage and palm kernel/barley grain in the dairy shed (see Section 9.3 for quantities).

Fertiliser during the 15/16 season was purchased from Ravensdown and Ballance, fertiliser inputs into Overseer have been based on fertiliser purchase records and spreading/fertiliser information provided directly from Ravensdown/Ballance for the dairy platform and runoff blocks.

See Ballance & Ravensdown Fertiliser records in Appendix 3

Whole farm N & P inputs were

- Fertiliser N = 176kg N/ha/yr
- P added as fertiliser = 16kg P/ha/yr

Effluent was applied by a Cobra Rain Gun travelling irrigator to the large Rotorainer block (121.1ha) and Cobra effluent block unirrigated (37.48ha), pond solid sludge was applied to these blocks as well.

Loafing pad solids applied to all non-effluent blocks in January

As only one nutrient budget has been completed for the sheep block run as an organic sheep and beef operation, the modelled N & P loss from the 17/18 nutrient budget where the sheep block was modelled has been added to the 15/16 seasons budget and the 16/17 seasons budget.

These figures were:

17/18 Total N lost from sheep blocks = 1221kg N

17/18 Total P lost from sheep blocks = 15kg P

	15/16	**17/18 Sheep block**	**Total**	**15/16 per ha**
Nitrogen Loss (kg/N)	19119	1221	20340	43
Phosphorus Loss (Kg/P)	282	15	297	0.6
Pasture Production (Dairy Platform – kg/DM/ha/yr)				18746 irrigated 14060 non-irrigated

- *June 2016 – May 2017*

Farm management blocks are the same as for 15/16 seasons, see Farm Map 1 on previous page

In the 2016/17 season the farming enterprises occupied an area of 442.6 ha of which 434ha is effective, peak cow numbers were 950 cows/ha grazed with 720 cows wintered on the dairy platform and 209 R1 and 209 R2 on the runoff block.

32ha of fodder beet was grazed in the 16/17 winter on the dairy platform and 4ha of annual ryegrass to fodder beet plus a sowing event of 3.5ha of fodder beet on the runoff block

200t DW of baleage was made off the dairy platform and was carried over and 150t DW baleage made off the runoff block, this supplement was also carried over.

Milk production for the season was 437215kg/MS across the dairy platform, or an average of 460.2kg/MS/cow. In order to achieve this level of production cows were fed 1135t DM from molasses, straw, baleage and palm kernel/barley grain in the dairy shed (see Section 9.3 for quantities).

Fertiliser during the 15/16 season was purchased from Ravensdown and Ballance, fertiliser inputs into Overseer have been based on fertiliser purchase records and spreading/fertiliser information provided directly from Ravensdown/Ballance for the dairy platform and runoff blocks.

Whole farm N & P inputs were

- Fertiliser N = 166kg N/ha/yr
- P added as fertiliser = 36kg P/ha/yr

Effluent was applied by a Cobra Rain Gun travelling irrigator to the large Rotorainer block (121.1ha) and Cobra effluent block unirrigated (37.48ha), pond solid sludge was applied to these blocks as well.

Loafing pad solids applied to all non-effluent blocks in January

As for the 15/16 season nutrient budget, the modelled N & P loss from the 17/18 nutrient budget where the sheep block was modelled has been also added to the 16/17 seasons budget.

These figures were:

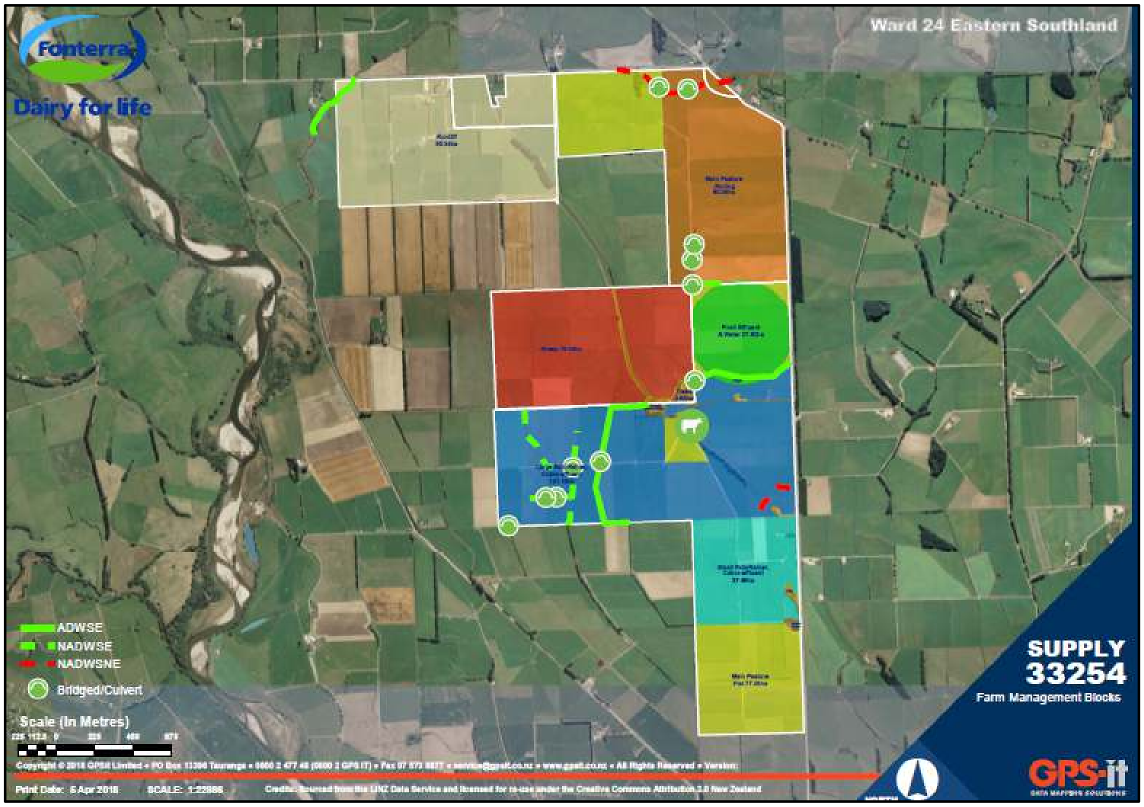
17/18 Total N lost from sheep blocks = 1221kg N

17/18 Total P lost from sheep blocks = 15kg P

	16/17	**17/18 Sheep block**	**Total**	**16/17 per ha**

Nitrogen Loss (kg/N)	16614	1221	17835	38
Phosphorus Loss (Kg/P)	275	15	290	0.6
Pasture Production (Dairy Platform – kg/DM/ha/yr)				18088 irrigated 13567 non-irrigated

- *June 2017 – May 2018*



Farm Map 2 - Farm Management Blocks for the 17/18 season

Farm Map 2 shows that a centre pivot was added to the farm (green circle) to irrigate an area that was previously irrigated by the small Rotorainer and the small Rotorainer was moved down onto the main pasture flat Cobra effluent block, this increased the irrigated area on farm from 148.9ha in 15/16 & 16/17 seasons to 186.41ha in the 17/18 season.

The area highlighted in red is the 80.29ha organic sheep and beef block which was modelled in the 17/18 season nutrient budget as an organic sheep/beef block operation, this has increased total land area from 442.6ha to 522.9ha

In the 2017/18 season the farming enterprises occupied an area of 442.6 ha of which 434ha is effective, the organic sheep/beef block was modelled as well, to bring total land area up to 522.9ha. Peak cow numbers were 960 cows/ha grazed with 730 cows wintered on the dairy platform and 211 R1 and 211 R2 on the runoff block.

34ha of fodder beet was grazed in the 17/18 winter on the dairy platform, 4ha of fodder beet on the runoff block and 4ha of swedes on the sheep block

126t DW of baleage was made off the dairy platform and feed during the season plus 168t DW of whole crop baleage which was carried over. 250t DW of baleage was made on the runoff and went to storage plus 28t DW of whole crop oats and peas

Milk production for the season was 437028kg/MS across the dairy platform, or an average of 455.2kg/MS/cow. In order to achieve this level of production cows were fed 1185t DM from molasses, straw, baleage and palm kernel/barley grain in the dairy shed (see Section 9.3 for quantities).

Fertiliser during the 17/18 season was purchased from Ravensdown and Balance, fertiliser inputs into Overseer have been based on fertiliser purchase records and spreading/fertiliser information provided directly from Ravensdown/Ballance for the dairy platform and runoff blocks.

Whole farm N & P inputs were

- Fertiliser N = 197kg N/ha/yr
- P added as fertiliser = 48kg P/ha/yr

Effluent was applied by a Cobra Rain Gun travelling irrigator to the large Rotorainer block (121.1ha) and small Rotorainer block (37.48ha) plus effluent was injected into pivot water (27.82ha) and pond solid sludge was applied to these blocks as well. Effluent area increased from 158.6ha to 186.4ha in 17/18

Loafing pad solids applied to all non-effluent blocks in January

The 17/18 nutrient budget modelled N & P loss from the sheep blocks were:

17/18 Total N lost from sheep blocks = 1221kg N

17/18 Total P lost from sheep blocks = 15kg P

Sheep block inputs

Only one year's modelling was completed for the sheep block, the only information available was from Country & CO Realty Limited, who provided the following stock figures for 160ha as only 80ha block being included stock figures were worked out on a/ha bases and then multiplied to 80ha.

Stock figures provided for 160ha

- 1800 Ewes = 11.25/ha = 900 for 80ha = 900 RSU
- 500 Hogget's = 3.125/ha = 250 for 80ha = 200 RSU
- 20 Rams = 0.125/ha = 10 for 80ha = 15 RSU
- 40 Cows = 0.25/ha = 20 for 80ha = 120 RSU
- 2 Bulls = 0.0125/ha = 1 for 80ha = 5 RSU

- Total RSU used for 17/18 nutrient budget
    - 1065 Sheep RSU
    - 125 Cattle RSU

Fertiliser inputs were not available for the organic sheep/beef operation, inputs used were

- 200kg/ha of Guano Phosphate in November
- 35kg/ha x 3 applications of Bio Marinus Fish Fertiliser in Sept/Dec & April
- Swedes – 400kg/ha of Guano & 35kg/h of Fish Fertiliser at sowing in Nov

As no fertiliser records were available for the organic sheep/beef block I contacted local organic sheep and beef farmers in the Eastern Southland district to gather information on what they would typically use on their farms.

Supplements made on sheep/beef block

- 100 bales of hay, 24t DM equivalent

	17/18	**17/18 Sheep block**	**Total**	**17/18 per ha**
Nitrogen Loss (kg/N)	19866	1221	21087	40
Phosphorus Loss (Kg/P)	295	15	310	0.6
Pasture Production (Dairy Platform – kg/DM/ha/yr)				19229irrigated 14423 non-irrigated

- **Proposed Land Use**

In the proposed scenario there are no changes in land area and irrigation from the 17/18 seasons nutrient budget, the only change is the sheep/beef blocks have been incorporated into the dairy platform, I have not combined the soil areas of these blocks with the original dairy platform soil areas have just changed the inputs to dairy. In Overseer the blocks are labelled Dairy/Sheep.

Farm management blocks and land area are the same as for 17/18 season, see Farm Map 2 on page 10

In the pro-posed scenario the farming enterprises will occupy an area of 522.9ha ha of which 510.5ha is effective, peak cow numbers are 10000 cows/ha grazed with 800 cows wintered on the dairy platform and 220 R1 and 220 R2 on the runoff block. This relates to 2 peak cows/ha grazed compared with the average of the last three years at 2.3 peak cows/ha grazed

An annual rotation of approximately 34ha of fodder beet (dairy platform) and 4ha fodder beet (runoff) will be grazed each winter. These were entered as fodder crops in Overseer

Supplement imported onto the property will be reduced as the extra pasture will be utilised, barley grain has been reduced from 700t down to 350t and no brought in baleage, PKE or Molasses is to be purchased.

It is envisaged that approximately 413t DW of supplements will be made of the dairy platform and runoff.

Milk production is expected to be 470000kg/MS across the dairy platform, or an average of 470kg/MS/cow. In order to achieve this level of production cows will be fed 750t DM to be on hand each season from, straw, baleage and barley grain in the dairy shed (see Section 9.3 for quantities) and to be supplemented from feed made on farm.

Fertiliser for the pro-posed scenario was purchased from Ravensdown and Balance, fertiliser inputs into Overseer have been based on fertiliser purchase records and spreading/fertiliser information provided directly from Ravensdown/Ballance for the dairy platform and runoff blocks.

Whole farm N & P inputs were

- Fertiliser N = 156kg N/ha/yr
- P added as fertiliser = 33kg P/ha/yr

With a reduced /head stocking rate down to a low of 2 cows/ha/grazed, less N as fertiliser is required for pasture production, Overseer for the pro-posed scenario shows pasture production at 17680 (irrigated) and 13206 (non-irrigated), which are realistic figures. P added as fertiliser is sufficient to maintain Olsen P values at required levels

Effluent applied by a Cobra Rain Gun travelling irrigator to the large Rotorainer block (121.1ha) and small Rotorainer block (37.48ha) and on the pivot block via injection into the fresh water, pond solid sludge was applied to these blocks as well.

Loafing pad solids applied to all non-effluent blocks in January

No modelled losses of N & P from sheep blocks as these blocks now incorporated into the dairy platform

	Pro-posed Scenario	**Pro-Posed Scenario per ha**
Nitrogen Loss (kg/N)	19668	38
Phosphorus Loss (Kg/P)	317	0.6
Pasture Production (Dairy Platform – kg/DM/ha/yr)		17680 irrigated 13260 non-irrigated

- **Modelling Inputs**

To construct the nutrient budgets the following input data has been used;

- *Blocks*

The farm has been split into the following pastoral (effluent and non-effluent), fodder crops (rotating) and crop blocks.

- Soil areas were obtained from soils mapping provided by Fonterra's GIS mapping software.
- Soil settings were obtained from SMap for all soil types.

15/16 Nutrient budget blocks

Block name	Type	Effective area (ha)
Small Rotorainer Eure 23a.1	Pastoral	24.8
Small Rotorainer Morv 7a.1	Pastoral	3.0
Large RR & Cobra Effluent Eure...	Pastoral	1.1
Large RR & Cobra Effl Selw 50a.1	Pastoral	85.6
Large RR & Cobra Effl Morv 7a.1	Pastoral	34.4
Main Pasture Flat Cobra Effl Bal...	Pastoral	19.8
Main Past Flat Selw 50a.1	Pastoral	42.3
Main Past Flat Morv 7a.1	Pastoral	35.6
Main Past Roll Morv 7a.1	Pastoral	67.8
Main Past Roll Pyr 1a.1	Pastoral	12.3
Fodder Beet 5ha	Fodder Crop	-
Kale 14ha	Fodder Crop	-
Runoff Clar 33a.1	Pastoral	29.3
Runoff Selw 50a.1	Pastoral	33.3
Runoff Morv 7a.1	Pastoral	15.0
Annual Grass/Fodder Beet/Grass...	Crop	4.0
Annual Grass/Fodder Beet/Grass...	Crop	4.0
Runoff Beet Sowing	Crop	4.0
Main Past Flat Cobra Effl Selw 5...	Pastoral	17.7

Select block type and add

Pastoral Add

Total farm area	442.6 ha
Total area declared as blocks	434.0 ha
Non-productive area (includes lanes, races and yards)	8.6 ha

16/17 Nutrient budget blocks

Block name	Type	Effective area (ha)
Small Rotorainer Eure 23a.1	Pastoral	24.8
Small Rotorainer Morv 7a.1	Pastoral	3.0
Large RR & Cobra Effluent Eure…	Pastoral	1.1
Large RR & Cobra Effl Selw 50a.1	Pastoral	85.6
Large RR & Cobra Effl Morv 7a.1	Pastoral	34.4
Main Pasture Flat Cobra Effl Bal…	Pastoral	19.8
Main Past Flat Selw 50a.1	Pastoral	42.3
Main Past Flat Morv 7a.1	Pastoral	35.6
Main Past Roll Morv 7a.1	Pastoral	67.8
Main Past Roll Pyr 1a.1	Pastoral	12.3
Fodder Beet 32ha	Fodder Crop	-
Runoff Clar 33a.1	Pastoral	25.8
Runoff Selw 50a.1	Pastoral	37.3
Runoff Morv 7a.1	Pastoral	15.0
Annual Grass/Fodder Beet/Grass…	Crop	4.0
Annual Grass/Fodder Beet/Grass…	Crop	4.0
Runoff Beet sowing 3.5ha	Crop	3.5
Main Past Flat Cobra Effl Selw 5…	Pastoral	17.7

Select block type and add

Pastoral **Add**

Total farm area	442.6 ha
Total area declared as blocks	434.0 ha
Non-productive area (includes lanes, races and yards)	8.6 ha

17/18 Nutrient budget blocks

Block name	Type	Effective area (ha)
Pivot Water & Effluent Eure 23a.1	Pastoral	24.8
Pivot Water & Effluent Morv 7a.1	Pastoral	3.0
Pivot Water & Cobra effluent Eur...	Pastoral	1.1
Large RR & Cobra Effl Selw 50a.1	Pastoral	17.6
Large RR & Cobra Effl Morv 7a.1	Pastoral	16.4
Small RR & Cobra Effl Selw 50a.1	Pastoral	17.7
Small RR & Cobra Effl Balm 21a.1	Pastoral	19.8
Main Past Flat Selw 50a.1	Pastoral	42.3
Main Past Flat Morv 7a.1	Pastoral	35.6
Main Past Roll Morv 7a.1	Pastoral	67.8
Main Past Roll Pyr 1a.1	Pastoral	4.3
Fodder Beet/oats & peas/grass B...	Crop	21.0
Fodder Beet/oats & peas/grass B...	Crop	21.0
Fodder Beet/grass Blk 1 Morv 7a.1	Crop	9.0
Fodder Beet/grass Blk 2 Morv 7a.1	Crop	9.0
Fodder Beet/beet Blk 1 Pyr 1a.1	Crop	4.0
Fodder Beet/beet Blk 2 Pyr 1a.1	Crop	4.0
Runoff Clar 33a.1	Pastoral	30.3
Runoff Selw 50a.1	Pastoral	33.8
Runoff Morv 7a.1	Pastoral	15.0
Runoff Beet/Oats & Peas/Grass...	Crop	3.5
Runoff Beet/Oats & Peas/Grass...	Crop	3.5
Sheep Selw 50a.1	Pastoral	30.6
Sheep Clar 33a.1	Pastoral	22.8
Sheep Morv 7a.1	Pastoral	23.1
Sheep swedes 4ha	Fodder Crop	-
Dairy Platform Beet sowing 26ha	Crop	26.0
Runoff Beet sowing 3.5ha	Crop	3.5

Select block type and add
Pastoral Add

Total farm area 522.9 ha

Total area declared as blocks 510.5 ha

Non-productive area (includes lanes, races and yards) 12.4 ha

Pro-Posed Scenario Nutrient budget blocks

Block name	Type	Effective area (ha)
Pivot Water & Effluent Eure 23a.1	Pastoral	24.8
Pivot Water & Effluent Morv 7a.1	Pastoral	3.0
Pivot Water & Cobra effluent Eur...	Pastoral	1.1
Large RR & Cobra Effl Selw 50a.1	Pastoral	85.6
Large RR & Cobra Effl Morv 7a.1	Pastoral	34.4
Small RR & Cobra Effl Selw 50a.1	Pastoral	17.7
Small RR & Cobra Effl Balm 21a.1	Pastoral	19.8
Main Past Flat Selw 50a.1	Pastoral	42.3
Main Past Flat Morv 7a.1	Pastoral	35.6
Main Past Roll Morv 7a.1	Pastoral	67.8
Main Past Roll Pyr 1a.1	Pastoral	12.3
Runoff Clar 33a.1	Pastoral	37.3
Runoff Selw 50a.1	Pastoral	37.3
Runoff Morv 7a.1	Pastoral	15.0
Dairy/Sheep Selw 50a.1	Pastoral	30.6
Dairy/Sheep Clar 33a.1	Pastoral	22.8
Dairy/Sheep Morv 7a.1	Pastoral	23.1
Dairy Platform Beet 34ha	Fodder Crop	-
Runoff Beet 4ha	Fodder Crop	-

Select block type and add

Pastoral Add

Total farm area	522.9 ha
Total area declared as blocks	510.5 ha
Non-productive area (includes lanes, races and yards)	12.4 ha

- *Climate Data*

- Location setting = Southland
- Climate station tool used for block climate data

- 854mm of rainfall

- 10°C mean annual temperature
- 731-1450mm daily rainfall pattern. Low variation.
- 749mm mean annual PET

  - *Farm System Inputs*

15/16 season 442.6ha (Total ha) Dairy Platform & Runoff (Effective 434ha)

Blocks

Dairy Platform 344.4 - Non Effluent 185.8, Effluent 158.6

Runoff – 77.6 (12ha of crop blocks off the runoff, total area 89.6)

Crop Blocks – 12ha

Irrigated – 148.9 Large & Small Rotorainers

Stock numbers

1000, wintered on 400, stocking rate 2.4 peak cows/ha grazed

Supplements imported

Straw 50t DW

Baleage 250t DW = 1000 bales baleage (250kg) – feed on crops

Barley Grain 300t DW

Molasses 22t DW

PKE 400t DW

Baleage 63t DW **Total 1085t**

Supplements Made

Baleage 150t DW to storage (600 bales @ 250kg) – Dairy platform

Baleage 150t DW to storage (600 bales @ 250kg) - Runoff

Crop Grazed 15/16

Fodder Beet – Grass = 5ha – dairy platform

Kale – Grass = 14ha – dairy platform

Annual Ryegrass to Fodder beet 4ha – Runoff

Pasture production

18746kg DM/ha/yr irrigated

14060kg DM/ha/yr non-irrigated

Milk Production

Milk Solids - 407656

Whole farm fertiliser

Fertiliser N – 176kg N/ha/yr

P added as fertiliser – 16kg P/ha/yr

16/17 season 442.6ha (Total ha) Dairy Platform & Runoff (Effective 434ha)

Blocks

Dairy Platform 344.4 - Non Effluent 185.8, Effluent 158.6

Runoff – 78.1 (11.5ha of crop blocks off the runoff, total area 89.6)

Crop Blocks – 11.5ha

Irrigated – 148.9 Large & Small Rotorainers

Stock numbers

950, wintered on 720, stocking rate 2.2 peak cows/ha grazed

Supplements imported

Straw 50t DW

Baleage 300t DW, 1400 bales baleage (250kg) – feed on crops

Barley Grain 700t DW

Molasses 22t DW

Baleage 63t DW **Total 1135t**

Supplements Made

Baleage 200t DW to storage, (800 bales @ 250kg) – Dairy platform

Baleage 150t DW to storage (600 bales @ 250kg) - Runoff

<u>Crop Grazed 16/17</u>

Fodder Beet – Grass = 32ha

Annual Ryegrass to Fodder beet 4ha – Runoff

<u>Pasture production</u>

Irrigated - 18088kg DM/ha/yr, variation decrease 3.5% from 15/16

Non-irrigated - 13567kg DM/ha/yr

<u>Milk Production</u>

Milk Solids - 437215

<u>Whole farm fertiliser</u>

Fertiliser N – 167kgN/ha/yr

P added as fertiliser – 36kg P/ha/yr

<u>17/18 season 522.9ha (Total ha) Dairy Platform & Runoff & Sheep block, (Effective 510.5ha)</u>

<u>Pivot Irrigation</u>

<u>Blocks</u>

Dairy Platform 250.4 - Non Effluent 150, Effluent 100.4

Crop Blocks 104.5ha

Runoff – 79.1 (10.5ha of crop blocks off the runoff, total area 89.6)

Sheep 76.5 (4ha of fodder crop included, (80.29 total area)

<u>Irrigated</u> – 186.4 Pivot, Large & Small Rotorainers

<u>Stock numbers</u>

960, wintered on 730, stocking rate 2.4 peak cows/ha grazed

Supplements imported

Straw 50t DW

Baleage 350t DW 1400 bales baleage (250kg)

Barley Grain 700t DW

Molasses 22t DW

Baleage 63t DW **Total 1185t DM**

Supplements Made

Baleage 126t DW feed, (504 bales @ 250kg) – Dairy platform

Baleage 250t DW to **storage** (1000 bales @ 250kg) – Runoff

Whole Crop (Oats & Peas) – Dairy Platform 168t DW **storage**

Whole Crop (Oats & Peas) – Runoff 28t DW **storage**

Crop Grazed 17/18

Fodder Beet – Whole crop – Grass = 21ha, Dairy Platform

Fodder Beet – Grass = 9ha, Dairy Platform

Fodder – Fodder Beet = 4ha, Dairy Platform

Fodder Beet – Fodder Beet 3.5ha -Runoff

Sheep swedes 4ha

Pasture production

Irrigated - 19229kg DM/ha/yr, variation increase 6.3% from 16/17

Non-irrigated - 14423kg DM/ha/yr

Milk Production

Milk Solids – 437028

Whole farm fertiliser

Fertiliser N – 197kgN/ha/yr

P added as fertiliser – 48kg P/ha/yr

Pro-Posed Scenario 522.9ha (Total ha) Dairy Platform & Runoff, (Effective 510.5ha)

Pivot Irrigation

Blocks

Dairy Platform 420.9ha - Non Effluent 234.5ha, Irrigated & Effluent 186.4ha

Runoff – 89.6

Stock numbers

1000, wintered on 800, stocking rate 2 peak cows/ha grazed

Supplements imported

Straw 50t DW

Baleage 350t DW 1400 bales baleage (250kg), feed on crop

Barley Grain 350t DW **Total 750t DM**

Supplements Made

Baleage 350t DW 1400 bales baleage (250kg), to **storage**

Baleage 63t DW, (252 bales @ 250kg) – Made off Dairy platform & **Feed** dairy platform

Crop Grazed 17/18

Fodder Beet – Grass = 34ha – Dairy Platform

Fodder Beet – Grass = 4ha - Runoff

Both entered as fodder crops as will be an annual rotation

Pasture production

Irrigated - 17680kg DM/ha/yr, variation decrease

Non-irrigated - 13260kg DM/ha/yr

Milk Production

Milk Solids – 470000

Whole farm fertiliser

Fertiliser N – 156kgN/ha/yr

P added as fertiliser – 33kg P/ha/yr

- **Modelling Results**
  - *Pre-Expansion Results*

	15/16*	16/17	17/18	Average
Peak Cows	1000 (2.4/ha)	950 (2.2/ha)	960 (2.4/ha)	970 (2.3/ha)
Total N Loss (kg)	20344**	17835**	21087	19757
N Loss/ha (kg)	43	37	40	40
Total P Loss (kg)	297***	290***	310	299
P Loss/ha (kg)	0.6	0.6	0.6	0.6

Pasture Grown Kg/DM/ha/yr (Dairy Platforms)	18,746 (irrigated) 14060 (non-irrigated)	18088 (irrigated) 13567 (non-irrigated)	19229 (irrigated) 14423(non-irrigated)	18687 14016

*See Section 7.1 & 10.1 for the makeup of these results

** Includes 1221kg total N loss from sheep 17/18 added

*** Includes 15kg total P loss from sheep 17/18 added

- *Post Expansion Results*

	Proposed Dairy Unit
Peak Cows	1000 (2.0/ha)
Total N Loss (kg)	19668
N Loss/ha (kg)	38
Total P Loss (kg)	317
P loss/ha (kg)	0.6
Pasture Grown **Kg/DM/ha/yr**	17680 (irrigated) 13260 (non-irrigated)

- **Modelling Conclusions**

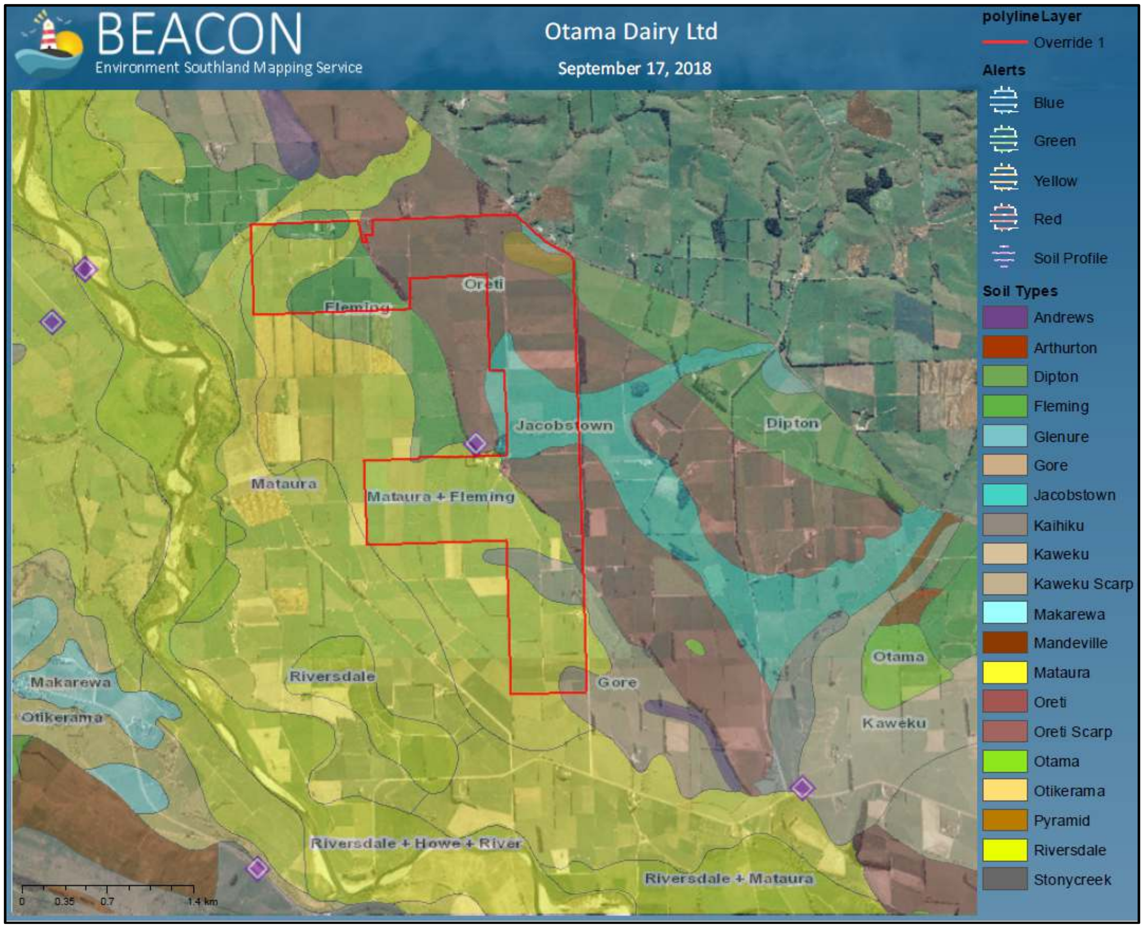
Using Overseer, combined nutrient budgets have been developed for Cashmere Bay Dairy Ltd and the Runoff Block, comparing the nutrient loss of the pre-expansion farm systems against the proposed farm system.

Overseer has predicted that the nitrogen loss will decrease with the expansion of land area and consented cow numbers staying at 1000 cows and phosphorus loss shows a slight increase of 18kg over the whole farm, while the /ha loss at 0.6kg P/ha/yr remains the same over the four nutrient budgets.

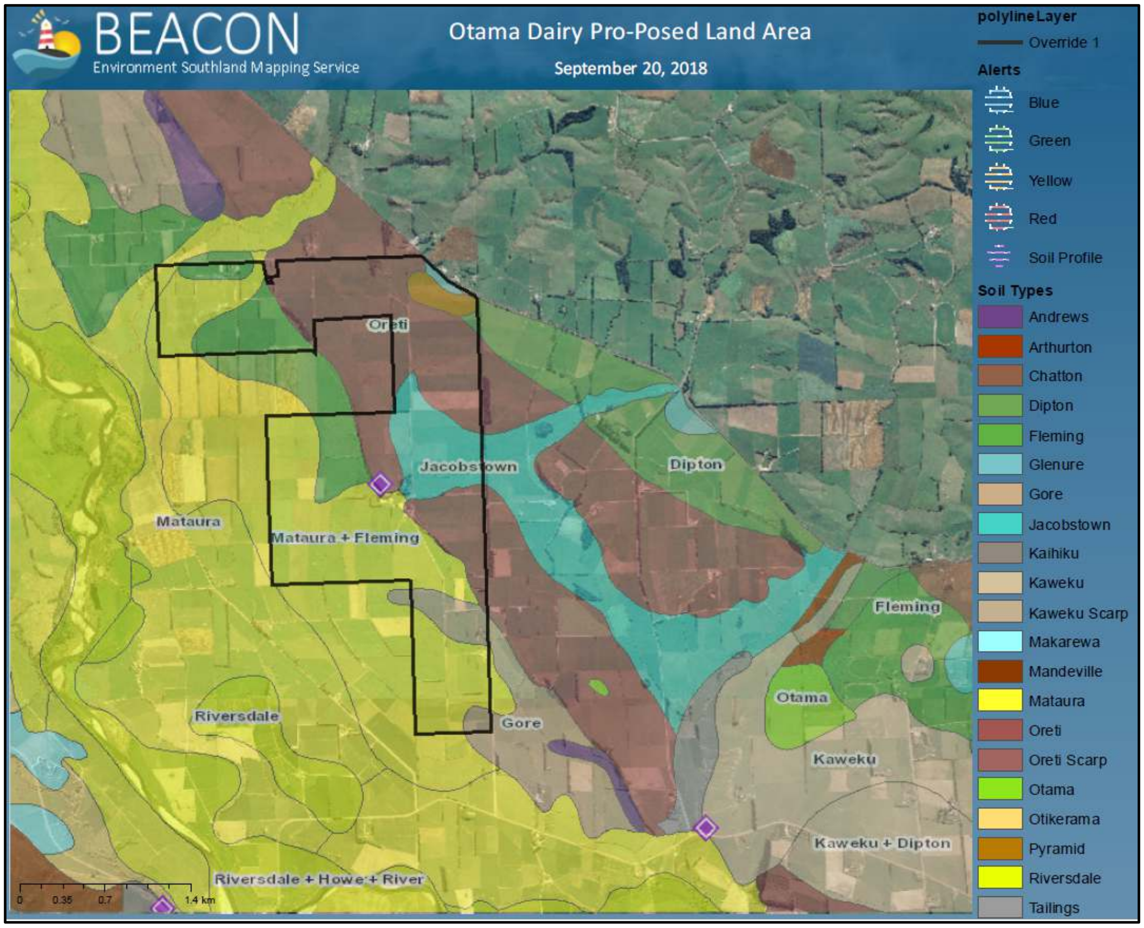
While Overseer shows a slight increase in total P lost I feel these losses can be fully mitigated outside of Overseer through good management practices.

Appendix

Appendix 1 – Farm Soil Maps for Cashmere Bay



Farm Soils Map for 15/16 & 16/17 Nutrient Budgets



Farm Soils Map for 17/18 & Pro-Posed Nutrient Budgets

Appendix 2 – Nutrient Budgets & Block Reports

15/16 Whole Farm Nutrient Budget & Scenario Block Reports for Nitrogen & Phosphorus

Scenario reports

Nutrient Budget | Nitrogen | Phosphorus | Comments | Summary | Nitrogen overview | Phosphorus overview | Greenhouse gases | Energy | Footprint units | Footprint product | Effluent | Pasture production | Other values | Full parameter report

(kg/ha/yr)	N	P	K	S	Ca	Mg	Na
Nutrients added							
Fertiliser, lime & other	176	16	29	26	16	9	0
Rain/clover N fixation	98	0	2	4	2	5	22
Irrigation	1	0	1	1	5	1	5
Supplements	46	10	31	7	5	5	2
Nutrients removed							
As products	76	13	17	5	19	2	5
Exported effluent	0	0	0	0	0	0	0
As supplements and crop residues	0	0	0	0	0	0	0
To atmosphere	67	0	0	0	0	0	0
To water	43	0.6	12	37	55	2	10
Change in farm pools							
Plant Material	20	3	14	4	9	1	4
Organic pool	110	14	5	-8	1	1	0
Inorganic mineral	0	2	-26	0	-3	-5	-6
Inorganic soil pool	5	-7	41	0	-51	19	18

Scenario reports

Nutrient Budget | Nitrogen | Phosphorus | Comments | Summary | Nitrogen overview | Phosphorus overview | Full parameter report

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
Small Rotorainer Eure 23a.1	756	32	9.5	229	246
Small Rotorainer Morv 7a.1	325	116	**23.5**	260	246
Large RR & Cobra Effluent Eure 23a.1	30	30	10.4	260	281
Large RR & Cobra Effl Selw 50a.1	2,595	32	11.1	252	281
Large RR & Cobra Effl Morv 7a.1	3,096	95	**24.6**	284	281
Main Pasture Flat Cobra Effl Balm 21a.1	1,059	57	**20.8**	244	281
Main Past Flat Selw 50a.1	789	20	9.6	189	247
Main Past Flat Morv 7a.1	1,867	56	**20.1**	207	247
Main Past Roll Morv 7a.1	3,562	56	**20.1**	207	247
Main Past Roll Pyr 1a.1	416	36	**13.8**	200	247
Fodder Beet 5ha	339	68	**24.5**	185	60
Kale 14ha	959	68	**24.1**	142	32
Runoff Clar 33a.1	845	29	**11.5**	152	17
Runoff Selw 50a.1	614	18	8.9	145	17
Runoff Morv 7a.1	707	47	**17.0**	159	17
Annual Grass/Fodder Beet/Grass Blk 1	64	16	5.7	-25	18
Annual Grass/Fodder Beet/Grass Blk 2	299	75	**26.2**	121	44
Runoff Beet Sowing	22	6	2.6	58	38
Main Past Flat Cobra Effl Selw 50a.1	326	20	9.4	201	281
Other sources	449				
Whole farm	19,119	43			
Less N removed in wetland	0				
Farm output	19,119	43			

Scenario reports

Nutrient Budget | Nitrogen | Phosphorus | Comments | Summary | Nitrogen overview | Phosphorus overview | Full parameter report

Block name	Total P lost	P lost to water	P loss categories		
	kg P/yr	kg P/ha/yr	Soil	Fertiliser	Effluent
Small Rotorainer Eure 23a.1	10	0.4	Low	Low	N/A
Small Rotorainer Morv 7a.1	1	0.2	Low	Low	N/A
Large RR & Cobra Effluent Eure 23a.1	0	0.4	Low	Low	Low
Large RR & Cobra Effl Selw 50a.1	29	0.4	Low	Low	Low
Large RR & Cobra Effl Morv 7a.1	4	0.1	Low	Low	Low
Main Pasture Flat Cobra Effl Balm 21a.1	1	0.1	Low	Low	Low
Main Past Flat Selw 50a.1	8	0.2	Low	Low	N/A
Main Past Flat Morv 7a.1	2	0.1	Low	Low	N/A
Main Past Roll Morv 7a.1	12	0.2	Low	Low	N/A
Main Past Roll Pyr 1a.1	9	0.8	Low	Medium	N/A
Fodder Beet 5ha	2	0.4	N/A	N/A	N/A
Kale 14ha	6	0.4	N/A	N/A	N/A
Runoff Clar 33a.1	8	0.3	Low	Low	N/A
Runoff Selw 50a.1	6	0.2	Low	Low	N/A
Runoff Morv 7a.1	1	0.0	Low	Low	N/A
Annual Grass/Fodder Beet/Grass Blk 1	1	0.4	N/A	N/A	N/A
Annual Grass/Fodder Beet/Grass Blk 2	3	0.7	N/A	N/A	N/A
Runoff Beet Sowing	1	0.3	N/A	N/A	N/A
Main Past Flat Cobra Effl Selw 50a.1	3	0.2	Low	Low	Low
Other sources	174				
Whole farm	282	0.6			

16/17 Whole Farm Nutrient Budget & Scenario Block Reports for Nitrogen & Phosphorus

Scenario reports

Nutrient Budget | Nitrogen | Phosphorus | Comments | Summary | Nitrogen overview | Phosphorus overview | Greenhouse gases | Energy | Footprint units | Footprint product | Effluent | Pasture production | Other values | Full parameter report

(kg/ha/yr)	N	P	K	S	Ca	Mg	Na
Nutrients added							
Fertiliser, lime & other	166	36	33	54	55	1	0
Rain/clover N fixation	86	0	2	4	2	5	22
Irrigation	1	0	1	1	5	1	5
Supplements	42	8	26	5	6	3	2
Nutrients removed							
As products	81	14	18	5	19	2	5
Exported effluent	0	0	0	0	0	0	0
As supplements and crop residues	0	0	0	0	0	0	0
To atmosphere	62	0	0	0	0	0	0
To water	38	0.6	11	64	50	3	10
Change in farm pools							
Plant Material	21	4	11	6	8	1	4
Organic pool	84	12	4	-10	1	0	0
Inorganic mineral	0	2	-26	0	-3	-5	-6
Inorganic soil pool	10	12	42	0	-7	10	17

Scenario reports

Nutrient Budget | Nitrogen | Phosphorus | Comments | Summary | Nitrogen overview | Phosphorus overview | Full parameter report

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
Small Rotorainer Eure 23a.1	626	27	8.0	189	215
Small Rotorainer Morv 7a.1	276	99	**20.0**	218	215
Large RR & Cobra Effluent Eure 23a.1	26	26	9.0	229	279
Large RR & Cobra Effl Selw 50a.1	2,187	28	9.5	220	279
Large RR & Cobra Effl Morv 7a.1	2,683	84	**21.8**	249	279
Main Pasture Flat Cobra Effl Balm 21a.1	874	48	**17.6**	213	279
Main Past Flat Selw 50a.1	666	17	8.3	156	216
Main Past Flat Morv 7a.1	1,506	46	**16.5**	171	216
Main Past Roll Morv 7a.1	2,870	46	**16.5**	171	216
Main Past Roll Pyr 1a.1	354	31	**12.0**	165	216
Fodder Beet 32ha	1,458	46	**16.4**	71	66
Runoff Clar 33a.1	702	29	**11.8**	157	23
Runoff Selw 50a.1	649	19	9.1	150	23
Runoff Morv 7a.1	675	49	**17.6**	165	23
Annual Grass/Fodder Beet/Grass Block 1	62	16	5.6	4	37
Annual Grass/Fodder Beet/Grass Block 2	307	77	**26.9**	72	38
Runoff Beet sowing 3.5ha	43	12	4.4	137	117
Main Past Flat Cobra Effl Selw 50a.1	270	16	7.9	167	279
Other sources	381				
Whole farm	16,614	38			
Less N removed in wetland	0				
Farm output	16,614	38			

Scenario reports

Nutrient Budget | Nitrogen | Phosphorus | Comments | Summary | Nitrogen overview | Phosphorus overview | Full parameter report

Block name	Total P lost (kg P/yr)	P lost to water (kg P/ha/yr)	P loss categories: Soil	P loss categories: Fertiliser	P loss categories: Effluent
Small Rotorainer Eure 23a.1	11	0.5	Low	Low	N/A
Small Rotorainer Morv 7a.1	1	0.2	Low	Low	N/A
Large RR & Cobra Effluent Eure 23a.1	0	0.4	Low	Low	Low
Large RR & Cobra Effl Selw 50a.1	31	0.4	Low	Low	Low
Large RR & Cobra Effl Morv 7a.1	5	0.1	Low	Low	Low
Main Pasture Flat Cobra Effl Balm 21a.1	1	0.1	Low	Low	Low
Main Past Flat Selw 50a.1	8	0.2	Low	Low	N/A
Main Past Flat Morv 7a.1	2	0.1	Low	Low	N/A
Main Past Roll Morv 7a.1	13	0.2	Low	Low	N/A
Main Past Roll Pyr 1a.1	9	0.8	Low	Medium	N/A
Fodder Beet 32ha	14	0.4	N/A	N/A	N/A
Runoff Clar 33a.1	7	0.3	Low	Low	N/A
Runoff Selw 50a.1	6	0.2	Low	Low	N/A
Runoff Morv 7a.1	1	0.0	Low	Low	N/A
Annual Grass/Fodder Beet/Grass Block 1	1	0.4	N/A	N/A	N/A
Annual Grass/Fodder Beet/Grass Block 2	3	0.7	N/A	N/A	N/A
Runoff Beet sowing 3.5ha	2	0.7	N/A	N/A	N/A
Main Past Flat Cobra Effl Selw 50a.1	3	0.2	Low	Low	Low
Other sources	157				
Whole farm	275	0.6			

17/18 Whole Farm Nutrient Budget & Scenario Block Reports for Nitrogen & Phosphorus

Scenario reports

Nutrient Budget | Nitrogen | Phosphorus | Comments | Summary | Nitrogen overview | Phosphorus overview | Greenhouse gases | Energy | Footprint units
Footprint product | Effluent | Pasture production | Other values | Full parameter report

(kg/ha/yr)	N	P	K	S	Ca	Mg	Na
Nutrients added							
Fertiliser, lime & other	197	48	36	73	34	5	3
Rain/clover N fixation	51	0	2	4	2	5	22
Irrigation	1	0	1	1	4	1	4
Supplements	37	7	24	4	6	3	2
Nutrients removed							
As products	72	12	16	5	17	1	5
Exported effluent	0	0	0	0	0	0	0
As supplements and crop residues	5	2	2	0	0	0	0
To atmosphere	62	0	0	0	0	0	0
To water	40	0.6	11	86	52	2	10
Change in farm pools							
Plant Material	14	3	12	5	13	2	9
Organic pool	84	9	3	-14	1	0	0
Inorganic mineral	0	2	-23	0	-3	-5	-6
Inorganic soil pool	9	27	43	0	-33	12	14

Scenario reports

Nutrient Budget | Nitrogen | Phosphorus | Comments | Summary | Nitrogen overview | Phosphorus overview

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
Pivot Water & Effluent Eure 23a.1	750	31	9.7	327	443
Pivot Water & Effluent Morv 7a.1	250	93	26.0	336	443
Pivot Water & Cobra effluent Eure 23a.1	35	32	9.9	331	443
Large RR & Cobra Effl Selw 50a.1	567	32	11.1	326	443
Large RR & Cobra Effl Morv 7a.1	1,697	103	26.7	342	443
Small RR & Cobra Effl Selw 50a.1	755	44	12.8	326	443
Small RR & Cobra Effl Balm 21a.1	2,555	129	26.3	359	443
Main Past Flat Selw 50a.1	723	17	5.3	266	355
Main Past Flat Morv 7a.1	1,919	54	19.5	266	355
Main Past Roll Morv 7a.1	3,655	54	19.5	266	355
Main Past Roll Pyr 1a.1	149	35	13.3	266	355
Fodder Beet/oats & peas/grass Blk 1 Selw 50a.1	395	19	5.8	-04	117
Fodder Beet/oats & peas/grass Blk 2 Selw 50a.1	1,057	52	19.4	-20	112
Fodder Beet/grass Blk 1 Morv 7a.1	509	57	18.6	-06	117
Fodder Beet/grass Blk 2 Morv 7a.1	1,252	142	46.4	54	21
Fodder Beet/beet Blk 1 Pyr 1a.1	157	39	13.7	-08	117
Fodder Beet/beet Blk 2 Pyr 1a.1	241	60	20.7	120	147
Runoff Clar 33a.1	721	24	9.5	150	57
Runoff Selw 50a.1	509	15	7.3	145	57
Runoff Morv 7a.1	596	40	14.4	157	57
Runoff Beet/Oats & Peas/Grass Blk 1	194	55	19.9	122	117
Runoff Beet/Oats & Peas/Grass Blk 2	442	126	40.4	24	142
Sheep Selw 50a.1	272	9	4.6	78	2
Sheep Clar 33a.1	282	13	5.2	81	2
Sheep Morv 7a.1	430	20	7.1	82	2
Sheep swedes 4ha	237	59	21.2	-25	1
Dairy Platform Beet sowing 26ha	139	5	2.5	62	44
Runoff Beet sowing 3.5ha	19	5	2.5	167	147
Other sources	425				
Whole farm	21,057	40			
Less N removed in wetland	0				
Farm output	21,057	40			

Scenario reports

Nutrient Budget | Nitrogen | Phosphorus | Comments | Summary | Nitrogen overview | Phosphorus overview

Block name	Total P lost kg P/yr	P lost to water kg P/ha/yr	P loss categories		
			Soil	Fertiliser	Effluent
Pivot Water & Effluent Eure 23a.1	15	0.6	Low	Medium **	Low
Pivot Water & Effluent Morv 7a.1	1	0.2	Low	Low	Low
Pivot Water & Cobra effluent Eure 23a.1	1	0.6	Low	Medium **	Low
Large RR & Cobra Effl Selw 50a.1	10	0.6	Low	Medium **	Low
Large RR & Cobra Effl Morv 7a.1	3	0.2	Low	Low	Low
Small RR & Cobra Effl Selw 50a.1	12	0.7	Low	High **	Low
Small RR & Cobra Effl Balm 21a.1	5	0.3	Low	Low	Low
Main Past Flat Selw 50a.1	12	0.3	Low	Medium	N/A
Main Past Flat Morv 7a.1	3	0.1	Low	Low	N/A
Main Past Roll Morv 7a.1	16	0.3	Low	Medium	N/A
Main Past Roll Pyr 1a.1	5	1.1	Low	Extreme **	N/A
Fodder Beet/oats & peas/grass Blk 1 Selw 50a.1	6	0.3	N/A	N/A	N/A
Fodder Beet/oats & peas/grass Blk 2 Selw 50a.1	5	0.3	N/A	N/A	N/A
Fodder Beet/grass Blk 1 Morv 7a.1	1	0.1	N/A	N/A	N/A
Fodder Beet/grass Blk 2 Morv 7a.1	1	0.1	N/A	N/A	N/A
Fodder Beet/beet Blk 1 Pyr 1a.1	2	0.4	N/A	N/A	N/A
Fodder Beet/beet Blk 2 Pyr 1a.1	2	0.5	N/A	N/A	N/A
Runoff Clar 33a.1	9	0.3	Low	Low	N/A
Runoff Selw 50a.1	6	0.2	Low	Low	N/A
Runoff Morv 7a.1	1	0.1	Low	Low	N/A
Runoff Beet/Oats & Peas/Grass Blk 1	2	0.7	N/A	N/A	N/A
Runoff Beet/Oats & Peas/Grass Blk 2	2	0.6	N/A	N/A	N/A
Sheep Selw 50a.1	5	0.2	Low	Low	N/A
Sheep Clar 33a.1	7	0.3	Low	Low	N/A
Sheep Morv 7a.1	1	0.1	Low	Low	N/A
Sheep swedes 4ha	2	0.6	N/A	N/A	N/A
Dairy Platform Beet sowing 28ha	5	0.3	N/A	N/A	N/A
Runoff Beet sowing 3.5ha	1	0.3	N/A	N/A	N/A
Other sources	165				
Whole farm	310	0.6			

Pro-Posed Scenario Whole Farm Nutrient Budget & Scenario Block Reports for Nitrogen & Phosphorus

Scenario reports

Nutrient Budget | Nitrogen | Phosphorus | Comments | Summary | Nitrogen overview | Phosphorus overview | Greenhouse gases | Energy | Footprint units | Footprint product | Effluent | Pasture production | Other values | Full parameter report

(kg/ha/yr)	N	P	K	S	Ca	Mg	Na
Nutrients added							
Fertiliser, lime & other	156	33	71	62	66	0	2
Rain/clover N fixation	97	0	2	4	2	5	22
Irrigation	2	0	1	2	6	1	6
Supplements	23	4	18	3	4	2	1
Nutrients removed							
As products	73	13	17	4	18	1	5
Exported effluent	0	0	0	0	0	0	0
As supplements and crop residues	0	0	0	0	0	0	0
To atmosphere	62	0	0	0	0	0	0
To water	38	0.6	14	69	50	3	10
Change in farm pools							
Plant Material	12	2	5	4	4	1	2
Organic pool	88	13	2	-7	1	0	0
Inorganic mineral	0	2	-18	0	-3	-5	-6
Inorganic soil pool	5	7	72	0	9	9	20

Scenario reports

Nutrient Budget | **Nitrogen** | Phosphorus | Comments | Summary | Nitrogen overview | Phosphorus overview | Full parameter report

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
Pivot Water & Effluent Eure 23a.1	599	26	8.2	209	215
Pivot Water & Effluent Morv 7a.1	190	70	**19.6**	223	215
Pivot Water & Cobra effluent Eure 23a.1	26	26	8.2	208	215
Large RR & Cobra Effl Selw 50a.1	1,981	25	8.7	200	215
Large RR & Cobra Effl Morv 7a.1	2,418	77	**19.9**	227	215
Small RR & Cobra Effl Selw 50a.1	512	32	9.2	204	215
Small RR & Cobra Effl Balm 21a.1	1,653	91	**18.6**	237	215
Main Past Flat Selw 50a.1	704	17	8.1	155	223
Main Past Flat Morv 7a.1	1,456	45	**16.2**	169	223
Main Past Roll Morv 7a.1	2,770	45	**16.2**	169	223
Main Past Roll Pyr 1a.1	343	31	**11.8**	163	223
Runoff Clar 33a.1	910	27	10.7	150	31
Runoff Selw 50a.1	656	18	8.5	144	31
Runoff Morv 7a.1	610	45	**16.1**	156	31
Dairy/Sheep Selw 50a.1	460	16	8.0	155	223
Dairy/Sheep Clar 33a.1	561	27	10.8	161	223
Dairy/Sheep Morv 7a.1	939	44	**16.1**	168	223
Dairy Platform Beet 34ha	2,056	60	**21.4**	139	113
Runoff Beet 4ha	393	98	**34.7**	149	113
Other sources	432				
Whole farm	19,668	38			
Less N removed in wetland	0				
Farm output	19,668	38			

Scenario reports

Nutrient Budget | Nitrogen | Phosphorus | Comments | Summary | Nitrogen overview | Phosphorus overview | Full parameter report

Block name	Total P lost	P lost to water	P loss categories		
	kg P/yr	kg P/ha/yr	Soil	Fertiliser	Effluent
Pivot Water & Effluent Eure 23a.1	10	0.4	Low	Low	Low
Pivot Water & Effluent Morv 7a.1	0	0.1	Low	Low	Low
Pivot Water & Cobra effluent Eure 23a.1	0	0.4	Low	Low	Low
Large RR & Cobra Effl Selw 50a.1	30	0.4	Low	Low	Low
Large RR & Cobra Effl Morv 7a.1	5	0.1	Low	Low	Low
Small RR & Cobra Effl Selw 50a.1	7	0.5	Low	Low	Low
Small RR & Cobra Effl Balm 21a.1	3	0.2	Low	Low	Low
Main Past Flat Selw 50a.1	8	0.2	Low	Low	N/A
Main Past Flat Morv 7a.1	2	0.1	Low	Low	N/A
Main Past Roll Morv 7a.1	12	0.2	Low	Low	N/A
Main Past Roll Pyr 1a.1	9	0.8	Low	Medium	N/A
Runoff Clar 33a.1	11	0.3	Low	Low	N/A
Runoff Selw 50a.1	7	0.2	Low	Low	N/A
Runoff Morv 7a.1	1	0.1	Low	Low	N/A
Dairy/Sheep Selw 50a.1	5	0.2	Low	Low	N/A
Dairy/Sheep Clar 33a.1	7	0.3	Low	Low	N/A
Dairy/Sheep Morv 7a.1	1	0.1	Low	Low	N/A
Dairy Platform Beet 34ha	14	0.4	N/A	N/A	N/A
Runoff Beet 4ha	2	0.4	N/A	N/A	N/A
Other sources	183				
Whole farm	317	0.6			

Appendix 3 – Balance & Ravensdown Fertiliser Records

	August	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	
Crop Fertiliser, Crop Grazed 15/16										
Cropzeal Boron Boost			1							Over Dairy Platform & Runoff fodde
Cropzeal Boron Boost				2						Kale & Runoff Annual Grass
SustaiN 25K							1			Over Dairy Platform & Runoff fodde
Muriate of Potash					8					Dairy Platform Beet/kale & Runoff
Dairy Platform 15/16										
N rich Ammo 36N	56									
Urea		12.52	10	9 + 12.51		28	16 + 7.03		11	
DAP				12						
Sustain N				4						
Pasturezeal G2 Balancer				23						
Sulphurgain Pure				2						
Superten								5		
Serpentine Super								3		
Non Effluent										
Pasturezeal G2 10K		26								
SuperTen 15k				8						
Sustain 25K				10	6					
Runoff										
Superten 15K				3						
Urea									3	
Crop Fertiliser, Crop Grazed 16/17										
Fodder Beet base		15								Over Dairy Platform & Runoff fodde
Cropzeal 16N		1								On Annual Ryegrass
Muriate of Potash		1								On Annual Ryegrass

	August	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	
Dairy Platform 16/17										
Serpentine Super		3	3		4					
Urea			21	12	20	4	5	22	16	
Superten					41					
DAP Sulphur Super						46				
Phased N						15				
Sustain 25K						5				
Sustain N								6		
Ammo 36	24.94	20.09								
0.9.0									28.52	
	August	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	
Non Effluent										
Superten 15K				33				3.6		
Potassium Chloride- gran				12						
Runoff										
Superten 15K								1.4		
Urea									4	
Crop Fertiliser, Crop Grazed 17/18										
DAP			9							Over Dairy Platform & Runoff fodd
Kieserite granular			8							Over Dairy Platform & Runoff fodd
Muriate of potash			3							Over Dairy Platform & Runoff fodd
Muriate of potash					3					Over Dairy Platform & Runoff fodd
SustainN 25K					4					Over Dairy Platform & Runoff fodd
SustainN								5		Over Dairy Platform & Runoff fodd

	August	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	
Dairy Platform 17/18										
PhasedN Quick Start	41.5									
DAP		42.5	7							
DAP Sulphur Super			6							
Sustain N			27	21	8	28	24	13.5		
Sulphurgain Pure			9	3	3					
Superten					17					
Urea						5				
0.9.0								60.33		
Ammo 36								23		
Non Effluent										
Muriate of Potash			10	7	3					
Runoff										
DAP				3						
Sustain N								5.5		
Phased N Quick Start	5.5									
Crop Fertiliser, Crop Grazed 18/19										
DAP			7.5							
Sustain N								4.5		
SustainN 25K					4.5					
Pro-Posed Scenario										Red = Ravensdown product
Ammo 31	18.64		18.64							
Urea				7.642	7.642		7.642	7.642	7.642	
Superphosphate				65.24						
Non Effluent										
Ammo 31	23.45	23.45								

	August	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April
Urea				16.4	16.4		16.4	16.4	16.4
30% Potash Super				128.9					
Runoff									
Ammo 31	8.96								
30% Potash Super				44.8					
Potassium hlotide				22.4					
Crop Fertiliser									
Dairy Platform Beet									
Cropmaster DAP			3.4						
McNab Fodder Beet Base mix			15.3						
N Protect					4.08				
Runoff									
CropmasterDAP			0.4						
McNab Fodder Beet Base mix			1.8		0.48				
N Protect									

Attachment B: Dairy Effluent Storage Calculator (Fonterra)

Brian Goodger
Fonterra
brian.goodger@fonterra.com
0277036550

Storage calculation for Otama Dairy Ltd, farm visit 26 November 2018 to obtain dairy shed catchment area and to confirm existing effluent pond dimensions

Original pond designed by Green Being Ltd in 2012 and constructed by Kelso Contracting, attached in appendix.

Climate

Rainfall site entered in storage calculation at Mandeville site to give mean annual rainfall of 950mm, actual rainfall for Otama Dairy Ltd is 854mm, this data from NIWA 500 metre grid long-term average rainfall, 30 years data used in Overseer. Rainfall has been overestimated for this storage calculation.

Soils

The Farm has an 186ha effluent irrigation area, 127ha high risk due to drainage on Mataura/Fleming and Jacobstown soils and 58ha low risk soils due to slope and drainage on Oreti and Gore soils, topography is all 27.8ha applied via the centre pivot and remaining 99.2ha via a low rate Cobra Rain-gun travelling irrigator

Note, Mataura soils not entered as low risk on Otama Dairy as in Beacon they are linked to Fleming soils which are classed as high risk due to their drainage characteristics.

Water use

For the purpose of this calculation an estimate of 63 litres/cow/day of wash down water is generated on the dairy and directed into the effluent system, this is an industry average not an actual measurement.

Catchments

Catchment areas determined from visit done on the 26 November 2018

- Shed, 336sqm and fully diverted all year round
- All concrete yard area, 1067sqm, diverted in the non-lactating months

No other areas to consider for including in the storage report

Cow Numbers

1000 cows and monthly numbers adjusted throughout the season to allow for culls

Emergency Storage Period

This has been entered as zero days as all effluent is gravity feed from dairy shed to the sump and then on to the pond, back up pumps are available and an umbilical cord system is available in the area as well.

Effluent Irrigation

Effluent is applied via a Cobra Raingun, 18mm nozzle, 44psi at the gun applying 21,000lt/hour, can apply 2mm depth on the fastest speed, 5.6mm depth at the mid speed and 10.3mm depth on the slowest speed, application rate approximately 5.8mm/hour

Effluent can also be injected into the pivot water or applied as effluent only, effluent only applied at 12lt/sec, 720lt/minute or 43,200lt/hour, the pivot will apply at 2.5mm depth when effluent is being applied without water. The effluent pond can be lowered by 345m³ in an 8 hour period or 604m³ over one full circle of the pivot, which takes 14 hours. Averaged effluent via the pivot to 4 hours at 43, 000lt/hour.

Very hard to model the effluent being applied by the pivot in the Massey Storage Calculator, can apply large volumes at low depths over a large area in a short period.

Effluent applied by the Cobra irrigator when fresh water irrigation not being applied is set at 5.6mm depth and as the pivot applies at 2.5mm depth in the spring/autumn period this cannot be entered in the storage calculation as you can't have a lower depth being applied spring/autumn than what is being applied in the winter/spring period, therefore depth for summer period entered as 6mm not 2.5mm for the pivot but the volumes of effluent applied are correct.

Existing Storage Pond

Existing pond designed by Green Being Ltd with dimensions of 33m x 33m x average depth of 3m with a 2:1 batter.

These dimensions confirmed from farm visit done on the 26 November 2018, could not confirm pond depth on the day, this could be done if required. Pond design report attached is very detailed and all other dimensions are correct.

No allowance made for the solids sump as it is small, it used as a stone trap, storage calculation 90% probability allows for solid content. The pond does have a good stirrer and this combined with a sump in the pond allows for all solids to be applied direct to land.

Total Pond Volume = 2223m³

Effective Pond Volume = 1710.8m³

90% Probability = 1175m³ (this is the effective volume required)

Storage Volume above Requirements = 535m³

TIAKI
FARM SOURCE SUSTAINABLE DAIRYING

Summary

Based on the input data used in the Massey storage calculator and the existing storage pond dimensions there is adequate storage requirements for the farms effluent system.

The industry required 90% probability is 1175m³ the existing storage pond has 1710m³ of effective storage giving 535 m³ of storage above requirements.

Dairy Effluent Storage Calculator

Summary Report

Regional authority:	Environment Southland Regional Council
Authorised agent:	Brian Goodger, Fonterra
Client:	G Raymond
Program version:	1.49
Report date:	Monday, 26 November 2018

General description:

Storage Pond Disclaimer
Climate for rainfall was taken at the Mandeville site to give a mean annual rainfall of 950 mm, farm location actual rainfall is 854mm (from 30yr Overseer climate data)

The farm entered as having an 186ha effluent irrigation area,127ha high risk due to drainage on Mataura/Fleming and Jacobstown soils and 58ha low risk soils due to slope and drainage on Oreti and Gore soils, topography is all flat.
For the purpose of this calculation an estimate of 63 litres/cow/day of wash down water is generated on the dairy and directed into the effluent system, this is an industry average not an actual measurement.

No emergency storage allowed for, as all effluent gravity feeds to the 152,000lt concrete sump.

Storage volumes have been based on using a low depth/rate Cobra travelling irrigator applying 21,000 litres/hour at 5.6mm depth in winter/spring for a 4 hour run (speed setting 2, travelling 1.1m/minute or 66m in one hour) putting out 84,000 liters.
The Pivot entered as applying at 6mm depth (actually 2.5mm), 43,000lt/hr running for 4 hours, total applied 173,000lt
These figures need to be confirmed by an irrigation specialist/designer to ensure they are achievable.

Based on the input data, the previous 30 years rainfall and soil moisture deficit data, the storage capacity you would require to meet the industry standard of a 90% probability the pond would be 1175 cubic meters (this DOES NOT INCLUDE freeboard and sludge allowances, this is the pump-able volume)

The maximum storage capacity that would have covered you for all climatic events in the last 30 years is 1671 cubic meters, this DOES NOT include freeboard and sludge allowances (refer to yellow bar on graph indicating 1981 as having the worst conditions for effluent application)
Other assumptions include: 1) 1000 cows 2) shed roof water is diverted away from the effluent pond all year 3) all concrete around the dairy is diverted in the winter 4) water use at 63lt /cow/day 5) effluent block is 127ha of high risk soils and 58ha of low risk soils.

Otama Dairy Ltd storage pond with the dimensions of 33m x 33m x 3m deep with a 2.0:1 batter was used in this calculation to give an actual size and surface area, a pond with these dimensions would provide a total capacity of 2223 cubic meters, (including freeboard and sludge) and 1710 cubic meters pump-able pond volume.
This gives the farm 535 cubic meters of storage above what is required.

According to the calculator, this is sufficient storage for your farm when the system is managed as per the input data provided. Please CHECK THE INPUT DATA in this report to ensure it is accurate.

Climate

Rainfall site: Mandeville

Mean annual rainfall: 950 mm/year

Effluent Block

Area of low risk soil: 58.0 hectares

Minimum area of high risk soil: 22.0 hectares

Surplus area of high risk soil: 106.0 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	940	5.0	59.2
February	940	5.0	59.2
March	940	5.0	59.2
April	780	5.0	49.1
May	780	5.0	49.1
June	0	0.0	0.0
July	0	0.0	0.0
August	1000	5.0	63.0
September	1000	5.0	63.0
October	1000	5.0	63.0
November	1000	5.0	63.0
December	1000	5.0	63.0

Irrigation

Winter-spring depth: 5 mm

Spring-autumn depth: 6 mm

Winter-spring volume: 84 cubic metres

Spring-autumn volume: 173 cubic metres

Irrigate all year? Yes

Catchments

Yard Area: 1067 square metres

Diverted? Yes

- diversion start: 01 June

- diversion end: 31 July

Shed Roof Area: 335 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

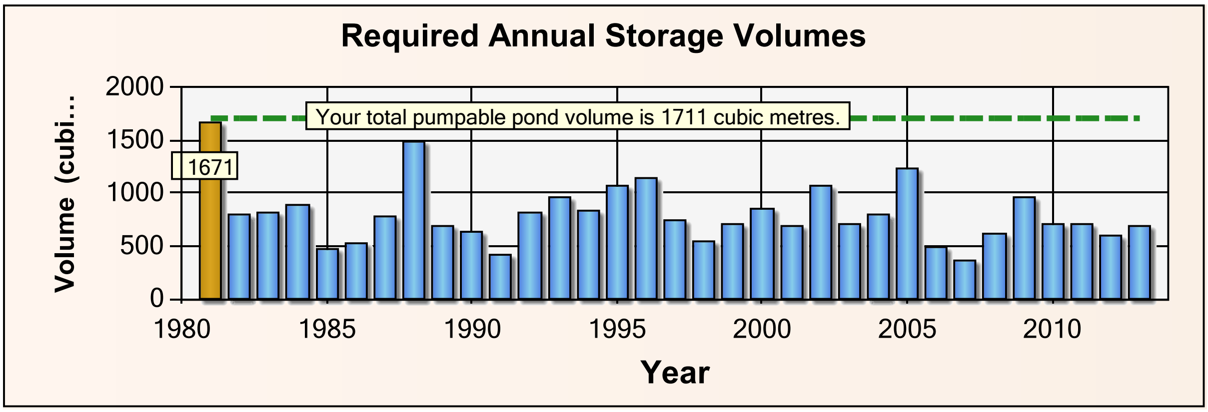
Pond/s present?	Yes
No. of ponds:	1 pond/s
Includes irregular ponds?	No
Pond 1	
- total volume:	2223 cubic metres
- pumpable volume:	1711 cubic metres
- surface area:	1089 square metres
- width:	33.0 metres
- length:	33.0 metres
- batter:	2.0:1
- total height:	3.0 metres
- pumped?	Yes
Tank/s present?	No
Emergency storage period:	0 days

Solids Separation

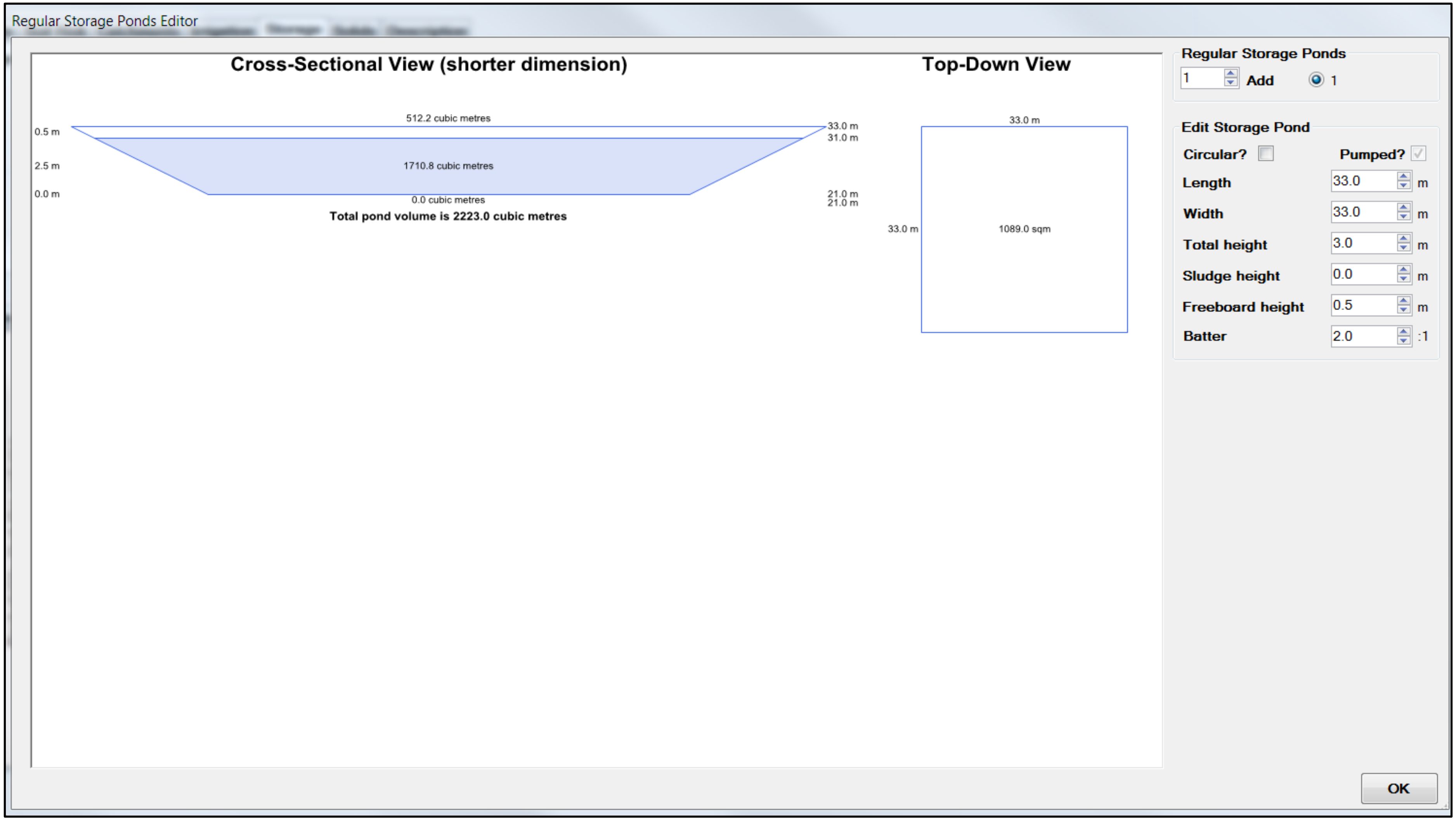
Solids separator/s present?	No

Outputs

Maximum required storage pond volume:	1671 cubic metres
90 % probability storage pond volume:	1175 cubic metres
During the period from:	01 July 1980
To:	30 June 2013



Required Annual Storage Volumes
Volume (cubi...
Year
Your total pumpable pond volume is 1711 cubic metres.
1671
2000
1500
1000
500
0
1980
1985
1990
1995
2000
2005
2010


Regular Storage Ponds Editor
Cross-Sectional View (shorter dimension)
512.2 cubic metres
0.5 m
2.5 m
0.0 m
1710.8 cubic metres
0.0 cubic metres
33.0 m
31.0 m
21.0 m
21.0 m
Total pond volume is 2223.0 cubic metres
Top-Down View
33.0 m
33.0 m
1089.0 sqm
Regular Storage Ponds
1
Add
1
Edit Storage Pond
Circular?
Pumped?
Length 33.0 m
Width 33.0 m
Total height 3.0 m
Sludge height 0.0 m
Freeboard height 0.5 m
Batter 2.0 :1
OK

POND DESIGN SUMMARY

Type of distribution system proposed	Low application Larall Smart Hydrant System with the option of a low application travelling irrigator in summer	
Coordinates of proposed pond NZMG	E 1279722 : N 4899868	
Maximum cows expected for design	800	
Type of dairy shed	Rotary	
Water use for design (two milkings a day)	70	litres/cow/day
Daily volume FDE produced	56	m^3
Stormwater catchment area of yard and other areas	880	m^2
Stormwater catchment area of ponds	1,199	m^2
Total catchment area for inclusion in pond design	2,079	m^2
Massey Calculator Design requirement (30 years)	1,758	m^3
TOTAL OPERABLE STORAGE volume of ponds proposed	2,410	m^3
ESCOP Calc. 60 day storage requirement	2,400	m^3
Proposed length at top of bank	33	m
Proposed width at top of bank	33	m
Proposed average depth	3	m

The larger than required pond size is to allow for a possible increase in cow numbers in the future.

During the winter months of no milking the yard stormwater will be diverted via a pipe to the nearest gully or soakpit.

The shed roof water is to be diverted all year round.

The discharge consent will need to include the flexibility to irrigate during the winter months when conditions allow, maintaining storage capacity for the following spring period.

1. INTRODUCTION

1.1 Scope

This report describes the design and assessment conducted at the above site for an existing dairy farm that is upgrading their dairy effluent systems to the current Farm Dairy Effluent (FDE) deferred storage requirements. It has been produced utilising the Massey effluent calculator, the Dairy NZ (FDE) Code of Practice, the IPENZ Practice Note 21 and current industry best management practices.

1.2 Description of Proposal

The existing infrastructure for the site involves an existing rotary shed and 880m^2 yard discharging through a stonetrap, which in turn discharges into an existing pump sump. From the sump the FDE is currently irrigated to land via a travelling irrigator. A new low application Larall Smart Hydrant irrigation system is proposed.

The new proposed system will gravity feed effluent to a new 2,223 m^3 storage pond, then pump directly out to the FDE application area.

The site and soil constraints combined with the farm managers' requirements have resulted in the following proposal.

- Effluent will gravity feed from the shed into the existing stonetrap, then into the existing concrete pump sump, and then into the new, 2,223m^3 effluent storage pond. Shed roof water will be diverted all year round, with the yard stormwater diverted to a soak pit or gully in the off-season.
- A new 4m x 4m blockwork solids bunker will be installed adjacent to the existing pump sump to be used as a solids drying bunker. The existing stonetrap will need emptying periodically once sediment has built up in it. To reduce the organic component in this trap, it can be agitated by using a hose from a newly installed water hydrant to mix the organics to slurry in order to flush them out, with the heavier stones/sand dropping out. The solids can then be cleaned out using a tractor mounted loader and dumped into the solids bunker to dry before dispersal to paddock. This will greatly reduce the organics being dumped into the stone dump. Any liquid remaining in the solids will flow into the existing sump via a new open drain. A small catch pit is to be installed in the new drain to prevent stones from entering the pump sump. An all-weather apron will be installed to allow for vehicle access to the solids hardstand bunker.
- The existing stirrer in the smaller sump is to remain.
- A new low application Larall Smart Hydrant irrigation system is to be installed with the existing low application traveling irrigator also able to be used during the drier months.
- A new Submersible Pond Floor Agitator (SPFA) horizontal stirrer will be installed in the new storage pond. This stirrer will help to keep solids within the pond in suspension, allowing them to more easily be irrigated to the pasture. These stirrers act to reduce solids build-up within the pond, while also allowing all of the nutrients contained within the solids to be irrigated to the pasture.
- With the proposed operation of the effluent and irrigation system, the new storage pond will have additional capacity. This additional capacity has been designed into

the pond to give additional storage should a possible future expansion in cow numbers occur.

The majority of fill material for the pond construction will be from the proposed pond excavation however; a small amount of additional fill may also be required.

Both the existing sump and the new pond will be fitted with pump outage and high and low level alarms to ensure that the shed operator is aware of failure and can immediately investigate the problem.

In order to know what the soil moisture conditions are prior to effluent discharge and as part of best management practice, we recommend the installation of soil moisture and temperature monitoring equipment (not aquaflex strips) and a weather station to record rainfall and ambient temperature across the effluent irrigation area. High and low level alarms in pump sumps and irrigator monitors and alarms are to be installed as needed. Proprietary monitoring systems such as Smart Farm and Regen systems would be ideal.

Local pump suppliers have quoted a maximum 8 hour response time should pumps fail and for a replacement to be installed. However, in the mean time, backup generators and/ or pumps could be used to ensure effluent is still able to transfer to the pond or paddock.

A synthetic liner has been specified as the most robust solution for leakage containment of the pond. For the purpose of providing clear drawings, a 1.5mm HDPE liner has been shown on the drawings. Other products would be allowed only if written engineering approval was given by the designer. A 100mm thick concrete based sump hole in the pond is proposed to ensure no damage to the base where pumps and stirrers are to be fitted. The pump pontoons, suction intake, or stirrer support will be able to rest on the base if necessary.

If pumps and stirrers are to be fitted at other locations in the pond, then we must be advised prior to pond construction.

Liner suppliers will need to provide a minimum 20-year warranty on durability, with installation of their systems in full accordance with their installation instructions. The liner installer is to install a uPVC inlet pipe as per the plans even if the shed pipe work is not installed at the time of installation.

Under all concrete pads within the storage pond, a non-welded square of liner is to act as a slip joint to protect the main liner from damage. It is essential no stones or foreign objects be between the two contact surfaces.

2. SITE ASSESSMENT

2.1 Soils Investigation

An initial soils investigation was undertaken on 1st September 2011 with one test pit conducted near the proposed pond site. Further investigations on the 11th May 2012 included a site walkover to inspect existing soil exposures, soil permeability testing and a desktop study to identify soil types from the Environment Southland database.

The test pits encountered a thin layer of topsoil overlying the soils which were generally a SAND, with varying ratios of silt and sub-rounded to sub-angular gravels. The test pit logs show these relationships and depths in more detail. Groundwater was not encountered in the test pits.

Environment Southland identified two main soil types across the effluent application area, Mataura soils and Oreti soils. A third soil type, the Jacobstown is present in the northern third of the farm, the technical data sheets for all three soils are contained within Appendix C. The Mataura soils are generally found in the western part of the effluent block, while the Oreti soils are towards the north east of the block. From the Topoclimate soils information technical data sheets, the Mataura soils are known for very severe structural compaction and slight waterlogging, while the Oreti soils are known for slight structural compaction and nil waterlogging. All of these soils respond well to aeration.

From the Massey Dairy Effluent Storage Calculator (DESC), the Mataura soils are classed as low risk however our soils permeability testing showed that these soils had low saturated conductivities. For this reason, the Mataura soils have been classed as high risk for the purposes of pond sizing calculations.

The table below shows each of the soils identified by the database and some of their relevant properties.

SOIL NAME	AREA (Ha)	STRUCTURAL COMPACTION	WATER LOGGING	SOIL RISK (flat terrain)	MEASURED Ksat (mm/hr)
Mataura	63	Very severe	Slight	High (due to low Ksat)	3,4
Jacobstown		Severe	Severe	High	-
Oreti	23	Slight	Nil	Low	14

Current industry research and accepted practice would suggest that deferred irrigation systems at low application rates would suit this particular farm and the soils present. Pulse/very low application irrigation can be utilised during the wetter months of autumn, winter and spring to keep the pond level low to maintain the deferral storage capacity if required. This irrigation should be balanced with the recommended soil monitoring.

2.2 Rainfall

The Massey pond calculator is able to analyse the last 30 years of rainfall data and provide calculations on the maximum pond size that would have been required, based on the depth of application and the volume of effluent discharged. When rainfall events of high intensity or long duration occur, these will cause surface water runoff and matrix, or piston flow drainage of the soil. In situations such as this, deferred storage is required.

Industry research has shown that very low (pulse), to low irrigation rates of FDE at, or near saturated soil conditions (or field capacity) has minimal, or no effect of nutrient leaching within artificially drained high-risk soils. Combined with aeration of soil structure, the soils are able to process the nutrients applied more readily, hence reducing or eliminating nutrient losses. The research reports are available at;

http://www.greenbeing.co.nz/news/latest.html.

While we have allowed for irrigation to occur below saturation, if extreme events occur outside the design capacity of this system (which require irrigation at saturated conditions to prevent overtopping of the pond), then provided irrigation rates lower than the saturated conductivities are used, research indicates that minimal, to no overland flow or leaching of nutrients would be expected.

DESIGN CONSIDERATIONS

3.1 Design Rationale

The current pond sizing selected is based on the Massey calculator utilising a 1 in 30 year capacity limit, and we have used this as a more accurate measure of storage requirement than the ESCOP. As can be seen on the summary sheet, we have increased the pond size calculated by the Massey Pond Calculator in order to accommodate an increase in cow numbers in the future.

The new Dairy NZ COP only requires a 1 in 10 year event to be considered, however we do not consider this suitable for these types of ponds. The calculator doesn't allow irrigation at field capacity but is an industry-accepted method of determining the storage volume. The calculator also doesn't currently give an output for the amount of stormwater included in the design on the summary report; however, it is accounted for in the design sizing.

Currently, the calculator works on the depth applied in a single pass by a travelling irrigator, or a daily depth event for that particular discharge event, and not on the saturated conductivities of the soil. The conditions shown in the summary report assumes the soil has reached saturation after the desired depth has been applied and not the real time state with the soil draining at the Ksat value of the soil. This would mean that a soil with a Ksat of 5mm/hr can absorb 5mm every hour at a rate that does not exceed 5mm per hour. If the instantaneous irrigation rate is higher than the Ksat value, the soil cannot absorb it fast enough. This will instigate ponding at the surface or drainage/sheet flow on the surface.

During the wetter parts of the year, the system can be pulsed to 1.5 mm depth application rates. These low application depths allow a greater opportunity to irrigate during the wetter times of the year when the soil water deficit is likely to be low. These regimes will be utilised to maintain storage as required. Typically, irrigation would occur until the nutrient limit for the soil is reached or the depth application specified in the Discharge Permit for an event is reached, whichever occurs first. On reaching this trigger level the guns would be moved to the next area. The irrigation contractor will determine the irrigation rationale in more detail and provide onsite training of staff to ensure they are suitable trained on its use.

Generally the creation of deferred storage in the form of ponds will allow the farmer to discharge when conditions suit, to avoid having to irrigate using such a regime. However the pond and discharge parameters have been set to allow the above worst-case situation to be sustainably managed.

The storage ponds are expected to be emptied daily or when conditions allow and should not be used to defer irrigation when an irrigation potential is present. The current design does not allow for deliberate storing of effluent in the pond if an irrigation potential is available and irrigation should occur on every available day. This includes the winter months when, if no winter milking is taking place, the pond is predominantly full of collected stormwater.

Ponds of this size will stagnate and cause nuisance odour, as well as Biological Oxygen Demand problems in the soil resulting in increased de-nitrification of the soil, unless oxygenation by means of mechanical stirring or aeration of the fluid is conducted. Separation of the solids from the fluid fraction of the FDE before it is stored in the pond will greatly reduce this problem, and if the pond is properly managed stirring and aeration may not be required. This is also another reason why it is important to keep the pond as empty as possible. Outlet nozzles discharging into sumps or ponds should be flared to provide a flat stream to maximise air contact.

3.2 Irrigation Rationale

Approximately 63Ha of effluent disposal area is being utilised at this stage, however we would recommend the entire farm is applied for disposal of effluent to accommodate the posible increase in cow numbers and to allow the farmer the greatest potential to irrigate when possible.

During the spring, autumn and winter wet months the irrigation system will be set to pulse application rates of 1.5 mm/hr to discharge the daily FDE production and to continue to reduce the volume in storage when possible. These application rates will be dialled in by the farmer to suit the conditions. During the summer months the rate will be increased to the averaged maximum achievable by the low application irrigation setup.

While daily effluent of 56m^3 is expected for the design, we have specified an irrigation volume of 180m^3 as the system must be capable of these outputs (within a 24 hour period), in order to reduce any deferred volume. The successful irrigation supply company will be providing the irrigation system details and components to meet the volume required. At this stage a Larall Smart Hydrant setup is proposed for the low application irrigation system. The number and configuration of the pods is subject to design by the irrigation contractor.

On no account should FDE be applied when surface water is ponding or during, 6 hours before, or 12 hours after heavy rainfall intensities of greater than 3mm/hr. Combined with the soil moisture monitoring information, visual inspection of the proposed application areas must be conducted before each application to ensure conditions are suitable. Irrigation is to cease or be moved to a new area if adverse conditions are present.

3.3 Cleaning and Removal of Solids

Solids from the blockwork solids dump bunker will be spread on the paddocks as required, observing best practice separation distances from sensitive areas and avoiding spreading of solids during adverse climatic conditions.

A water hydrant connection is to be installed near the pond crest to allow washing down of sludge into the sump in the base of the pond. The wash down hoses from the yard should be used to agitate the effluent in the stonetrap either by connection to the pond system or by installing a new hydrant connection near the stonetrap. A recycling pump/diversion valve from an existing pump sump/pond may also suffice.

The frequency of cleaning is dependent on use. It may take a few seasons to establish a suitable cleaning regime.

4. RECOMMENDATIONS FOR PASTURE MANAGEMENT

As part of best management practice, a pasture management regime involving aerating of effluent paddocks should be introduced, particularly if pugging and/or waterlogging of the soils has occurred in paddocks. As shown in the research reporting mentioned above, aeration greatly improves the soils' ability to hold and process nutrients from FDE, which also provides for a 'healthier' soil matrix.

We recommend that aeration, or re-pasturing of the topsoil profile should be carried out immediately on any effluent paddocks that have suffered compaction, or pugging due to stock. This will re-establish the permeability of the soil and reduce overland drainage runoff.

5. APPLICABILITY

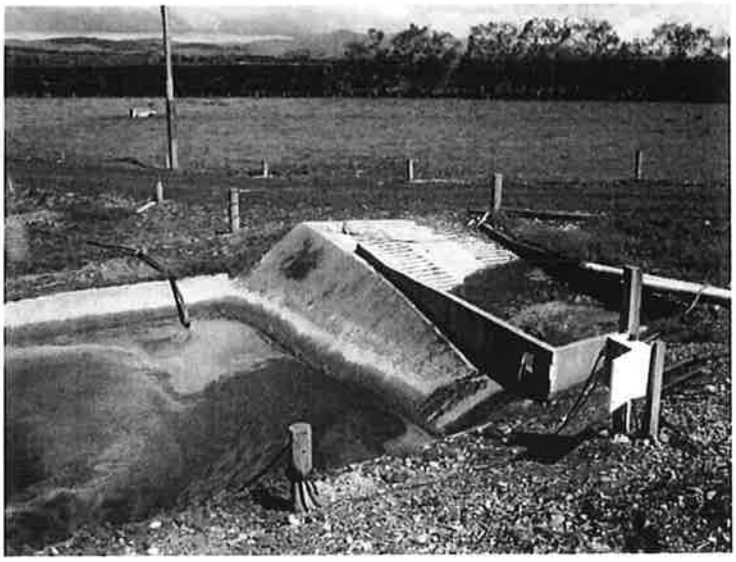
This report has been prepared based on the information provided to us by the Client or their representative. The design is iterative whereby changes can affect the entire design outcome. We must be notified of any potential changes to confirm the design is not compromised.

While we have exercised due care in assessing the pond size, we take no responsibility for the Massey pond calculator results. This is a proprietary software package still under development and is subject to vetting by its developers and reviewers.

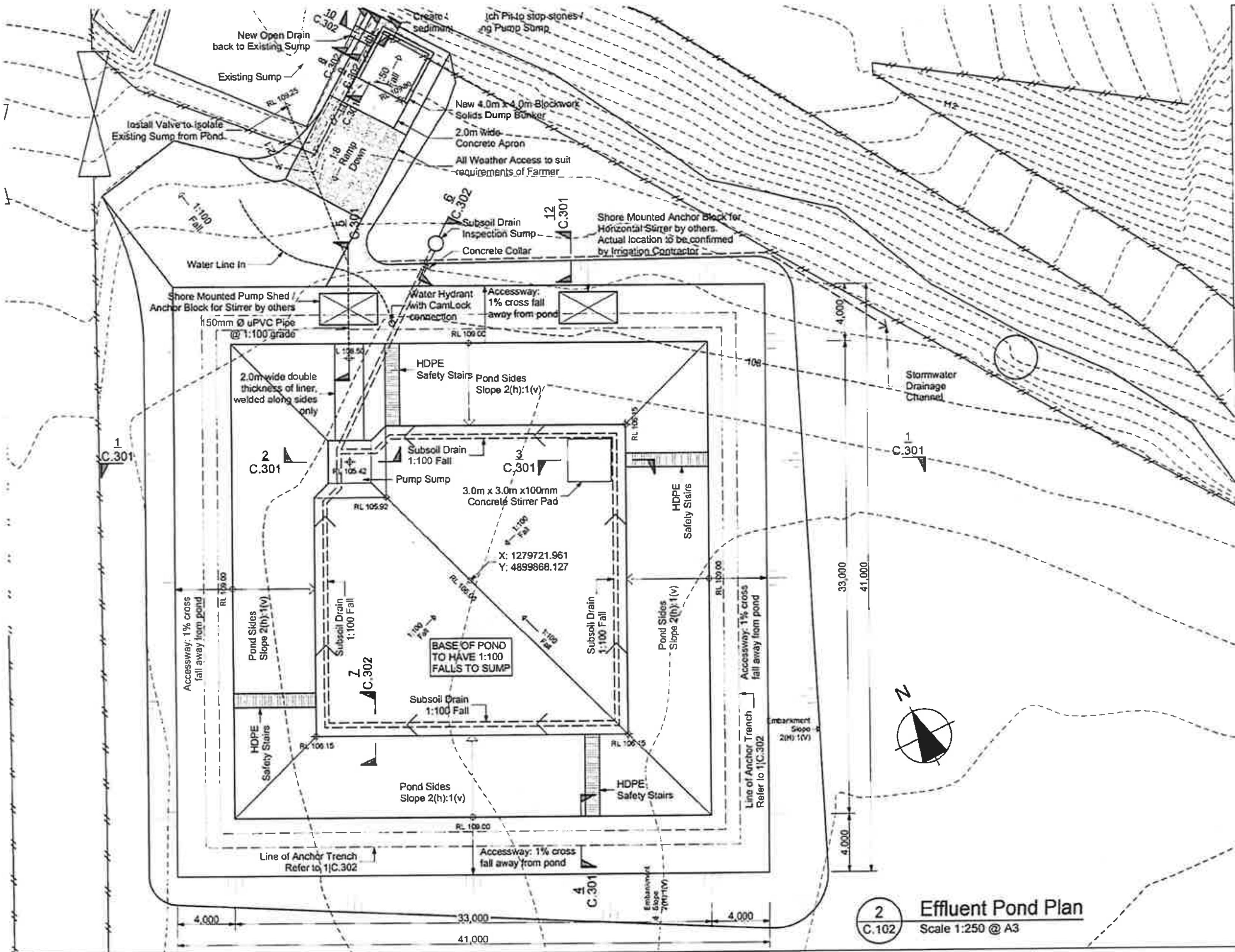
This report is only to be used by the parties named above for the purpose that it was prepared and shall not be relied upon or used for any other purpose without the express written consent of GREEN Being Ltd.

6. PHOTOS

Test pit 1



Existing pump sump and stonetrap.



Effluent Pond Plan
Scale 1:250 @ A3
2 / C.102

Revision History

rev	date	issue
01	28/09/2012	RESOURCE CONSENT

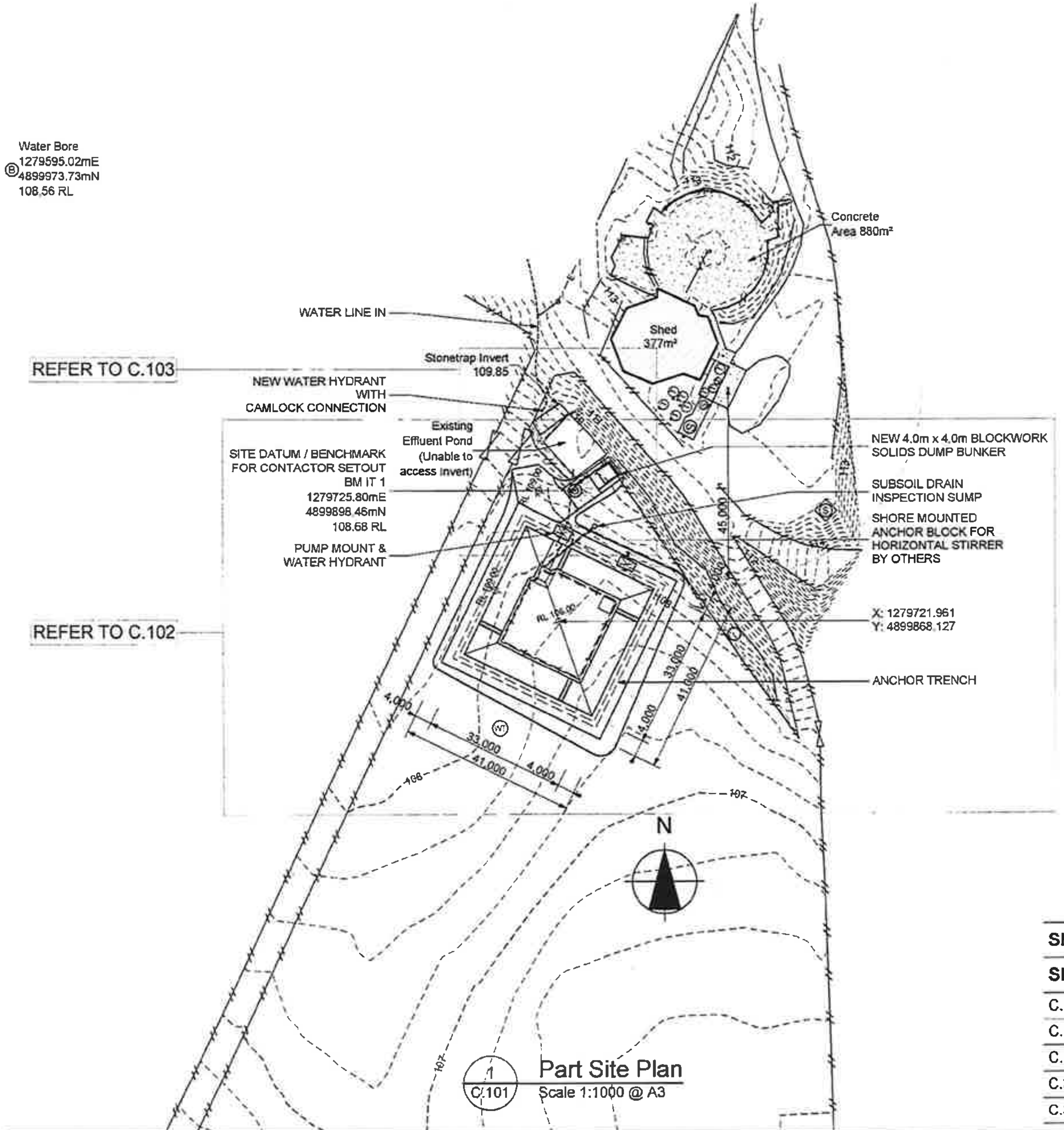
Notes:
1. Check all dimensions on site.
2. All drawings to be read in conjunction with GREEN Being Design Report and Specifications.
3. Cut / Fill volumes solid measure, approximate only, and based on typical pond section. Contractor to confirm volumes.
4. Any variations from the design drawings are to be confirmed by the Engineer in writing.
5. Irrigation Contractor to confirm new watermain details.
6. Coordinates in NZTM.
7. Effluent Line out of Pond to be determined by Irrigation Contractor.
8. All Pipework to have 1:100 grade unless stated otherwise.
9. Gas venting to be installed under the liner, by Liner Installer in accordance with their instructions.
10. Safety Rope System at Stairs to be installed by Principal or Liner Installer

KEY:

Existing Contours

Top Soil Strip:	250m³
Cut:	1400m³
Fill:	1450m³

GREEN Being	Engineering Firm	Project Manager	Client		Sheet Title	Scale	Drawing No
	GREEN Being Ltd P.O. Box 1298 Queenstown		OTAMA DAIRY LTD 145 JAFFRAY ROAD RD7, GORE	OTAMA EFFLUENT POND DESIGN	EFFLUENT POND PLAN Printed 28/09/2012	as shown Job No. 10124	C.102 Revision 01



Part Site Plan
1 / C.101
Scale 1:1000 @ A3

Revision History

rev	date	issue
01	28/09/2012	RESOURCE CONSENT

Notes.
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Legend

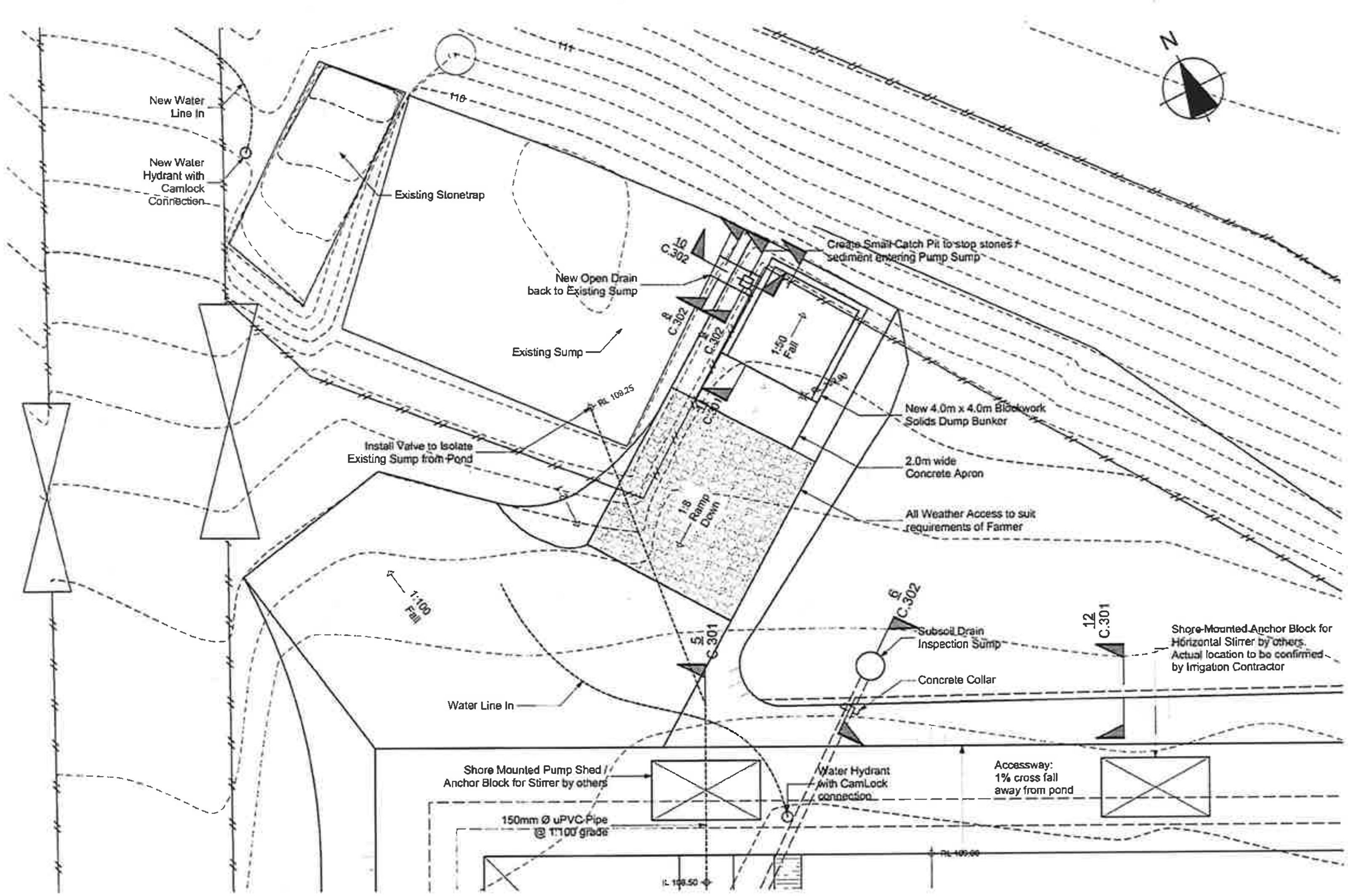
- Water Bore
- Water Tank
- Contours
- Gravelled Track, Hardstand
- Fenceline

Sheet Index

Sheet No.	Sheet Name	Published	Rev No.
C.101	SYSTEM OVERVIEW	⊠	01
C.102	EFFLUENT POND PLAN	⊠	01
C.103	SOLIDS BUNKER & EXISTING SUMP PLAN	⊠	01
C.301	DETAIL SECTIONS	⊠	01
C.302	DETAIL SECTIONS	⊠	01

Engineering Firm	Project Manager	Client		Sheet Title	Scale	Drawing No
GREEN Being Ltd P.O. Box 1298 Queenstown		OTAMA DAIRY LTD 145 JAFFRAY ROAD RD7, GORE	OTAMA EFFLUENT POND DESIGN	SYSTEM OVERVIEW Printed: 28/09/2012	as shown Job No. 10124	C.101 Revision 01

GREEN Being



3 C.103 **Solids Bunker & Existing Sump Plan**
Scale 1:150 @ A3

Revision History

rev	date	issue
01	28/09/2012	RESOURCE CONSENT

Notes:
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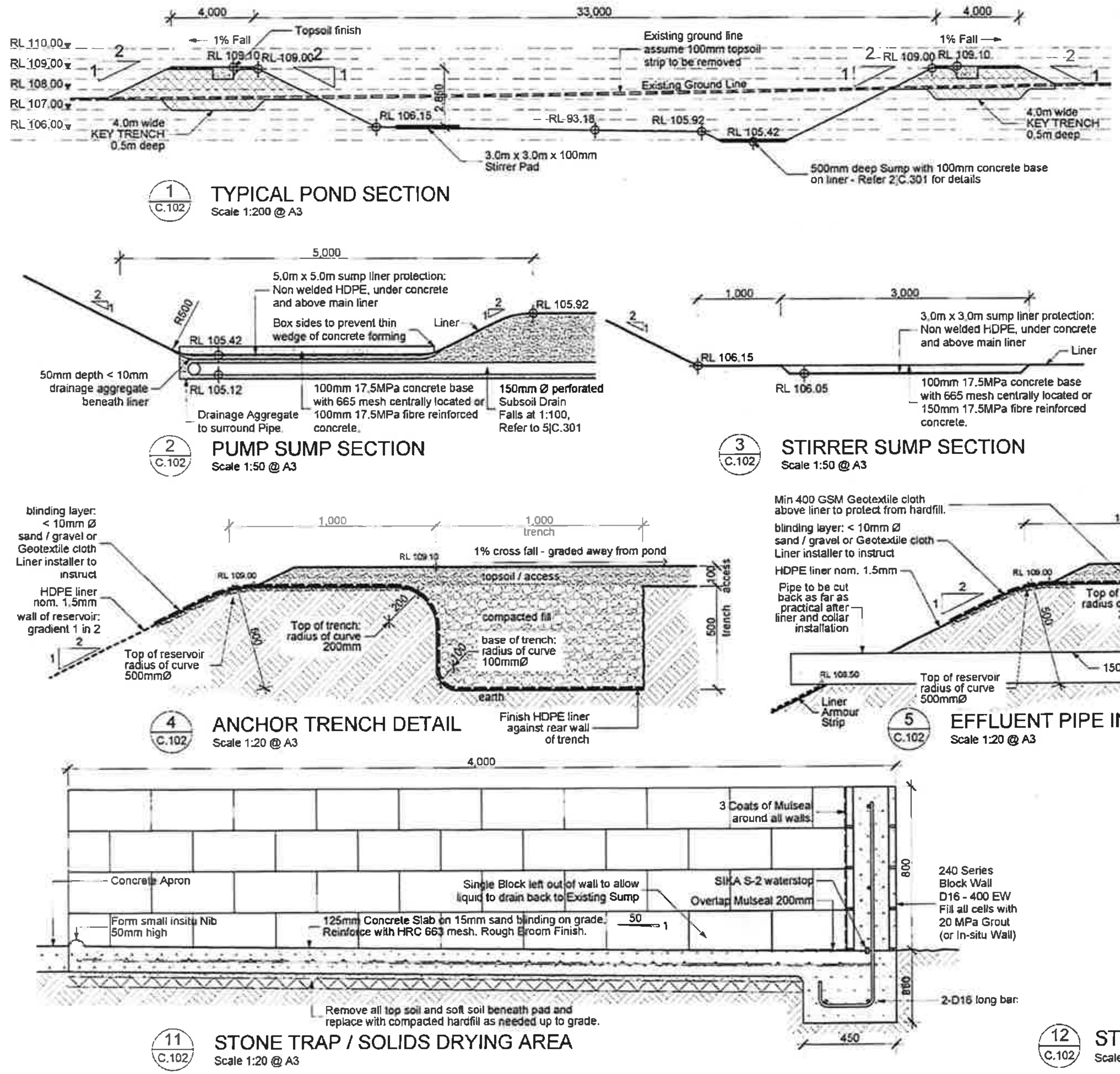
KEY:
Existing Contours

GREEN Being	Engineering Firm: GREEN Being Ltd, P.O. Box 1298, Queenstown	Project Manager	Client: OTAMA DAIRY LTD, 145 JAFFRAY ROAD, RD7, GORE	OTAMA EFFLUENT POND DESIGN	Sheet Title: SOLIDS BUNKER & EXISTING SUMP PLAN; Printed: 28/09/2012	Scale: as shown; Job No. 10124; Drawing No. C.103; Revision 01



Revision History

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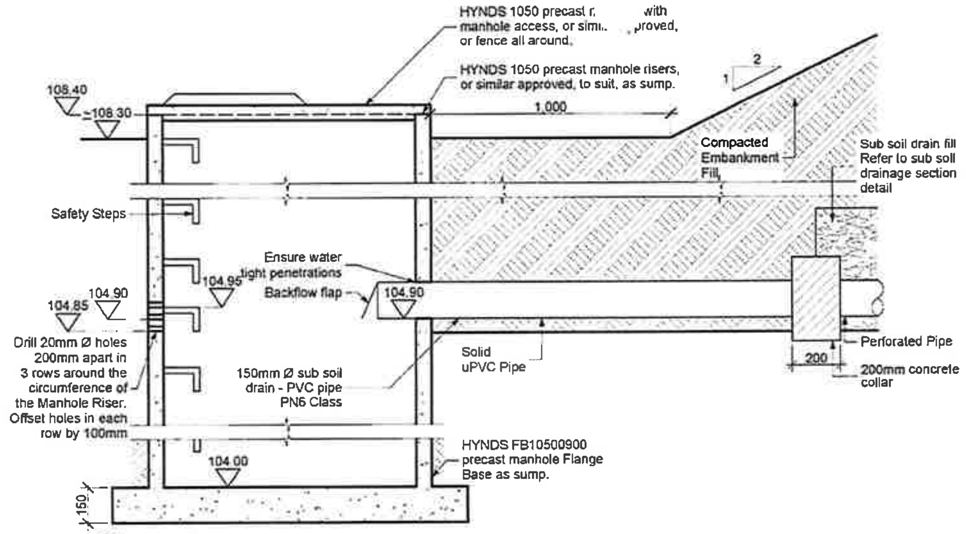
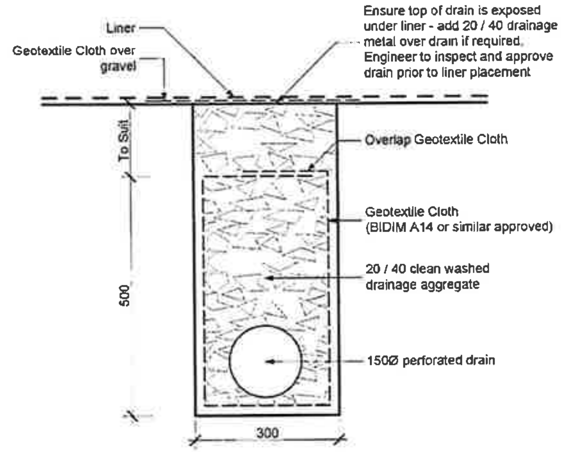
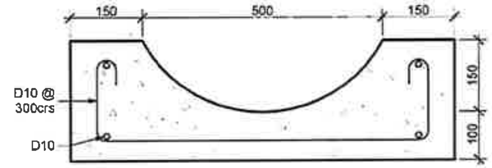


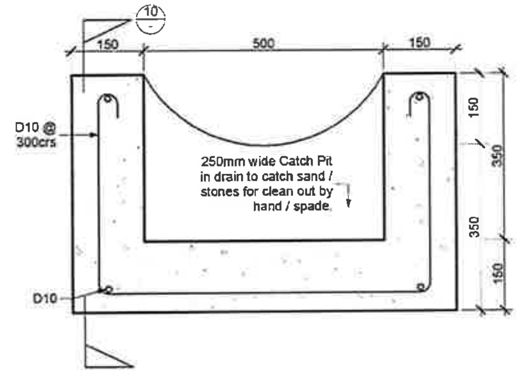
6 C.102 **SUBSOIL DRAIN INSPECTION SUMP DETAIL**
Scale 1:20 @ A3



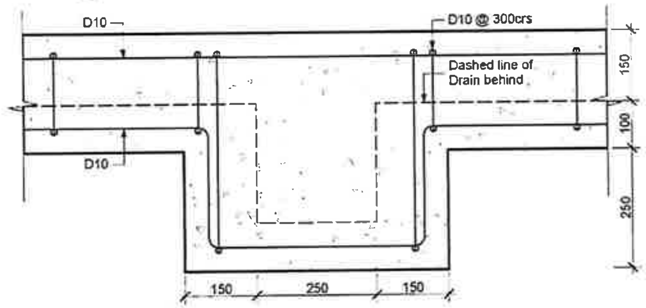
7 C.102 **SUBSOIL DRAIN SECTION**
Scale 1:10 @ A3



8 C.102 **DISH DRAIN CHANNEL SECTION**
Scale 1:10 @ A3



9 C.102 **CATCH PIT SECTION**
Scale 1:10 @ A3



10 C.102 **DISH DRAIN LONG SECTION**
Scale 1:10 @ A3

Revision History

rev	date	issue
01	28/09/2012	RESOURCE CONSENT

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GREENBeing	Engineering Firm: GREEN Being Ltd, P.O. Box 1298, Queenstown	Project Manager	Client: OTAMA DAIRY LTD, 145 JAFFRAY ROAD, RD7, GORE	OTAMA EFFLUENT POND DESIGN	Sheet Title: DETAIL SECTIONS; Printed 28/09/2012	Scale: as shown; Job No. 10124; Drawing No. C.302; Revision 01

NEW ZEALAND COMPANIES OFFICE

COMPANIES REGISTER

Certificate of Incorporation

CASHMERE BAY DAIRY LIMITED

1958675

NZBN: 9429033293974

This is to certify that CASHMERE BAY DAIRY LIMITED was incorporated under the Companies Act 1993 on the 12th day of July 2007.

Registrar of Companies
26th day of March 2019

Certificate generated 26 March 2019 11:40 AM NZDT

Attachment D: Farm Environmental Management Plan

33254

TIAKI

FARM SOURCE SUSTAINABLE DAIRYING

FARM ENVIRONMENT PLAN

ABOUT YOUR FARM ENVIRONMENT PLAN

This Farm Environment Plan document is the result of a tailored farm environment planning service provided to you through Tiaki Sustainable Dairying. It's part of the advantage you get through Farm Source as a member of the Fonterra Co-Operative. The purpose of this plan is to describe the environmental conditions present on your farm and the management of these conditions. From this, mitigations to potential impacts to water quality are documented and additional mitigations maybe planned, with sensible timeframes. Underpinning this plan, are the agreed national Good Farming Practices that are supported by the agricultural and horticultural sectors. Industry bodies along with Regional Councils and Central Government have developed the Good Farming Practice: Action Plan for Water Quality 2018 in a commitment to swimmable rivers and improving the ecological health of our waterways. The Dairy Industry Strategy (Dairy Tomorrow), as well as the Good Farming Practice: Action Plan for Water Quality 2018, both align with the goal for all dairy farms to have a Farm Environment Plan by 2025. Now that this plan has been created it's the plan owner's responsibility to ensure it is put into action and kept up to date as actions are completed or conditions on farm change. Tiaki Sustainable Dairying is here to help with that implementation and ongoing management through our team of Sustainable Dairying Advisors who can be contacted via the details below.

PHONE: 0800 65 65 68

EMAIL: sustainable.dairying@fonterra.com

CONTENTS:

FARM DETAILS

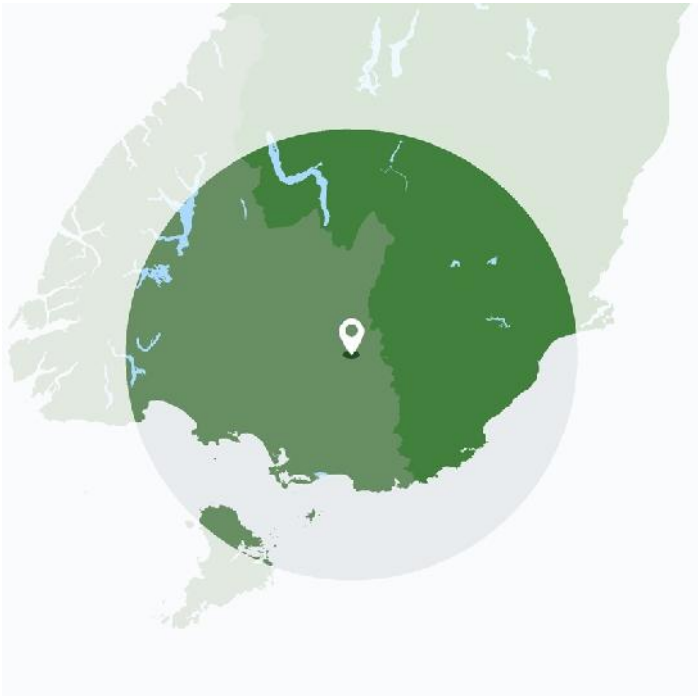
SUPPLIER NUMBER 33254

PLAN OWNER George Edward Digby Raymond

+64 3 2087244
otamadairy@gmail.com

FARM ADDRESS JAFFRAY RD, Riversdale

LOCATION



REGIONAL COUNCIL Southland

PLAN LAST EDITED DATE 06 March 2019

POINTS OF NOTE

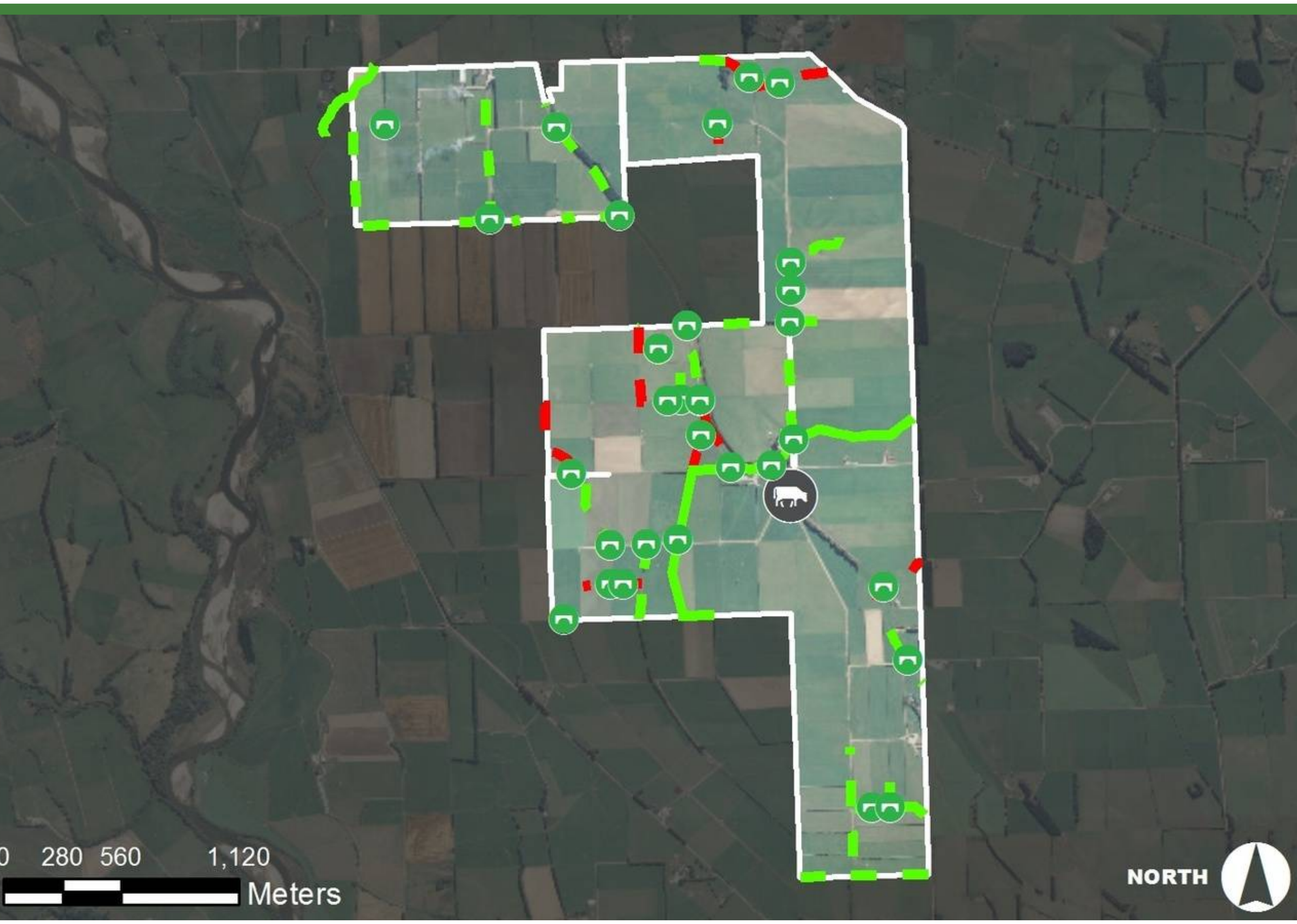
Bedrock/Hill Country - Artificial Drainage: 1.13 ha - 0.22 %. Bedrock/Hill Country - No Variant: 10.40 ha - 1.99 %. Gleyed - No Variant: 49.36 ha - 9.44 %. Gleyed - No Variant: 55.50 ha - 10.61 %. Gleyed - No Variant: 7.88 ha - 1.51 %. Gleyed - No Variant: 0.03 ha - 0.01 %. Gleyed - Overland Flow : 0.95 ha - 0.18 %. Old Mataura - No Variant: 57.00 ha - 10.90 %. Oxidising - No Variant: 0.14 ha - 0.03 %. Oxidising - No Variant: 0.00 ha - 0.00 %. Oxidising - No Variant: 0.32 ha - 0.06 %. Oxidising - No Variant: 330.92 ha - 63.26 %. Oxidising - Overland Flow: 0.37 ha - 0.07 %. Bedrock/Hill Country - Overland Flow: 9.11 ha - 1.74 %. Riverine - No Variant: 0.02 ha - 0.00 %. Type:Water Permit,ID:AUTH-20158314,Expiry:2025-10-08: 0.01 ha - 0.00 %. T

LAND PARCELS

Fee Simple, 1/1, Section 4 Block II Otama Survey District, 809,371 m2, Fee Simple, 1/1, Section 5 Block II Otama Survey District, 805,324 m2, Fee Simple, 1/1, Closed Road intersecting Section 10 Block II Otama Survey District, 1,922 m2, Fee Simple, 1/1, Part Section 9 Block II Otama Survey District, 506,439 m2, Fee Simple, 1/1, Section 2 Block II Otama Survey District, 809,371 m2, Fee Simple, 1/1, Part Section 10 Block II Otama Survey District, 410,124 m2, Fee Simple, 1/1, Section 1 Block II Otama Survey District, 427,829 m2, Fee Simple, 1/1, Section 4 Block I Otama Survey District, 783,901 m2, Fee Simple, 1/1, Lot 2 Deposited Plan 324253 and Lot 2 Deposited Plan 12628, 932,000 m2, Fee Simple, 1/1, Deposited Plan Red411, 302,932 m2, Fee Sim

FARM OVERVIEW MAP

The map below presents the land on which the farming operations covered in this document occur and identifies some key points of interest. More detailed maps looking at specific environmental management topics are contained throughout the document.



- Accord Defined Stock Excluded Waterway
- Accord Defined Stock Not Excluded Waterway
- Non-Accord Defined Stock Excluded Waterway
- Non-Accord Defined Stock Not Excluded Waterway
- Farm Boundary
- Compliant Crossing
- Non-Compliant Crossing
- Non-Compliant Non-Regular Crossing
- Dispensation Crossing
- Dairy Shed

SUMMARY OF OPEN ACTIONS

This table includes all open or ongoing actions that have been agreed as part of this Farm Environment Plan. They are organized by their target due date. Where an action has been identified as especially important an additional (Flag) icon may have been added.

CATEGORY	FEATURE TYPE & NAME	ACTION REQUIRED	TARGET DATE
F4	Water Use Overview - Farm Water Use	Secure Bore Casings	01 Apr 19
L9	Critical Source Area - Muddy Area 15/16	Improve Drainage for Muddy Area	01 Apr 19
E4	Effluent Irrigation - Effluent Irrigation	GFP - 18 Calibrate Cobra Rain Gun	31 May 19
W4	Critical Source Area - Critical Source Area 77	Repair Drainage Paddock 77	31 May 19
W5	Critical Source Area - CSA 76	Fence/plant CSA paddock 76	01 Aug 19
W6	Riparian Management Unit - Paddock 78 Drain	Fence Drain Paddock 78 to	01 Aug 19
L7	Winter Grazing - Winter Grazing	Establish Waterway Buffers	01 Sep 19
E1	Effluent Overview - Effluent Overview	GFP - EG Provide an Effluent Management Plan	01 Sep 19
N2	End of Season Nitrogen Report - Nutrient Budget	GFP - 09 Monitor P Inputs from Fertiliser	01 Sep 19
I3	Probe - Irrigation Probes	GFP - 13 Fully Use Soil Moisture Probe Data	01 Oct 19
I2	Pivot Irrigator - Pivot/Rotorainer Irrigation	GFP - 14 Bucket Test Irrigators	01 Nov 19
L10	Overland Flow Path - Critical Source Area 31 & 32	Manage Critical Source Areas 31/32	01 Aug 20
W3	Crossing - Crossings/Culverts	Culvert Repairs	01 Aug 20
F1	Farm Overview - Farm Overview	GFP - 02 Maintain Accurate Records	Ongoing
L2	Southland Physiographic Zone - Oxidising Physiographic Zone	Good management in the Oxidising zone	Ongoing
L3	Southland Physiographic Zone - Gleyed Physiographic Zone	Good Management in the Gleyed Zone	Ongoing

	L4	Southland Physiographic Zone - Old Mataura Physiographic Zone	Good Management in the Old Mataura Zone	**Ongoing**
	L5	Southland Physiographic Zone - Bed Rock /Hill Country Physiographic Zone	Good Management in the Bedrock/Hill Country Zone	**Ongoing**
	I1	Irrigation Overview - Irrigation Overview	GFP - 14 Consider Irrigation Scheduling Training	**Ongoing**
	W1	Waterways & Biodiversity Overview - Waterway Overview	GFP - 06 Future Laneway Maintenance	**Ongoing**
	W2	Pond Area - Pond 69	Extend Pond Fencing/Potential Wetland	**Ongoing**
	W7	New Block - New Block Waterways	Continue Fencing New Block	**Ongoing**
	W8	Artificial or Tile Drainage - Artificial/Tile Drains	Consider Tile Drain Treatment Methods	**Ongoing**
	W9	Riparian Management Unit - Pro-posed Wetland Area	Pro-Posed Wetland	**Ongoing**
	W10	Riparian Management Unit - Dairy Platform Drains	Fence/Nova-Flow Non-defined Drains	**Ongoing**

FARM MANAGEMENT

F1	Farm Overview - Farm Overview
F2	Infrastructure, storage, waste Overview - Storage, Infrastructure & Waste Overview
F3	Calving Pad - Calving Pad
F4	Water Use Overview - Farm Water Use
F5	Resource Consents - Resource Consents
F6	Key Feature - F45/0442
F7	Key Feature - F45/0426
F8	Key Feature - F45/0434
F9	Key Feature - F45/0172
F10	Key Feature - F45/0422
F11	Key Feature - F45/0173
F12	Key Feature - F45/0182
F13	Key Feature - Offal Pit
F14	Key Feature - Fuel Storage

FARM MANAGEMENT

F1

Farm Overview

Farm Overview

DESCRIPTION:

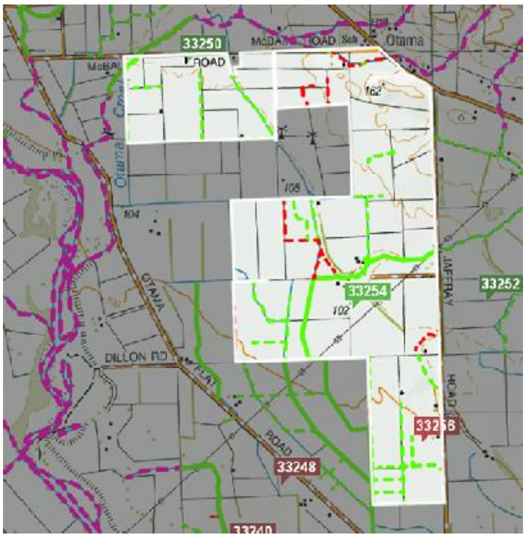
The property is owned by Cashmere Bay Dairy Limited, is located on Jaffray Road, Otama and sits within the Mataura River/Okapua Stream and Otama Creek catchments. Topography is mainly flat to rolling/easy hill

The dairy farm is 523.38ha (this area includes an 89ha runoff and an 80ha new block) in size of which approximately 508ha is available for effective grazing.
The farm rears young stock and heifers on the runoff, cows are wintered on farm.
Around 36ha of fodder beet sown for wintering of cows and heifers for the 2019 winter.
Supplements for 18/19 season from baleage made on farm and imported barley grain.

Good Farming Practice: Identify a farms environmental characteristics and plan for their management

Practices:
* The physical and biophysical characteristics of the farm system are identified, risk factors to water quality associated with the farm system have been assessed and are managed appropriately by the developement of this Farm Environment Plan.

IMAGES:



OPEN ACTIONS:

GFP - 02 Maintain Accurate Records

Maintain records of good environmental management

Practices:
* Accurate and auditable records of annual farm inputs, outputs and management practices are maintained.
This is particularly important for supplementary feed, fertiliser use and location of spreading and stock numbers.
Without this data an accurate picture of the farms environmental and economic performance cannot be obtained.

TARGET DATE: **Ongoing**

F2

Infrastructure, storage, waste Overview

Storage, Infrastructure & Waste Overview

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

DESCRIPTION:

There is an historic silage pit on farm but is not used as supplements made on farm are generally baleage.
All fertiliser is spread by the farm with storage on concrete and in a covered shed.
All imported grain stored in silos at the dairy shed.
General shed/house hold rubbish taken off farm via a skip and there are two separate dead holes, one on the runoff for the occasional calf and the other on the dairy platform, both are located so storm water cannot enter the holes and they do not intercept drains or springs.
Fuel storage for diesel is bunded and enclosed in a plastic storage and all chemicals stored in a locked shed.

Good Farming Practice:

Store, transport and distribute feed with minimal wastage, leachate and soil damage and leaching

Practices:
* Feed storage areas are located away from waterways
* Silage and other feeds are stored on hardsealed areas and leachate is collected
* Overland flow and rain water are diverted away from feed storage areas
* Silage is sufficiently wilted before being put into stack
* Silage remains sealed while stored to prevent rotting
* Permanent feed-out areas / facilities are sealed and effluent is collected
Evidence:
* Farm map identifying tracks, feed areas and troughs

Good Farming Practice:

Store and load fertiliser with minimal spillage and leaching

Practices:
* The Fertiliser Industry - Code of Practice for fertiliser handling, storage and use is followed
* Storage sites are located away from waterways
* Stored fertiliser is covered
Evidence:
* Farm map with storage sites identified

Good Farming Practice:

Farm waste is minimised and managed properly

Practices:
* Waste is recycled where possible
* Waste is contained and removed from farm where feasible
* Dead animals are sent off farm for processing or correctly disposed on-farm
* On-farm waste pits are small, away from waterways, and above the water table
* Pests are controlled

IMAGES:

OPEN ACTIONS:

NO ACTION REQUIRED

F3

Calving Pad

Calving Pad

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

DESCRIPTION:

Wood bark/chip lined calving pad, only used in August for short periods by under 100 cows, scrapped each year and solids applied to whole farm.
Located well away from any waterways, no runoff from the pad when it is in use.

IMAGES:

OPEN ACTIONS:

NO ACTION REQUIRED

F4

Water Use Overview

Farm Water Use

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

DESCRIPTION:

There are seven Environment Southland labelled bores on farm and locations are shown on the Farm Overview map, bores are;

F45/0172, at the old dairy and supplies house water only, casing well above ground level to avoid surface water contamination, casing needs to be capped to prevent direct contamination from occurring.

F45/0422, paddock 9, test bore only, casing well above ground level and is securely capped.

F45/0426, paddock 9, supplies irrigation water, casing secure, telemetry metered and readings sent via Harvest.

F45/ 0434, paddock 15, supplies irrigation water, casing secure, mechanical meter and readings also sent via Harvest.

F45/0422, back of old cowshed, irrigation water and shed/stock supply (separate meter for this),casing secure, telemetry metered and readings sent via Harvest.

F45/0173, beside old cowshed, historic and not used, casing above ground but casing needs to be capped.

F45/0182, no visible sign of this bore in the location shown.

Good Farming Practice:

Water use for the dairy shed and stock water is efficient

Practices:
* All water use on farm is measured (water meters)
* Water wastage is minimised from the dairy shed
* All leaks are fixed as soon as possible
* Water troughs are checked daily where animals are grazing
Evidence:
* Water meter and telemetry records

IMAGES:

OPEN ACTIONS:

Secure Bore Casings

Bore at the old dairy which is used for domestic water supply needs to have the casing capped to prevent direct contamination of the bore from occurring.
Historic bore beside old cowshed also needs to be capped.

TARGET DATE: **01 April 2019**

F5

Resource Consents

Resource Consents

DESCRIPTION:

The dairy farm holds three resource consents, to discharge effluent to land, abstract water for dairy shed and stock drinking purposes and to take and use groundwater for the purpose of irrigation.
A land use consent application is underway for the purchase of additional land to be added to the dairy platform, this is being done by Landpro.

Water Permit Number for Dairy Supply:	301812-V1, expires 19 December 20122
Appendix 1:	Current Resource Consents
Water Permit Number for Irrigation:	AUTH-20158314
Discharge Consent Number:	301811-V2, expires 19 December 2022

OPEN ACTIONS:

NO ACTION REQUIRED

LAND MANAGEMENT

L1	Land Overview - Land Overview
L2	Southland Physiographic Zone - Oxidising Physiographic Zone
L3	Southland Physiographic Zone - Gleyed Physiographic Zone
L4	Southland Physiographic Zone - Old Mataura Physiographic Zone
L5	Southland Physiographic Zone - Bed Rock /Hill Country Physiographic Zone
L6	Soil - Soils
L7	Winter Grazing - Winter Grazing
L8	Laneways - Laneways
L9	Critical Source Area - Muddy Area 15/16
L10	Overland Flow Path - Critical Source Area 31 & 32
L11	Key Feature - Fodder Beet

L1

Land Overview

Land Overview

DESCRIPTION:

Physiographic Zones are a way of grouping areas of Southland that have similar landform types and water quality, zones have been identified according to water origin, soil type, geology and topography.
The farm sits within the Oxidising Zone (63% land area), the Gleyed Zone (22% land area), Old Mataura Zone (11% land area) and Bedrock/Hill Country Zone (4% land area).
The soils on farm are dominated by well drained Mataura and Oreti soils and smaller areas of Fleming, Jacobstown, Gore and Pyramid soils.
For the 2019 winter season 36ha of Fodder Beet has been sown to be grazed in May through to August. All crops are on flat topography, strategic grazing/back fencing of crops is undertaken, portable troughs are used when required, baleage placed alongsides of paddocks pre-winter and a lane left down sides of paddocks so baleage can be placed in feeders without driving over the crop.
Beet sown conventionally and approximately half the area re-sown early in September/October by minimum tillage into oats/peas to act as catch crops.

Critical Source Areas (CSA) have been identified under this Farm Environment Plan, these areas have a high risk of channelling
contaminants to water, for this property they are generally linked to the waterways on farm and are discussed under waterways.

Practices impacting land management include:
* Wintering
* Critical Source Areas

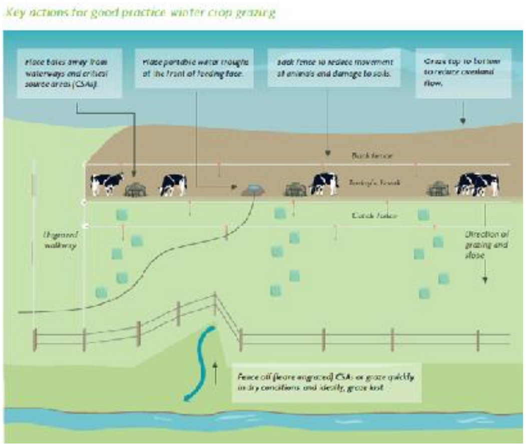
Good Farming Practice:	Manage grazing to minimise nutrient loss from risk areas Practices: * If paddocks near waterways are used during wet periods, a buffer strip beside the waterway is fenced off * More feed is offered in cold conditions when demand is high and utilization low * When break feeding: --Feeding is towards the waterway --Fences are moved daily rather than offering a few days feed at a time -Land that has already been grazed is back-fenced * Crops: --Long narrow breaks are offered rather than wide breaks --Crops are sown across slopes not up and down where practical
Good Farming Practice:	Reduce periods of bare soil between crops and pasture to reduce erosion and leaching Practices: * Bare paddocks are re-sown as soon as practical * Erosion damaged areas are rest and re-sown * Cover crops (e.g. oats, mustard) are used to reduce losses and increase soil organic matter
Good Farming Practice:	Use appropriate paddocks for intensive grazing Practices: * Low risk paddocks are selected for intensive grazing that are ideally: --Further away from waterways --With soils least likely to pug and compact --Flatter with as few gullies and swales as possible Evidence: * Map winter cropping areas

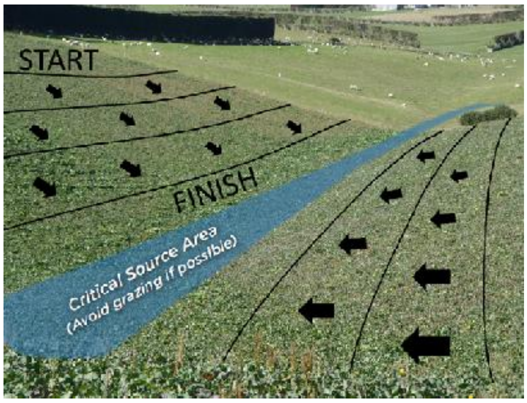
Good Farming Practice:

Minimise losses of sediment and nutrient to water, and maintain soil structure

Practices:
* Pugging and compaction of soils is avoided
* No tillage or low impact cultivation methods and timing are considered
* Supplement feed-out areas are located away from waterways
* Riparian margins or buffer strips are left beside waterways and other areas where sediment and nutrients may flow such as gullies or swales.

IMAGES:





OPEN ACTIONS:

NO ACTION REQUIRED

L2

Southland Physiographic Zone

Oxidising Physiographic Zone

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = **HIGH RISK RATING**

DESCRIPTION:

Groundwater quality in the Oxidising zone is susceptible to nitrate leaching and accumulation in groundwater due to the flat topography, well drained soils and low denitrification potential of soils and aquifers. Nitrate which accumulates between summer and early autumn is leached to underlying groundwater during the drainage season.
In areas where soils are sloping and/or slowly permeable overland flow and bypass flow via artificial drainage provides pathways for losses of nitrogen, phosphorus, microbes and sediment to water.

Appendix 2: Physiographic Zone map

Key contaminant pathway: Deep Drainage

IMAGES:

OPEN ACTIONS:

Good management in the Oxidising zone

Reduce the effects of deep drainage by reducing the accumulation of surplus nitrogen in the soil, particularly during autumn and winter by minimising the applications of nitrogen fertiliser and effluent in these high risk periods.

TARGET DATE: Ongoing

LAND MANAGEMENT

L3

Southland Physiographic Zone

Gleyed Physiographic Zone

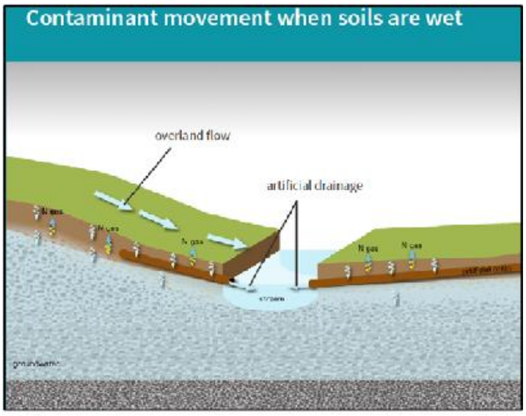
DESCRIPTION:

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 on sloping topography.

Key contaminant pathway: Overland Flow

Key contaminant pathway: Artificial Drainage

IMAGES:



Glayed

OPEN ACTIONS:

Good Management in the Gleyed Zone

1. Reduce the effects of artificial drainage by:
• Protecting soil structure, particularly in gullies and near stream areas
• Reducing phosphorus use and loss
• Reducing the accumulation of surplus nitrogen in the soil, particularly during autumn and winter
• Avoiding preferential flow of effluent through drains
• Capturing contaminants at drainage outflows

2. Reduce the effects of overland flow by:
• Protecting soil structure, particularly in gullies and near stream areas
• Managing critical source areas (CSA)
• Reducing phosphorus use or loss

TARGET DATE: Ongoing

L4

Southland Physiographic Zone

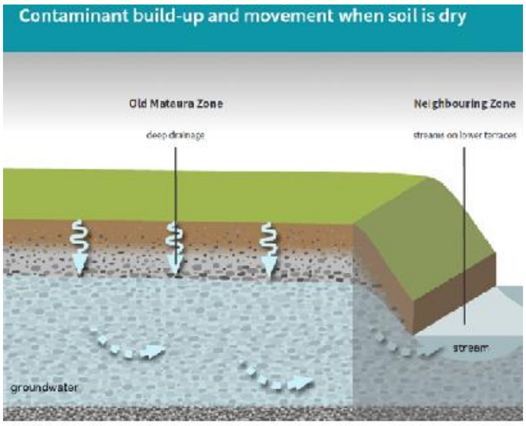
Old Mataura Physiographic Zone

DESCRIPTION:

Typically, soils in this zone are well drained with water draining straight down to underlying aquifers andno ability to remove nitrogen (denitrification) they have little to no connection to main river systems, and therefore no dilution by pristine Bedrock/Hill Country and Alpine zone waters.

Key contaminant pathway: Deep Drainage

IMAGES:



Old Mataura Zone

OPEN ACTIONS:

Good Management in the Old Mataura Zone

Reduce the effects of deep drainage by reducing the accumulation of surplus nitrogen in the soil, particularly during autumn and winter, similar to the GMP for the Oxidising zone

TARGET DATE: **Ongoing**

L5

Southland Physiographic Zone

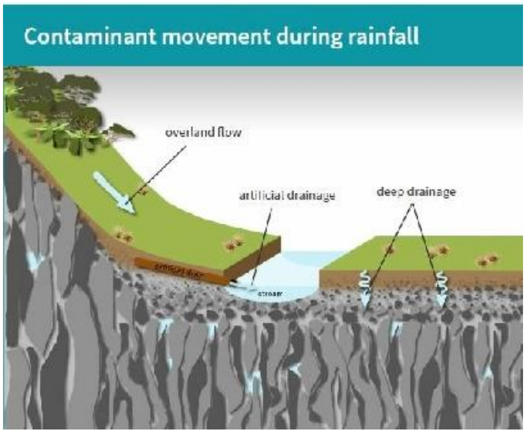
Bed Rock /Hill Country Physiographic Zone

DESCRIPTION:

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

Key contaminant pathway:	Overland Flow
Key contaminant pathway:	Artificial Drainage

IMAGES:



OPEN ACTIONS:

Good Management in the Bedrock/Hill Country Zone

Good management in the Bedrock/Hill Country zone includes measures for reducing the effects of overland flow and artificial drainage.

Reduce the effects of overflow by:
• Protecting soil structure, particularly in gullies and near stream areas
• Managing critical source areas (CSA)
• Reducing Phosphorus use and loss

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

TARGET DATE: Ongoing

L6

Soil

Soils

DESCRIPTION:

Mataura soils comprise 213.5ha of the effective area, they are typically free draining with occasional depression areas that have imperfect drainage. Textures are typically silt loam to loamy silt with 10 to 20% clay in the topsoil, this reflects their very severe rating for structural compaction due to low clay and P retention in the topsoil. The moderate permeability and high water holding capacity reflects a moderate rating for nutrient leaching.

Oreti soils 9178.9ha) are well drained, top soil textures are silt loam to sandy loam to sand in the deeper horizons and soils stony in both the top and subsoil. The good drainage, low total available water and rapid permeability reflect a very severe rating for nutrient leaching and slight rating for structural compaction.

Fleming soils (60.1ha), these soils are imperfect to poorly drained with a dense fragipan at 45-90cm, textures are silt loams but range between loamy silt and heavy silt loam. These characteristics provide a slight rating for nutrient leaching but severe for structural compaction and waterlogging.

Jacobstown soils (25.9ha) have similar characteristics to the Fleming soils but are poorly drained, the soils are moderate deep too deep with slow subsoil permeability and are stone free.

Gore soils (19.8ha) are stony in both the topsoil and subsoil which limits rooting depth and water holding capacity, textures are silt loams in the topsoil grading to sandy in the subsoil, subsoils commonly very to extremely gravelly from 30cm depths, this leads to very severe rating for nutrient leaching due to the moderate water holding and rapid permeability this also leads to nil rating for waterlogging and only moderate rating for structural compaction.

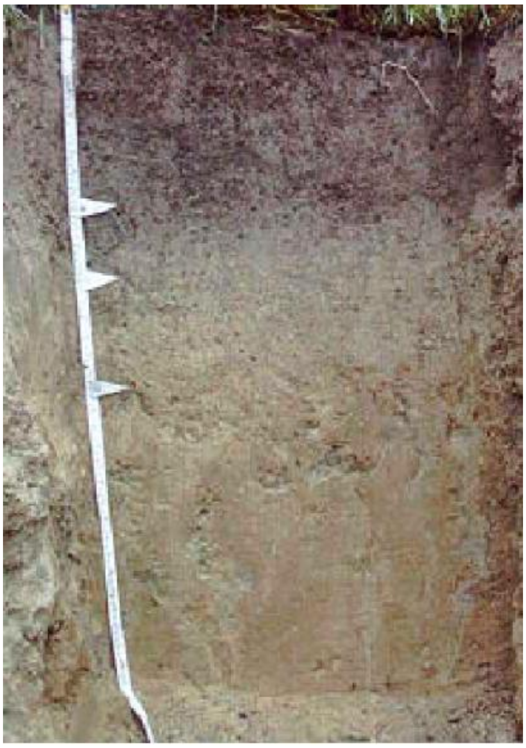
Pyramid soils (12.3ha), a minor soil in Southland and of the farm area, these soils are Pallic and are free draining, they have a severe rating for structural compaction and nutrient leaching.

Appendix 3: Farm Soil map

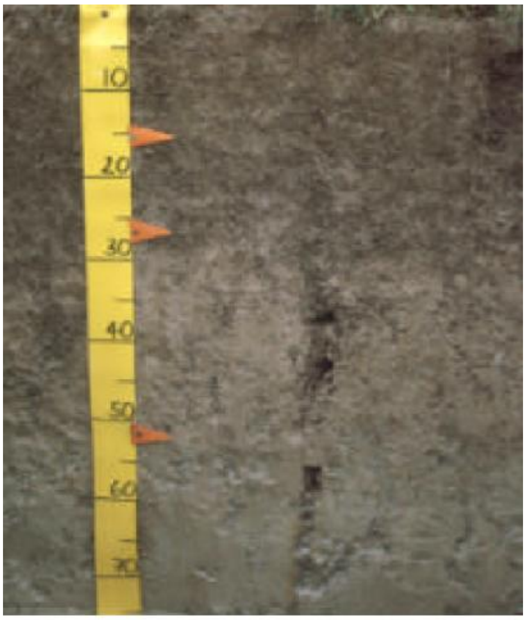
IMAGES:

Oreti profile

Gore profile



Fleming profile



Jacobstown Profile

Mataura profile

OPEN ACTIONS:

NO ACTION REQUIRED

L7

Winter Grazing

Winter Grazing

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

DESCRIPTION:

Winter grazing in Southland is one of the biggest issues facing dairy farmers, good management practices that are undertaken on farm currently are helping to mitigate these issues.

For the 2019 winter 5.42 of Beet to grazed by R2 heifers on the runoff, 21ha of beet on the new block and 4.94ha on the dairy platform for the cows.
All paddocks are on flat ground, one critical source area identified on the new block (north side of the pond) which you plan to fence out and graze last, any land sloping towards drains/waterways will also be grazed last.

Currently all drains and waterways next to crops are permanently fenced, main waterway on the runoff has a 5m buffer between crop and water, crop next to drains on the dairy platform have on average a 3- 4m grass buffer.
In the future good management practice to leave a buffer strip between crops and waterway, minimum buffer size of 5m and further depending on slope.

Catch crop sown after winter grazing:	Oats
Slopes grazed from top to bottom:	Yes
Stock back fenced off areas already grazed:	Yes
Baleage placed in paddock before soil is too wet:	Yes
Critical Source Areas fenced off and retained:	Yes
Silt and Sediment Traps Utilised:	N/A
Portable or Permanent Water Troughs:	Yes
Paddock soil tested and results utilised:	Yes
Minimisation of fallow periods:	1-2
Soil-and-crop-suitable fertiliser used:	Yes

IMAGES:





OPEN ACTIONS:

Establish Waterway Buffers

In the future it would be good management practice (future permitted rules) to leave an uncultivated buffer strip of 5m between crop and waterways, to help filter any potential sediment and nutrient runoff.
For crops sown in September 18 and to be grazed winter 19 look to grazing crop that sits alongside any drains/waterway last so a 5m strip can be maintained till the last break is grazed.

TARGET DATE: 01 September 2019

L8

Laneways

Laneways

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

DESCRIPTION:

The dairy lanes over the farm are generally wide enough to facilitate good cow flow (5~7m) with a solid base and a very good surface incorporating an appropriate crown and camber (see attached pictures).
Quality lanes allow for good stock flow, which reduces lameness issues and the build-up of effluent on the lane surface and adjacent paddocks.

If areas of lane are on a slope then cut-outs can be placed to allow water to run-off at regular intervals rather than being
channelled into the creek (see attached example)

IMAGES:

Source: New Zealand Farm Environment Award Trust 2003

Source: New Zealand Farm Environment Award Trust 2003

OPEN ACTIONS:

NO ACTION REQUIRED

L9

Critical Source Area

Muddy Area 15/16

IMPACT OF CONTAMINATION  +  LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

DESCRIPTION:

Large area in paddocks 15 & 16 that was muddied over in October, a risk in wet conditions of sediment runoff and P loss, there is a drain to this area but has become sealed over, need to re-work top layer to allow drainage to occur and check drain outlet.

IMAGES:

OPEN ACTIONS:

Improve Drainage for Muddy Area
Re-work the area so drainage installed allows area to dry and grass can be re-sown.
TARGET DATE: **01 April 2019**

L10

Overland Flow Path

Critical Source Area 31 & 32

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

DESCRIPTION:

Critical source areas that start in paddock 31 and goes up to paddock 34, connected to the non-defined drain on the boundary, potential for pugging to occur and some sediment loss.
This area is not grazed when conditions are wet only when soil conditions are suitable are the cows allowed into graze these paddocks.
Plan for drainage work to occur through these paddocks

IMAGES:

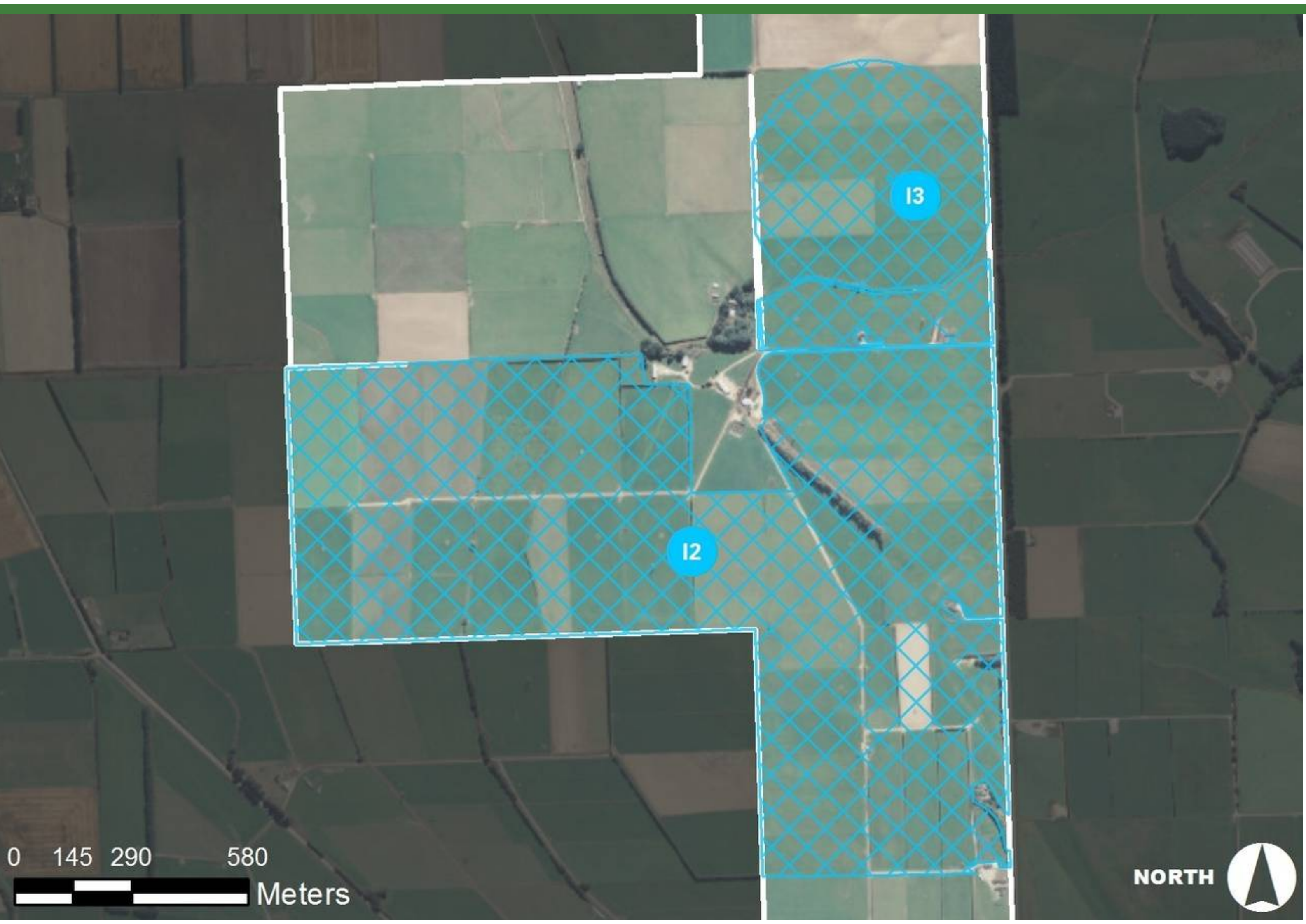
OPEN ACTIONS:

Manage Critical Source Areas 31/32

Continue to restrict grazing to these paddocks in wet conditions but would be GMP to have drainage installed to remove water from these CSAs

TARGET DATE: **01 August 2020**

IRRIGATION MANAGEMENT



I1 Irrigation Overview - Irrigation Overview

I2 Pivot Irrigator - Pivot/Rotorainer Irrigation

I3 Probe - Irrigation Probes

I1

Irrigation Overview

Irrigation Overview

DESCRIPTION:

The farm currently utilises Pivot irrigation and Rotorainers to irrigate approximately 186.4ha and irrigation can be subject to restrictions based on minimum flow of 11 cumec/sec on the Mataura River or total water take of 600,00m³/year.

Soil moisture probes were installed 5 years ago by Hydro Services and the Harvest monitoring system has been installed to monitor water use and record where, when and amounts.
Current farm policy if 10mm of rain occurs then both forms of irrigation are switched off for 2 days.

Water Force do an annual dry check on the pivot system but no bucket tests have been done on the Pivot or Rotorainers, these are planned to be done, recommendation from Irrigation NZ, a bucket test on all irrigation systems should be done every 3 years, this will ensure pasture production is maximised and water is being used efficiently.

With great importance being placed on the efficient use of water in the dairy industry consideration should be given to attending a training programme to ensure irrigation scheduling is as efficient as possible, there are courses available for owners through Irrigation NZ

Good Farming Practice:

Irrigation rates and timing match plant requirements

Practices:
* Soil moisture levels and weather when scheduling irrigation are assessed by: --Estimating soil moisture levels with a soil water budget or --Monitoring soil moisture levels with real time soil moisture equipment
* All water use on farm is measured (water meters)
* Large water takes are measured (telemetry)
* Irrigation events are recorded - when, where, amount
Evidence:
* Water meter and telemetry records
* Irrigation event and location records

Good Farming Practice:

Design, calibrate and operate irrigation systems to use water efficiently

Practices:
* An accredited design and installation company is used - Blue tick for new irrigation system or upgrades
* Irrigation system(s) are evaluated annually to check application efficiency and performance (consider using a skilled professional to assess)
* Inspect and maintain regularly

OPEN ACTIONS:

GFP - 14 Consider Irrigation Scheduling Training

Design, calibrate and operate irrigation systems to use water efficiently

Practices:
* All staff are trained to use the system (Consider Irrigation NZs operator and manager training)

TARGET DATE: Ongoing

I2

Pivot Irrigator

Pivot/Rotorainer Irrigation

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

DESCRIPTION:

Pivot cover an area of 29ha and is currently run at 3.3mm/24 hours when soil conditions are suitable, this is at 70% of the pivot speed, the end guns can switch off for lanes and boundaries.

Two Rotorainers which cover an area of 157.5ha, generally run at 30mm/24 hours with a 10 day return period.

Recommend both Rotorainers and pivot are bucket tested to ensure they are operating at required specifications, applying water efficiently and at correct depths of water.

IMAGES:

OPEN ACTIONS:

GFP - 14 Bucket Test Irrigators

Design, calibrate and operate irrigation systems to use water efficiently

Practices:
* Routine bucket tests are carried out to assess performance

TARGET DATE: 01 November 2019

I3

Probe

Irrigation Probes

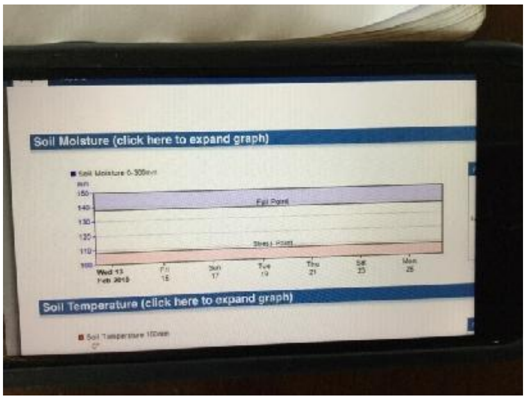
IMPACT OF CONTAMINATION + **LIKELIHOOD OF CONTAMINATION** = **HIGH RISK RATING**

DESCRIPTION:

Probes have been installed under the pivot irrigator and are used for both irrigation systems and recommendations from water check.com are sent weekly. .
Soil moisture monitoring technology is a simple and real time way to assess what soil moisture levels are in the soil, and can help demonstrate that irrigation events are justified and suitable when combined with weather forecast information and application depths of the system.
They are not used to set trigger and targets for scheduling irrigation and replacing soil moisture deficit, but more on when and not to irrigate based on soil moisture levels.

Where irrigation infrastructure and scheduling is not managed to meet plant demands there is a risk of nutrient runoff and nitrogen leaching to water due to over application and excess drainage.
The use of soil moisture probes should allow irrigation to replace soil moisture deficit only and match irrigation rates and timing to plant requirements.

IMAGES:



OPEN ACTIONS:

GFP - 13 Fully Use Soil Moisture Probe Data

Large investment gone into installing irrigation infrastructure on farm and I think the soil moisture probe data could be used more to schedule irrigation events, by doing this irrigation data entered into Overseer could be updated and would show an N loss to water reduction.

TARGET DATE: **01 October 2019**

EFFLUENT MANAGEMENT

E1 Effluent Overview - Effluent Overview

E2 Dairy Shed - Dairy S/N 33254

E3 Effluent Storage - Effluent Pond

E4 Effluent Irrigation - Effluent Irrigation

E1

Effluent Overview

Effluent Overview

DESCRIPTION:

Effluent system for the farm is well designed and set up, effluent can be applied to 158ha via a low rate Cobra Rain Gun and by injection into pivot water or 100% through the pivot with no water.
All three systems have fail safes in place to prevent accidental discharges from occurring and there is a backflow valve in place to prevent effluent contaminating the water supply.

A storage calculation was done for the farm and showed there is sufficient requirements to meet the farms needs.

When the pivot is bucket tested for water irrigation this will provide clarification of depths applied and would be GMP to test the Cobra Rain Gun as well.

An effluent management plan is a good management practice to have at the dairy this shows how the system operates, the risk areas, emergency procedures for when the system breaks down and what and when maintenance needs to be carried out, this will also be a requirement of your discharge consent in the future and Fonterra can supply this for you.

Good Farming Practice: Effluent system meets code of practice

Practices:
* Effluent is collected from all sources: dairy sheds, yards, feeds pads, underpasses
* The system design is appropriate for the soil type, topography, and climate
* New systems: accredited designer has been used

Good Farming Practice: Effluent applied at correct depth, rate and time

Practices:
* Effluent application timing and rates are adjusted based on soil moisture levels
* Nutrient load is spread evenly across the largest area practical
* Tests for high potassium (K) levels on effluent block are done to avoid animal health issues
* Risk areas for effluent application are identified and recorded on a map
* Odour impact is considered during application
Evidence:
* Soil test results
* Nutrient budget - effluent report
* Effluent application area risk map

Good Farming Practice: Spreading equipment is well maintained and calibrated

Practices:
* Effluent equipment is inspected and maintained regularly
* Effluent pumping equipment is routinely serviced

Good Farming Practice: Sufficient suitable storage available

Practices:
* Dairy Effluent Storage calculator has been used to work out storage needs
* New storage built, has been by an accredited effluent designer
* Effluent is applied whenever possible to keep storage low
* Storage facilities are sealed

* Effluent solids that accumulate are routinely removed
* Safety barriers, equipment and signage are in place
Evidence:
* Dairy Effluent Storage Calculator report
* Storage design plans

Good Farming Practice:

All effluent systems

Practices:
* Effluent consent conditions and regional rules are understood and complied with
* All effluent applications are recorded
* Staff are trained on how to operate and maintain the effluent system

OPEN ACTIONS:

GFP - EG Provide an Effluent Management Plan

Staff are trained on how to operate and maintain the effluent system and by providing an effluent management plan will provide them with documentation on how this is achieved and will meet your discharge consent conditions.
This can be provided by Fonterra

TARGET DATE: 01 September 2019

E2

Dairy Shed

Dairy S/N 33254

DESCRIPTION:

A 50 rotary shed and overall presentation is good with a tidy shed and surrounds.

All effluent is contained on concrete from the dairy shed/main yard and entry/exit onto the yard, gravity feeds to the lined effluent pond via a stone-trap and concrete solids pond.
Storm water is diverted off the shed roof all year round and all concrete catchment diverted in the winter months

IMAGES:

OPEN ACTIONS:

NO ACTION REQUIRED

E3

Effluent Storage

Effluent Pond

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

DESCRIPTION:

HDPE lined effluent pond with the dimensions of 33m x 33m x average depth of 3m with a 2:1 batter gives a total volume of 2223m³ and an effective volume of 1710.8m³
A storage calculation has been done based on this volume and shows there is sufficient storage available for the farm when effluent applied at low rate with the Cobra Rain Gun and injected into the pivot.
With solids removed before the pond and a stirrer in the pond all solids are removed from the pond which alleviates the risk of having to de-sludge the pond.

Dairy effluent storage calculator:	Yes
Solids management:	Spread immediately
Pond lining:	Clay
Stormwater diversion:	Yes
Appendix 5:	Original Pond Design
Pond Volume:	Total Volume 2223m³, Effective Volume 1710.8m³
Appendix 4:	Storage Report

IMAGES:

OPEN ACTIONS:

NO ACTION REQUIRED

E4

Effluent Irrigation

Effluent Irrigation

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

DESCRIPTION:

The area of effluent irrigation on the farm is 186ha (this area does not include setbacks and buffers), 127ha on high risk soils due to the slope and drainage characteristics and 58ha low risk.
Good Management Practice to have minimum 8ha/100 cows for the regular effluent area, with consented cow numbers to be set at 1000 this would require 80ha.

Effluent is applied via the Cobra Rain Gun when the pivot is not running, it can apply down to depths of 1.2mm or rates at between 4.9mm to 6.4mm, so is suitable in the shoulders of the season or when conditions are wet. Has a fail-safe if irrigator stops and high/low pressure failsafe. Good Management Practice to have this depth tested and check fail-safe regularly to confirm it is working.

Pivot effluent is controlled with end guns being able to turn off, sections can shut down when close to waterways, policy for the farm if effluent applied at 100% then pivot run at 100% applying 2mm/application. If the pivot stops then pump automatically switches off and no siphoning of effluent can occur.

Irrigation method:	Through pivot (injected)
Irrigation method:	Travelling irrigator
Application depth testing:	No

IMAGES:

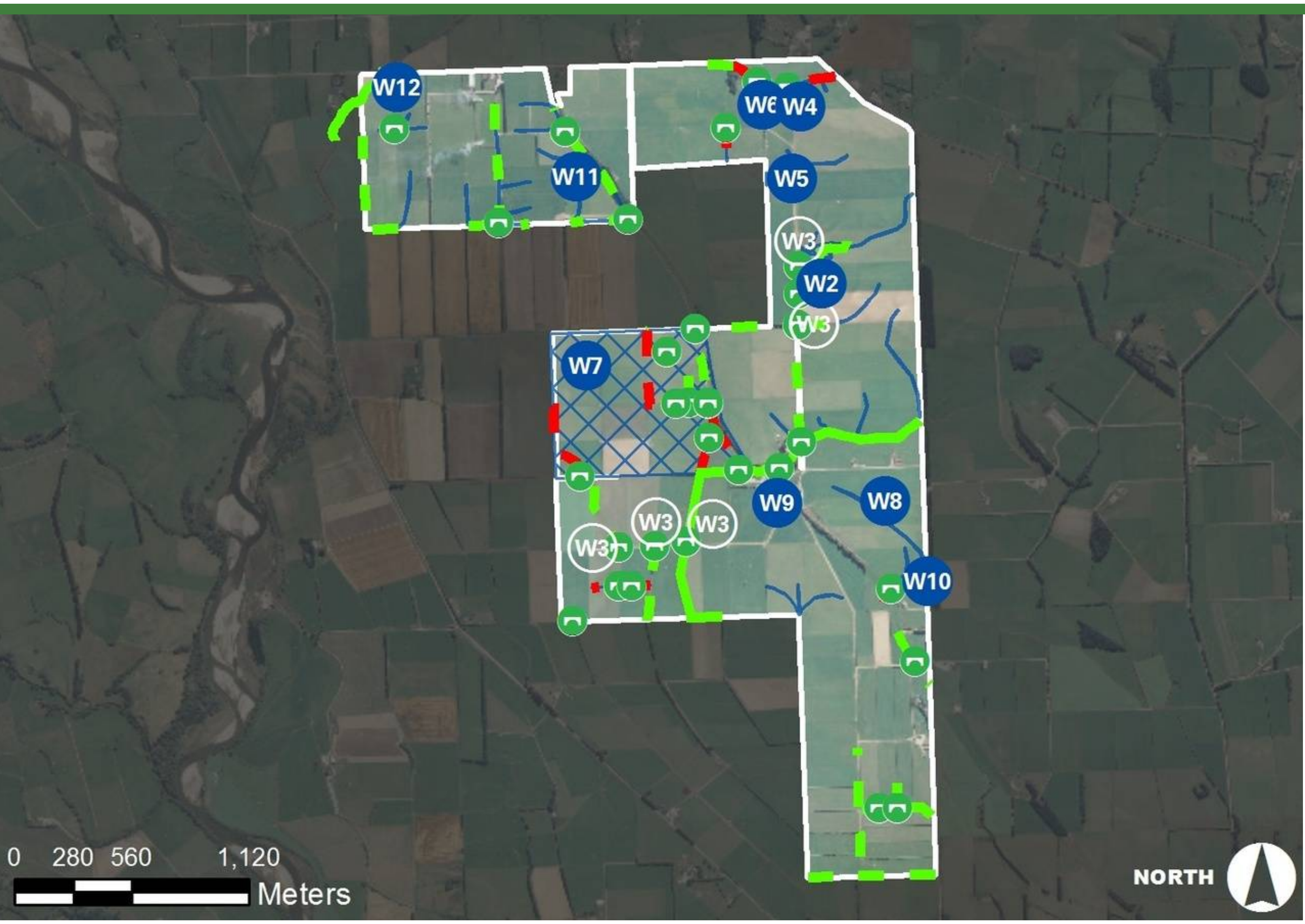
OPEN ACTIONS:

GFP - 18 Calibrate Cobra Rain Gun

Need to know what your effluent system can apply and will also be a consent requirement, Fonterra has a testing kit which we can supply or we can do the test for you.
Check Fail-safe

TARGET DATE: **31 May 2019**

WATERWAYS & BIODIVERSITY MANAGEMENT



W1	Waterways & Biodiversity Overview - Waterway Overview
W2	Pond Area - Pond 69
W3	Crossing - Crossings/Culverts
W4	Critical Source Area - Critical Source Area 77
W5	Critical Source Area - CSA 76
W6	Riparian Management Unit - Paddock 78 Drain
W7	New Block - New Block Waterways
W8	Artificial or Tile Drainage - Artificial/Tile Drains
W9	Riparian Management Unit - Pro-posed Wetland Area
W10	Riparian Management Unit - Dairy Platform Drains
W11	Riparian Management Unit - Runoff Drains

W12 Riparian Management Unit - Runoff Waterway

Accord Defined Stock Excluded Waterway

Accord Defined Stock Not Excluded Waterway

Non-Accord Defined Stock Excluded Waterway

Non-Accord Defined Stock Not Excluded Waterway

Compliant Crossing

Non-Compliant Crossing

Non-Compliant Non-Regular Crossing

Dispensation Crossing

W1

Waterways & Biodiversity Overview

Waterway Overview

DESCRIPTION:

Two defined waterways on the farm (2.5km), one in the north west corner on the runoff (attached picture) and the other running through the center of the farm, both are permanently fenced to exclude stock.
The farm has 7.9km of non-defined drains which are also permanently fenced and there are 2.9km of drains that are not fenced, there are actions as part of this FEP to fence off some of these and some drains that have been dug in the past do not carry any water and these will be filled in over time. All drains on the runoff are fenced.

The new block recently purchased has non-defined drains and these are all well underway to being permanently fenced, unfenced areas still to be fenced have been identified on the waterway maps (red dotted lines on New Block).
New block also has a pond which will be permanently fenced, and the defined waterway (350m long) will have a 10m riparian buffer both sides and also a plan to involve Land Sustainability staff from Environment Southland to create a wetland area to filter drains and tiles from the upper part of the dairy platform.

Approximately 1.2km of lane (5.5km of lanes in total) run alongside non-defined drains, currently there is a 2-3m buffer of rank grass which allows for filtering of sediment/e-coli off the lanes, in the future if lane maintenance to be done look to camber this area of lane out into the paddocks so any potential runoff will be filtered through grass.

Good Farming Practice:

Tracks, feed areas, gateways and troughs are located away from waterways

Practices:
* Tracks are located away from waterways where practical
* Supplement is feed out away from waterways
* Water troughs are located away from waterways in a dry area of paddocks
* Gateways are in a dry point and are wide enough for good cow flow to reduce pugging
Evidence:
* Farm map identifying tracks, feed areas and troughs

Good Farming Practice:

Stock are excluded from waterways

Practices:
* All permanently flowing waterways (including wetlands) are fenced
* All regular stock crossings are bridged or culverted
* Any temporary streams are temporarily fenced if grazing while water is flowing
* A riparian management plan has been developed (include any plantings)
* Drains are well managed
Evidence:
* Farm waterways map with fencing and crossings shown

Good Farming Practice:

Identify areas where runoff may occur and manage to avoid runoff entering waterways

Practices:
* Risk areas where surface runoff may enter waterways are identified
* A grass buffer strip or riparian plantings have been left between waterways and fences
* When cultivating paddocks an uncultivated buffer strip between cultivation and waterway is left (the steeper the land the wider the buffer strip is)
* Bridges and culverts have raised sides or mounds to stop runoff

entering waterway
* Track cut-outs are maintained to appropriately direct track runoff
Evidence:
* Risk areas identified on farm map
* Record any riparian fencing, planting or buffer strips on farm map

IMAGES:

OPEN ACTIONS:

GFP - 06 Future Laneway Maintenance

Identify areas where runoff may occur and manage to avoid runoff entering waterways

* Where tracks are beside waterways, the track is sloped in the opposite direction to avoid potential effluent and sediment flowing into the waterway

TARGET DATE: 01/08/2021

W2

Pond Area

Pond 69

DESCRIPTION:

Large area in paddock 69 which includes a pond, drainage from the hill above is directed through the pond to catch any sediment runoff from the hill above.
Good to get Land Sustainable staff from Environment Southland to look at the area below the pond to see if a potential wetland area would be feasible.
There are some CSAs areas outside the fence that are wet, of low grazing value and would be good to see them incorporated into the stock excluded area.

IMAGES:

OPEN ACTIONS:

Extend Pond Fencing/Potential Wetland

Consider fencing off critical source areas that boundary this block and investigate potential wetland area, recent work done in Waituna shows significant reductions with N loss from new wetlands.

TARGET DATE: Ongoing

W3

Crossing

Crossings/Culverts

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

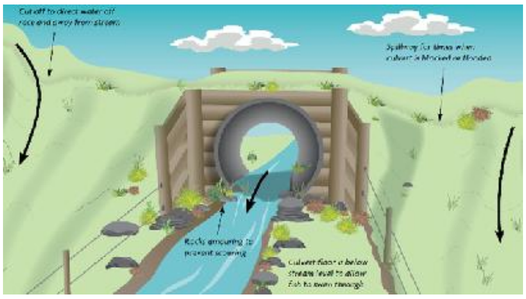
DESCRIPTION:

There are 31 stock crossings on farm, all the waterways have culverts, but crossings by paddocks 4, 5, 7, 68 and 69 require some minor repairs, low risk for sediment/e coli runoff as lanes in very good condition and no effluent build-up.

Type:	Culvert
Fish Passage (Culvert):	Yes

IMAGES:



OPEN ACTIONS:

Culvert Repairs
Sides of culverts need to be built up and allow for any surface water runoff to be directed out into the paddocks not directly to the waterway
TARGET DATE: **01 August 2020**

W4

Critical Source Area

Critical Source Area 77

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = MEDIUM RISK RATING

DESCRIPTION:

Very wet gully with a spring at the top, was previously drained but it is now blocked, do not want cows pugging this gully as potential for sediment to reach nearby creek.

IMAGES:

OPEN ACTIONS:

Repair Drainage Paddock 77

Gully drain needs to be repaired to allow drainage to occur or permanently fence this off. In the short term would consider temporary fencing if stock are grazing.

TARGET DATE: 31 May 2019

W5

Critical Source Area

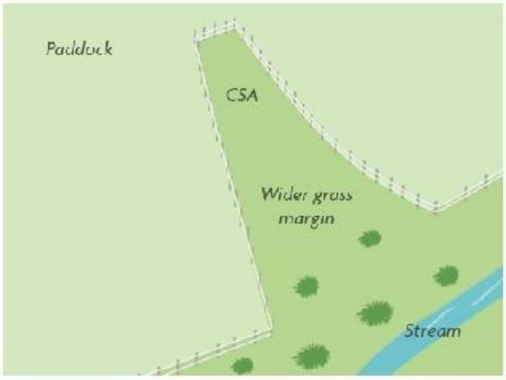
CSA 76

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = MEDIUM RISK RATING

DESCRIPTION:

Wet area next to the boundary in paddock 76, the end of a tile drain and this would be an ideal area to fence off from the boundary fence and plant out in Flax and Toi- Toi to help take up any nutrients and filter sediment from the tile drain.

IMAGES:



Fencing CSAs creates a grass buffer zone to filter out nutrients before they enter waterways

OPEN ACTIONS:

Fence/plant CSA paddock 76

Would consider ending the tile at the start of the wet area and by planting this area would mitigate any nutrient/sediment runoff from the tile drain (see attached example two pictures)

TARGET DATE: 01 August 2019

W6

Riparian Management Unit

Paddock 78 Drain

IMPACT OF CONTAMINATION  +  LIKELIHOOD OF CONTAMINATION = MEDIUM RISK RATING

DESCRIPTION:

This unfenced non-defined waterway runs from the boundary through paddock 78 to past the old sheds, you plan to permanently fence this creek off to exclude stock.
Potential for pugging of waterway by stock and contaminates sediment, nutrients and e coli carried downstream. When fencing consider wet areas that extend out from the creek and will end up as CSA, would be good management practice to extend the fence out to encompass these points.

Vegetation status: Grazed Pasture

Flood risk: Low

IMAGES:

OPEN ACTIONS:

Fence Drain Paddock 78 to
Look to permanently fencing this waterway, runs small amount of water all year and water quality leaving the farm would benefit from fencing this off to exclude stock.
TARGET DATE: **01 August 2019**

W7

New Block

New Block Waterways

DESCRIPTION:

All waterways on the new block are non-defined, they are all to be fenced with a 2m wide buffer from waterway to the fence and if cropping to occur on these paddocks then a tractor width should be left alongside as well to give a 5m buffer.
750m has been fenced with 1500m still to be done, temporary fencing to be used if stock grazing areas unfenced.

Example of current fencing show in the attached pictures and in the future could consider planting carex-secta to help control weeds and shade the waterway to prevent weed build up (see example)

IMAGES:

OPEN ACTIONS:

Continue Fencing New Block

Fencing to continue so all waterways on the new block are permanently fenced, consider planting some of these drains in the future, will help control weeds on the banks and shade the water to prevent weed build up there as well.

TARGET DATE: **Ongoing**

W8

Artificial or Tile Drainage

Artificial/Tile Drains

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = HIGH RISK RATING

DESCRIPTION:

The farm has some tile drains/nova-flow mainly for draining wet gullies and CSA on farm.

This prevents soil damage, protects pasture and allows the land to be used for intensive farming.
The downside is subsurface drainage provides a rapid transport mechanism for contaminants such as sediment, E.coli and nutrients to also be transported from the land and subsoil to waterways on the farm.
Knowing where your tile drains are, map them and marking the drain outlets will help staff manage effluent applications so the irrigator is run across a tile compared to running along the length of the tile, also outlets can be checked for blockages.

Where possible tile drains should be directed into sediment traps (ponds) prior to discharging into waterways to allow sediment and associated nutrients (phosphate) to be filtered.

Outlets marked:	No
Outfall location:	Stream
Subsurface Drains Mapped:	Yes

IMAGES:

OPEN ACTIONS:

Consider Tile Drain Treatment Methods

Tile drains are a pathway for the transportation of contaminants such as sediment and nutrients to surface waterways.
Where practical, consider creating sediment ponds prior to major tile drains discharging into surface water bodies or diverting tile outlets into existing ponds.
Attached photos of low cost sediment traps placed at the end of a tile drain, planted with flax to take up nutrients and overflow pipe to nearby creek

TARGET DATE: Ongoing

W9

Riparian Management Unit

Pro-posed Wetland Area

DESCRIPTION:

Area on the new block where existing trees were pulled out due to their age, a pro-posed wetland area plus 10m wide riparian strip both sides of the waterway.
Plan to use the Land Sustainability team for advice on wetland and riparian strip.

IMAGES:

OPEN ACTIONS:

Pro-Posed Wetland
Continue with plan for wetland and large riparian area
TARGET DATE: **Ongoing**

W10

Riparian Management Unit

Dairy Platform Drains

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

DESCRIPTION:

Apart from non-defined drain in paddock 78 there are 3 other drains that dont carry water all year that are not fenced (approximately 790m).
When conditions are wet water will flow in these drains and stock access will cause sediment and contaminates to be carried to nearby defined waterways.
Not a requirement under Fonterras minimum standards as yet to have these fenced, would be good management practice and to enhance water quality leaving the farm consider fencing these drains or installing nova-flow, minimum to temporary fence when water flowing to prevent stock access.

Waterway Type: Non-Defined Drain

Fencing status: Unfenced

IMAGES:




OPEN ACTIONS:

Fence/Nova-Flow Non-defined Drains

Consider fencing or draining these non-defined waterways in paddocks 10/11, 81/83 and 48

TARGET DATE: **Ongoing**

W11

Riparian Management Unit

Runoff Drains

DESCRIPTION:

All non-defined drains on the runoff block are permanently fenced.

IMAGES:

OPEN ACTIONS:

NO ACTION REQUIRED

W12

Riparian Management Unit

Runoff Waterway

DESCRIPTION:

Main defined waterway paddock 1 and 2 has been planted in native trees.

Vegetation status:	Native
Flood risk:	Medium
Waterway type:	Stream/Creek
Fencing status:	Permanently Fenced

IMAGES:

OPEN ACTIONS:

NO ACTION REQUIRED

NUTRIENT MANAGEMENT

N1 Nutrient Overview - Nutrient Management Overview

N2 End of Season Nitrogen Report - Nutrient Budget

N3 Fertiliser applications - Fertiliser Applications

N4 Plantain - Plantain (Ecotain)

N1

Nutrient Overview

Nutrient Management Overview

DESCRIPTION:

Nutrient management on farm is done through annual nutrient budgets done by Fonterra and soil testing by Ballance.

The dairy platform soil testing regime is every paddock every year and done this way for the last 5 years, Runoff is soil tested every paddock every 2 years.
Future crop paddocks are also soil tested to give an indication of nutrient requirements.

Olsen P levels aimed to maintain an optimum level of 30, current fertiliser applications for the 17/18 season show levels increasing with maintenance fertiliser that was applied.
Applications are done only when soil conditions are suitable and generally no applications are made during the winter and early spring months.

Nitrogen is used strategically with decisions based on available feed and weather conditions, seven applications applied throughout the season and between 18 to 24 units of N applied at any one time. Nitrogen fertiliser amounts are adjusted for the effluent blocks to account for N supplied from effluent.
Fertiliser applications are carried out with the farms own fertiliser spreader, a self-calibration is done by amount carried to ha spread.

Good Farming Practice: Fertiliser spreading equipment is well maintained and calibrated

Practices:
* Farm spreading equipment is calibrated regularly -- spreading width and volume checked
* Spreaders cleaned and greased routinely
* Paddocks are checked for paddock stripes after spreading

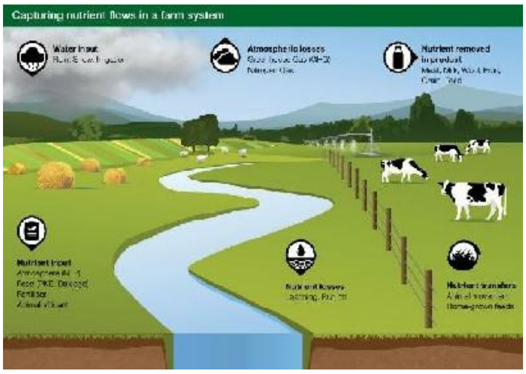
Good Farming Practice: General nutrient management

Practices:
* Soil-testing is done each year for each different management block
* Soil-testing is done well before crops are planted to identify nutrient levels
* A nutrient budget is used to help fertiliser decision making
* Supply farm nutrient information to your milk company at the end of each season
Evidence:
* Soil test results
* Nutrient budget
* End of season nutrient budget

Good Farming Practice: Monitor and maintain P levels at the economic optimum

Practices:
* Olsen P trends continue to be monitored over successive years
* Fertiliser applications are tailored for different management blocks
Evidence:
* Soil test results
* Nutrient budget
* End of season nutrient budget

IMAGES:



OPEN ACTIONS:

NO ACTION REQUIRED

N2

End of Season Nitrogen Report

Nutrient Budget

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = HIGH RISK RATING

DESCRIPTION:

A revised actual nutrient budget of the 17/18 season has been produced for this Farm Environment Plan.
The nutrient budget showed nitrogen fertiliser added 208kg N/ha/yr over the non-effluent area, 133kg N/ha/yr for the effluent blocks with a further 66 of N added from effluent.

The nutrient budget attached to the Farm Environment Plan has used your current maintenance fertiliser programme and an optimum Olsen P level of 30.
The nutrient budget shows that P fertiliser inputs + supplements adding 66kg P//ha/yr on the non-effluent area and increasing Olsen P by 9 units.
For the effluent block P fertiliser inputs + supplements + effluent is adding 51kg P//ha/yr and increasing Olsen P by 3 units

Generally Olsen P levels greater than 30 are expensive to maintain when compared to the limited extra pasture production that is achieved.

IMAGES:

OPEN ACTIONS:

GFP - 09 Monitor P Inputs from Fertiliser

Monitor and maintain P levels at the economic optimum

Discuss with your fertiliser representative.
The current levels of maintenance phosphorus being applied is significantly higher than what is required to maintain Olsen P levels at 30 (optimum economic fertility). On effluent blocks phosphorus inputs should be approximately 19kg/P/ha (currently 36) and 22kg/P/ha on non-effluent blocks (currently 66). Discuss this with your fertiliser representative.

TARGET DATE: 01 September 2019

N3

Fertiliser applications

Fertiliser Applications

DESCRIPTION:

All fertiliser on the farm is spread by the farm using a Giltrap towable spreader.
Each type of fertilisers are density measured then calibrated via computer in the tractor.
Consider using newer forms of spreading technology such as Fine Particle Application, these give a more accurate and uniform application of fertiliser with associated pasture growth benefits. Trials in Waituna have shown 50% less fertiliser can be used to grow the same amount of grass.

Fertiliser Programme Planned: Yes

Application method: Ground

Exclusion Zones defined for spreading: No

Proof of placement/Fertliser application records: No

IMAGES:

OPEN ACTIONS:

NO ACTION REQUIRED

N4

Plantain

Plantain (Ecotain)

DESCRIPTION:

The use of an environmental plantain (i.e. Ecotain) at a 20% pasture mix can result in a large reduction in N leaching from a cow urine patch - up to 89% depending on sward blend. This can provide an environmentally friendly forage solution to mitigate N leaching and also increases feed quality and/or supply during summer and autumn.

IMAGES:

OPEN ACTIONS:

NO ACTION REQUIRED

APPENDIX 1

environment SOUTHLAND

Cnr North Road and Price Street
(Private Bag 90116)
Invercargill

Telephone (03) 211 5115
Fax No. (03) 211 5252
Southland Freephone No. 0800 76 88 45

Discharge Permit

Pursuant to Section 104B of the Resource Management Act 1991, a resource consent is hereby granted by the Southland Regional Council (the "Council") to **Otama Dairy Ltd** (the "consent holder") of **197 Jaffray Road, R D 7, Gore 9777** from 19 December 2012

Please read this Consent carefully, and ensure that any staff or contractors carrying out activities under this Consent on your behalf are aware of all the conditions of the Consent.

Details of Permit

Purpose for which permit is granted:		To discharge dairy shed effluent to land
Location	- site locality	Jaffray Road, Otama
	- map reference	F45:896-619
	- receiving environment	Land
	- catchment	Mataura River/Okapua Stream/Otama Creek
Legal description of land at the site:		Section 2 Block II Otama SD, Section 4 Block I Otama SD and Section 5 Block II Otama SD
Expiry date:		19 December 2022

Consent Amended

- Conditions amended on 2 September 2013
- Condition 2(a) varied on 22 September 2017

Schedule of Conditions

These conditions should be read in conjunction with the best practice recommendations that are appended. These will reduce the risk of non-compliance with the consent conditions.

1. This consent is granted for a period of 10 years.

*(**Note**: Pursuant to Sections 123 and 124 of the Resource Management Act 1991, a new consent will be required at the expiration of this consent. The application will be considered in accordance with the plans in effect at that time, and the adverse effects of the proposed activity.)*

2. (a) This consent authorises the discharge of dairy shed effluent onto land, via Centre Pivot, Cobra Rain Gun, K-line , Umbilical System and/or any other low rate effluent application method, as described in application APP-301811-V2, at the locations described above.

   (b) This consent excludes effluent from winter milking, or any feedlot or wintering pad.

3. (a) No dairy shed effluent shall be discharged to any surface watercourse by overland flow, run-off, or via a pipe, nor shall there be any surface run-off/overland flow, ponding or contamination of water resulting from the exercise of this consent. ***See Best Practice Notes 1, 2 & 3***

   (b) The land disposal system shall be operated and maintained to ensure that there is no offensive or objectionable odour beyond the property boundary, or any spray drift into or beyond the buffer zones specified in condition 5.

   (c) The consent holder shall install and maintain an alarm and automatic switch-off system as a contingency measure in the event of an effluent system failure such as a sudden pressure drop, irrigator stoppage or breakdown. ***See Best Practice Note 4***

   (d) Between 1 May and 31 August each year, no dairy shed effluent shall be discharged to areas of Oreti and Jacobstown soils marked as 'Area A' on the Appendix 1 Plan.

4. Subject to condition 3(a), the land disposal system is limited to the following:

   (a) Between 1 September and 30 April each year a maximum depth of application of 10 mm for each individual application, at an instantaneous rate not exceeding 10 mm/hour;

   (b) Between 1 May and 31 August each year, a maximum depth of application of 5mm for each individual application, at an instantaneous rate not exceeding 1.5mm/hour on the land marked as 'Area B' on the Appendix 1 Plan;

   *(**Note:** The application depth needs to be less than the soil-water deficit (i.e. the depths above are maximum depths and as soil moisture levels approach field capacity, smaller depths will be necessary to avoid losses of contaminants from the root zone. When soil moisture levels reach field capacity, irrigation will need to cease completely to prevent these losses.)*

   (c) the maximum loading rate of nitrogen onto any land area shall not exceed 150 kg of nitrogen per hectare per year from dairy shed effluent. ***See Best Practice Note 5***

5. Effluent may be applied to the land as described in the application and generally as shown in Appendix 1, but the following specific buffers shall be observed:

   (a) 20 metres of any surface watercourse;
   (b) 100 metres of any potable water abstraction point;
   (c) 20 metres of any property boundary (unless the adjoining landowner's consent is obtained to do otherwise); and
   (d) 100 metres of any residential dwelling other than residential dwellings on the property.

   Where there is conflict between Appendix 1 and these specified buffers, the latter shall apply.

6. The amount of dairy shed effluent disposed of onto land shall not exceed that from 1000 cows.

7. By 30 June 2013, the consent holder shall provide at least 2,223 m^3 of effluent storage for the purpose of:

   (a) avoiding irrigation of effluent when soils are at or above field capacity; ***see Best Practice Note 8***.
   (b) providing a contingency measure when the irrigation system is inoperative; and/or
   (c) primary treatment when it is necessary for the proper operation of the effluent disposal system.

8. The consent holder shall maintain daily records of the location and method of effluent discharge. These records shall be provided to the Consent Authority upon request.

9. The consent holder shall notify the Council, by 31 March 2013, of the person who is in charge of the operation of the effluent disposal system. If the person in charge of the effluent system changes during the term of this consent, the consent holder shall notify the Council of the new operator no later than five working days after that person takes responsibility. ***See Best Practice Notes 6 & 7***

   *(**Note**: The person identified by condition 8 will be the primary contact for Council staff for monitoring purposes and/or in the event of an incident. Nothing in this condition removes or limits the consent holder's liability to ensure compliance with the consent and its conditions.)*

10. The Southland Regional Council may serve notice of its intention to review the conditions of this consent, in accordance with the conditions of this resource consent and Sections 128 and 129 of the Resource Management Act 1991, during the period 1 February to 30 September each year, or within two calendar months of the completion of any enforcement action (prosecution or infringement notice), for the purposes of:

    (a) dealing with any adverse or cumulative effects, including the adverse effects of high stocking rates, on the environment which may arise from the exercise of this consent;
    (b) considering any changes to information on the effects of land disposal of dairy shed effluent;
    (c) complying with the requirements of a regional plan;
    (d) amending monitoring requirements; or
    (e) imposing a notification requirement for potential effects on registered drinking water supplies.

11. By 31 December 2014, the consent holder shall drill or access a bore (or well) for the purposes of monitoring groundwater in the unconfined aquifer. Unless otherwise agreed in writing by Environment Southland's Compliance Manager the bore shall conform with the following requirements:

    (a) the bore shall be located within the south eastern corner of the effluent disposal field, but within 300m of Jaffray Road

    (b) The depth of the bore shall be between 6.5 and 9.5 metres below the static groundwater level, and no more than 12 metres deep in total;

    (c) The internal diameter of the bore shall be between 50 and 100 mm.

(d) The bore is to be used solely for monitoring purposes. This may include abstraction to take samples or to flush the bore prior to sampling, but excludes abstraction of water for domestic or farm supply.

Note 1: C*onstruction of a bore will require a separate land use consent. However the land use consent is a controlled activity and should not pose an impediment to the exercise of the discharge permit. A guideline on monitoring bore construction is available*

Note 2: *If a bore cannot be established in accordance with this condition, the consent holder may seek the Compliance Manager's agreement for an alternative monitoring bore, or may seek amendment to the resource consent.*

Note 3: *If it is necessary to draw water supply from the monitoring bore it may be necessary to install a new monitoring bore.*

12. The consent holder shall pay an annual administration and monitoring charge to the Southland Regional Council, collected in accordance with Section 36 of the Resource Management Act. This charge may include the costs of inspecting the site twice each year (or otherwise as set by the Council's Annual Plan), and:

(a) until December 31 2014 monitoring the effects of the discharge on groundwater by taking representative samples from bore/well F45/0182 once every six months and analysing for:

- electrical conductivity
- nitrate nitrogen concentration
- Total Nitrogen concentration
- Dissolved oxygen concentration – field measurement
- E. coli concentration
- bromine concentration
- chloride concentration

Except that the first sample shall also be analysed for Dissolved Iron concentration.

(b) From 1 January 2015 monitoring the effects of the discharge on groundwater by taking representative samples from bore established under condition 10 and analysing for:

- electrical conductivity
- nitrate nitrogen concentration
- Total Nitrogen concentration
- Dissolved oxygen concentration – field measurement
- E. coli concentration
- bromine concentration
- chloride concentration

Except that the first sample shall also be analysed for Dissolved Iron concentration.

13. If an event (such as effluent overflow to water, significant over-application on a free-draining area or pond collapse) occurs that may have significant adverse effect on water quality at the abstraction point of a registered drinking-water supply, the consent holder shall notify, as soon as reasonably practicable, the following:

- Environment Southland's Compliance Manager (ph 03 211 5115 or 03 211 5225 after hours);
- Gore District Council (ph 03 209 0330).

*(**Note:** The consent holder is advised to contact Environment Southland's Compliance Manager in the event of any unexpected event that may result in non-compliance with the conditions of this resource consent or the rules of a regional plan.)*

for the **Southland Regional Council**

Michael Durand
Consents Manager

Best Practice and Explanatory Notes

1. Dairy shed effluent should not be discharged onto any land area that has been grazed within the previous 5-10 days. Where there has been significant damage to soil during grazing, it is recommended that effluent not be applied until that damage has been repaired.

2. To avoid contaminating water directly or indirectly, the consent holder should not apply effluent to land when the soils are at or above field capacity. Moisture content is to be determined by either actual monitoring on site or by reference to the appropriate Council monitoring site. The Council's soil moisture monitoring sites can be viewed at *http://www.es.govt.nz* and following the "Farming", "Dairy Advisor" and "Soil Moisture Maps" links.

3. For the purposes of this condition, ponding is the accumulation of effluent on the soil surface resulting from the application of effluent to saturated soils, or the application of effluent inducing saturated soil conditions. It does not refer to the temporary accumulation of effluent on the soil surface resulting from the application of effluent at a rate that exceeds the soil infiltration rate.

4. Where the effluent reticulation system is installed in such a way that effluent can be siphoned when pumping ceases, the consent holder should install and maintain an anti-siphon device in the effluent pipe line.

5. A loading of 150 kg N/ha/year is approximately equivalent to a loading of dairy shed effluent to land of 4 ha/100 cows. However, there are significant benefits to having a larger effluent disposal area in terms of managing potassium. Further, scientific research has highlighted decreased nitrogen use efficiency and increased nitrogen leaching losses at annual nitrogen loading rates (from combined fertiliser and effluent N) greater than 150 kg/N/ha/yr. Extreme caution should therefore be taken when applying nitrogen fertiliser to the effluent disposal area. It is recommended that a nutrient budget is used to check that nitrogen and potassium application rates to the effluent disposal area are not excessive.

6. The consent holder should prepare and comply with a Farm Environmental Management Plan. The plan should:

   - specify and implement a nutrient budgeting system for the property;
   - provide for the management of effluent disposal to avoid applications when soils are at or above field capacity;
   - identify, as far as is practicable, the drains in the effluent disposal area, so that appropriate management procedures can be taken to avoid contamination of the drains by effluent;
   - if relevant, provide for the operation and management of any feedlot and/or wintering pad;
   - include the provision for monitoring application rates to ensure the consent requirements are being met;
   - include the monitoring requirements specified in this consent; and
   - address ancillary matters such as protecting well-head(s) from contamination; preventing leachate from any silage pits entering water, including groundwater; preventing soil damage; controlling runoff from lanes; and preventing stock access to and maintaining the riparian margins of any watercourses on the property.

   A template may be viewed at:
   www.es.govt.nz/media/4831/dairy-farm-plan-consent-template.pdf

7. The consent holder should display, in a prominent place in the dairy shed, a copy of the resource consent and relevant limits about the operation of the effluent disposal system that must be complied with. The material to be displayed will be provided by the Council on laminated sheets suitable for display purposes.

8. Storage ponds should be operated at low levels when conditions for effluent disposal are suitable in order to maintain storage for wet weather periods. In particular, storage ponds should be emptied in late summer/early autumn to ensure sufficient storage capacity for the following late winter/early spring period.

9. Storage ponds should not, for practical purposes, leak. This resource consent does not authorise the discharge of contaminants due to leaks or failure of the storage ponds. If an existing storage pond is modified (such as by increasing the embankment height to increase storage), the modification will require resource consent.

Environment Southland*

(03) 211 5115

Toll Free 0800 76 88 45 (Southland only)

or

Emergency After Hours (03) 211 5225

if you have an effluent or pollution problem,
call us

Held by: Otama Dairy Ltd

environment SOUTHLAND

- the total milking herd cannot exceed 1000 cows.

- effluent may only be applied within the area shown on the attached map, as detailed in the application for the Consent.

- effluent cannot be applied within 20 metres of the property boundary.

- if there are waterways within the approved area, effluent cannot be applied within 20 metres of the waterways and ditches.

- a maximum depth of application of 10 mm for each individual application, at an instantaneous rate not exceeding 10 mm/hour;

  *(**Note:** The application depth needs to be less than the soil-water deficit (i.e. the depths above are maximum depths and as soil moisture levels approach field capacity, smaller depths will be necessary to avoid losses of contaminants from the root zone. When soil moisture levels reach field capacity, irrigation will need to cease completely to prevent these losses.)*

- the contingency plan consists of:

  - 56 days of effluent storage capacity so that the discharge may be deferred during adverse conditions.

(the above is a synopsis. You should ensure you understand the full consent. If you do not have a copy, contact Environment Southland*)

Problem Solving

• the number of cows intended to be milked exceeds the consent limit	**Contact Environment Southland for a Variation to the Consent**

If you have any effluent or pollution problems, please contact Environment Southland at the following numbers: Environment Southland: (03) 211 5115 or 0800 76 88 45 during office hours or 03 211 5225 (emergency response) after hours.

environment SOUTHLAND
Te Taiao Tonga

Cnr North Road and Price Street
(Private Bag 90116
DX YX20175)
Invercargill

Telephone (03) 211 5115
Fax No. (03) 211 5252
Southland Freephone No. 0800 76 88 45

Water Permit

Pursuant to Section 104B of the Resource Management Act 1991, a resource consent is hereby granted by the Southland Regional Council to **Otama Dairy Ltd** of **197 Jaffray Road, RD 7, Gore 9777** from **8 October 2015.**

Please read this Consent carefully, and ensure that any staff or contractors carrying out activities under this Consent on your behalf are aware of all the conditions of the Consent.

Details of Permit

Purpose for which permit is granted: To take and use groundwater for the purpose of irrigation

Location	- site locality	Jaffray Road, Otama
	- map reference	NZTM 2000 1279381E, 4899633N NZTM 2000 1278580E, 4899432N NZTM 2000 1249580E, 4899934N
	- groundwater zone	Knapdale
	- catchment	Mataura River
	- well number	F45/0422, F45/0434 and F45/0426

Legal description of land at the site: Section 5 Blk II Otama SD and Section 2 Blk II Otama SD

Expiry date: **8 October 2025**

Schedule of Conditions

1. The permit authorises the taking of groundwater at the locations specified above. The total rate of abstraction shall not exceed:

   (a) 70 litres per second;
   (b) 6,050 cubic metres per day; and
   (c) 480,000 cubic metres per year.

2. Prior to the first exercise of this consent, the consent holder shall install a backflow prevention device or take other appropriate measures to ensure water and/or contaminants cannot return to the water source.

3. When the flow in the Mataura River, as recorded by the Consent Authority at its Gore flow measurement site, is at or below 11 cubic metres per second:

   (a) the consent holder shall not take water from well F45/0426 (also known as PW2);
   (b) the total rate of abstraction from wells F45/0434 and F45/0422 shall not exceed 33 litres/second or 2,851,200 litres/day.

4.
   (a) Prior to the first exercise of this consent, the consent holder shall install a water meter to record the water take, within an error accuracy range of +/-5% over the meter's nominal flow range, and datalogger with at least 24 months data storage capacity and a telemetry unit to record the rate and volume of take, and the date and time this water was taken. The consent holder shall forward a copy of the installation certificate to the Consent Authority within one month of installing the water meter and datalogger.

   (b) The water meter shall be installed in a straight length of pipe, before any diversion of water occurs. The straight length of pipe shall be part of the pump outlet plumbing, easily accessible, have no fittings and obstructions in it. There shall be a straight length of pipe on either side of the water meter, on the upstream side there shall be a distance that is 10 times the diameter of the pipe and on the downstream side there shall be a distance of 5 times the diameter of the pipe.

   (c) The consent holder shall ensure the full operation of the water meter and datalogger at all times during the exercise of this consent. All malfunctions of the water meter and datalogger during the exercise of this consent shall be reported to the Consent Authority within five working days of observation and appropriate repairs shall be performed within five working days. Once the malfunction has been remedied, a Water Measuring Device Verification Form completed with photographic evidence must be submitted to the Consent Authority within five working days of the completion of repairs.

   (d) (i) If a mechanical insert water meter is installed it shall be verified for accuracy each and every year from the first exercise of this consent.
   (ii) Any electromagnetic or ultrasonic flow meter shall be verified for accuracy every five years from the first exercise of this consent.
   (iii) Each verification shall be undertaken by a Consent Authority approved operator and a Water Measuring Device Verification Form shall be completed and supplied to the Consent Authority with receipts of service. These shall be supplied within five working days of the verification, and at any time upon request.

   (e) The consent holder shall record adequate data to demonstrate compliance with Condition 1. Data from the datalogger shall be provided once daily to the Consent Authority by means of telemetry. The consent holder shall ensure data is compatible with the Consent Authority's time-series database.

5. Prior to the exercise of this consent, the consent holder shall notify the Consent Authority of the person who is in charge of the operation this consent. If the person in charge changes during the term of this consent, the consent holder shall notify the

Consent Authority of the new operator no later than five working days after that person takes responsibility.

6.

(a) Irrigation to land shall not occur when the moisture content of the soils is at field capacity, nor shall irrigation increase soil moisture above field capacity.

(b) To demonstrate compliance with Condition 6(a), the applicant shall monitor on-site soil moisture within the irrigation area as follows:

(i) within one month of the first exercise of this consent, the consent holder shall install an Aquaflex soil-moisture tape, or alternative soil-moisture measurement device or method of similar accuracy as agreed in writing with the Consent Authority;
(ii) soil moisture shall be measured at two sites within the irrigation area on Mataura soils. The exact monitoring location and depth shall be confirmed in writing with the Consent Authority;
(iii) the soil moisture data is to be recorded at 30 minute intervals using an electronic datalogger system and this record shall be provided to the Consent Authority at least once every three months and upon request;
(iv) within six months of the first exercise of this consent, the consent holder shall, from the on-site monitoring record, determine the soil-moisture content that is equivalent to field capacity at the site and shall report this to the Consent Authority;
(v) within six months of the first exercise of this consent, soil moisture content, for the purposes of Condition 6(a), is to be determined by on-site measurement.

(c) Until the on-site soil moisture monitoring system required by Condition 6(b) is installed the consent holder shall demonstrate compliance with Condition 6(a) by making reference to the appropriate Consent Authority soil moisture monitoring site.

7. The consent holder shall pay an administration and monitoring charge to the Consent Authority collected in accordance with Section 36 of the Resource Management Act, payable in advance on 1 July each year.

8. The Consent Authority may, in accordance with Sections 128 and 129 of the Resource Management Act 1991, serve notice on the consent holder of its intention to review the conditions of this consent during the period 1 February to 30 September each year, or within two months of any enforcement action being taken by the Consent Authority in relation to the exercise of this consent, or on receiving monitoring results, for the purposes of:

(a) adjusting the consented rate or volume of water under Condition 1, should monitoring under Condition 4 or future changes in water use indicate that the consented rate or volume is not able to be fully utilised;
(b) determining whether the conditions of this consent are adequate to deal with any adverse effect on the environment which may arise from the exercise of the consent and which it is appropriate to deal with at a later stage;
(c) ensuring the conditions of this consent are consistent with any National Environmental Standards Regulations, relevant plans and/or the Environment Southland Regional Policy Statement; or
(d) adjusting or altering the method of water take data recording and transmission

Reisssed on the 16th of October 2015 after an administrative correction
for the **Southland Regional Council**

Michael Durand
Acting Consents Manager

Notes:

1. *In accordance with Section 125(1)(a) of the Resource Management Act, this consent shall lapse after a period of five years after the date of commencement unless it is given effect to or an application is made to extend the lapse period before the consent lapses.*
2. *Section 126 of the Resource Management Act provides for this resource consent to be cancelled if the consent has been exercised in the past but has not been exercised during the preceding five years.*
3. *If you require a replacement permit upon the expiry date of this permit, any new application should be lodged at least six months prior to the expiry date of this permit. Applying at least six months before the expiry date may enable you to continue to exercise this permit until a decision is made, and any appeals are resolved, on the replacement application.*

Consent No: 301812-V1

Cnr North Road and Price Street
(Private Bag 90116)
Invercargill

Telephone (03) 211 5115
Fax No. (03) 211 5252
Southland Freephone No. 0800 76 88 45

Water Permit

Pursuant to Section 104B of the Resource Management Act 1991, a resource consent is hereby granted by the Southland Regional Council (the "Council") to **Otama Dairy Ltd** (the "consent holder") of **197 Jaffray Road, R D 7, Gore 9777** from 19 December 2012.

Please read this Consent carefully, and ensure that any staff or contractors carrying out activities under this Consent on your behalf are aware of all the conditions of the Consent.

Details of Permit

Purpose for which permit is granted:		To take groundwater for a dairy operation
Location	- site locality	Jaffray Road, Otama
	- map reference	F45:894-619
	- groundwater zone	Knapdale
	- catchment	Mataura River/Okapua Stream/Otama Creek
Legal description of land at the site:		Section 2 Block II Otama Survey District
Expiry date:		19 December 2022

Consent Amended

Conditions amended on 2 September 2013 as follows

Schedule of Conditions

1. This consent is granted for a period of 10 years.

   (Note: Pursuant to Sections 123 and 124 of the Resource Management Act 1991, a new consent will be required at the expiration of this consent. The application will be considered in accordance with the plans in effect at that time, and the adverse effects of the proposed activity).

2. This consent authorises the abstraction of water from bore/well F45/0173 at about NZMS 260 F45: 894-619.

3. The rate of abstraction shall not exceed 120,000 litres per day.

   Under delegated authority, and in accordance with Section 127 of the Resource Management Act 1991, this application has not been notified and is approved

4. The consent holder shall install a backflow prevention device or take other appropriate measures to ensure water and/or contaminants cannot return to the water source.

5. From the commencement of the exercise of this resource consent, the consent holder shall monitor water usage to ensure compliance with condition 3 of this consent, as follows:

   (a) the consent holder shall install a flow meter(s):
      (i) able to continuously measure the amount of water taken;
      (ii) capable of accuracy to within 5% of the true flow rate, on each abstraction;
      (iii) capable of providing output in a form suitable for electronic data storage;
      (iv) that records volumes in litres or cubic metres;
      (v) in accordance with the manufacturer's instructions;
      (vi) that is sealed and as tamper proof as practicable;
      (vii) in a location that measures all water taken;

   (b) the consent holder shall install a datalogger and record the volume of water taken each day;

   (c) at least once every three months the consent holder shall report the record of the daily rate of abstraction to Environment Southland in Hilltop format, or XML formatted as required by Hilltop software.

6. The consent holder shall pay an administration and monitoring charge to the Southland Regional Council collected in accordance with Section 36 of the Resource Management Act, payable in advance on the first day of July each year.

7. The Council may, in accordance with Sections 128 and 129 of the Act, serve notice, during the period 1 February to 30 September each year, of its intention to review conditions for the purpose of:

   (i) dealing with any adverse effects on the environment which may arise from the exercise of this consent;
   (ii) requiring monitoring of the rate of, or the effects of, the abstraction;
   (iii) requiring efficiency of water use; and/or
   (iv) complying with the requirements of a regional plan.

for the **Southland Regional Council**

W J Tuckey
Director of Environmental Management

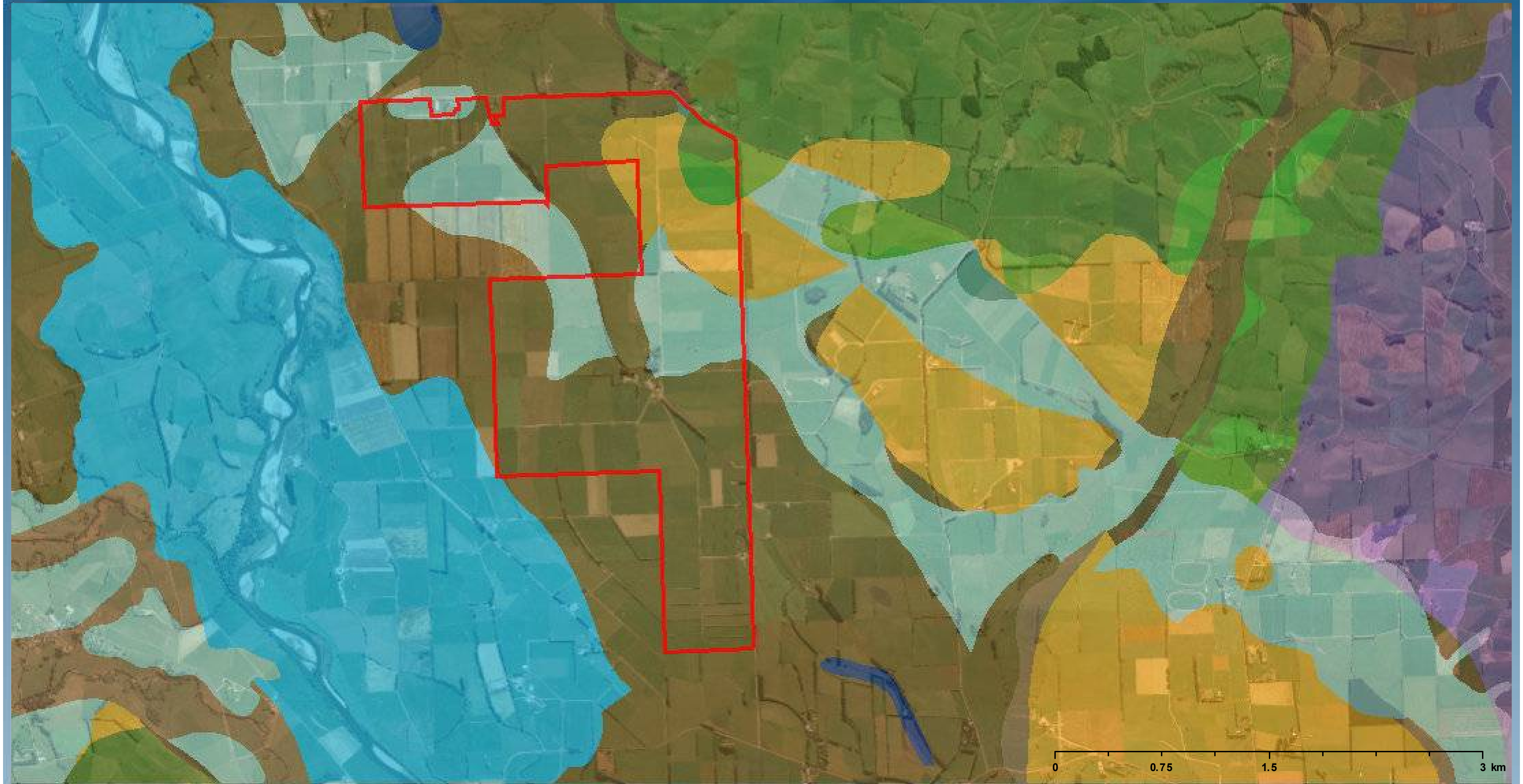
APPENDIX 2

BEACON

Environment Southland Mapping Service

Otama Dairy Ltd

February 25, 2019



polylineLayer

Override 1

Alerts

Blue

Green

Yellow

Red

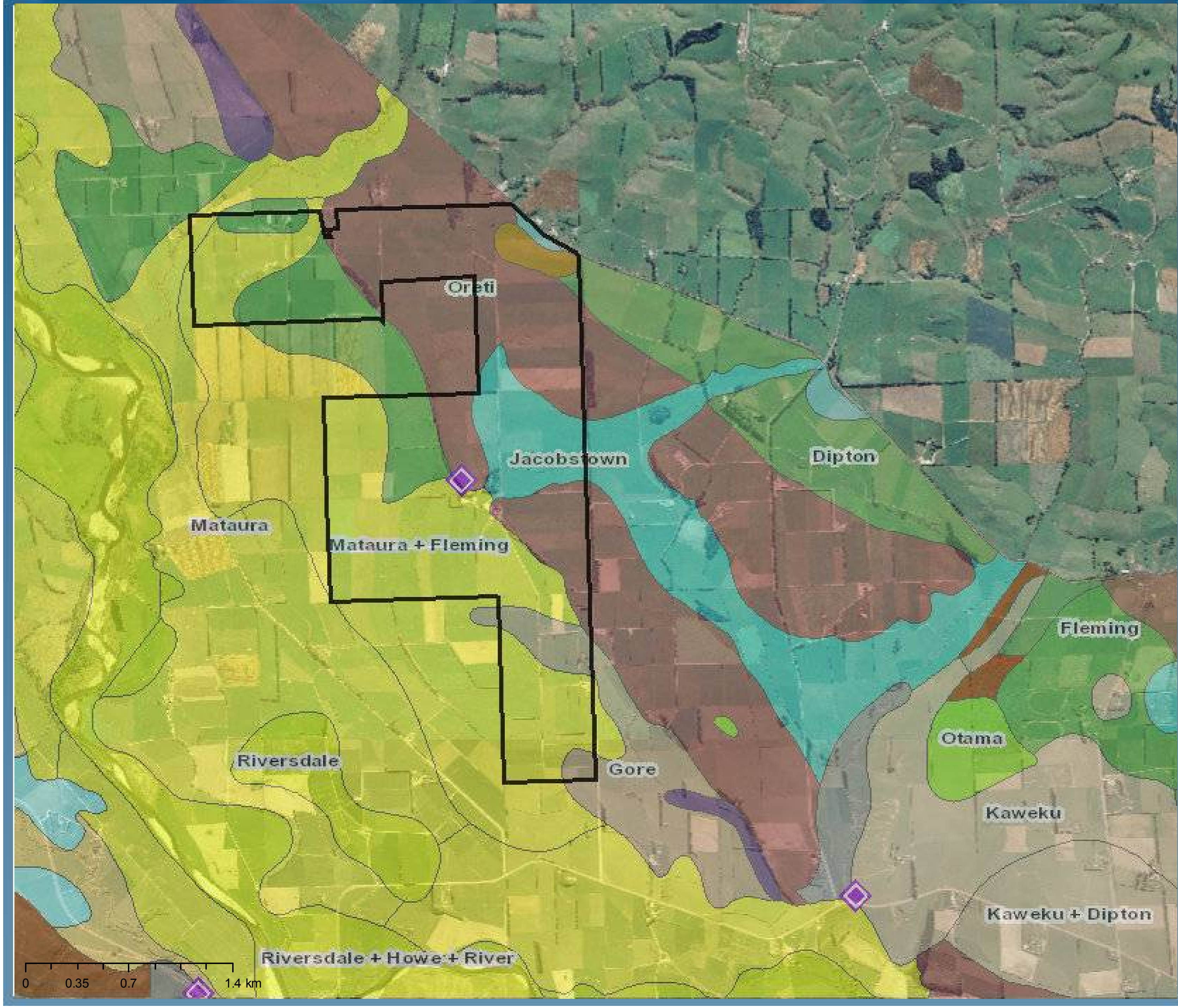
APPENDIX 3

BEACON

Environment Southland Mapping Service

Otama Dairy Pro-Posed Land Area

September 20, 2018



polylineLayer

Override 1

Alerts

Blue

Green

Yellow

Red

Soil Profile

Soil Types

Andrews

Arthurton

Chatton

Dipton

Fleming

Glenure

Gore

Jacobstown

Kaihiku

Kaweku

Kaweku Scarp

Makarewa

Mandeville

Mataura

Oreti

Oreti Scarp

Otama

Otikerama

Pyramid

Riversdale

Tailings

APPENDIX 4

Dairy Effluent Storage Calculator
Summary Report

Regional authority:	Environment Southland Regional Council
Authorised agent:	Brian Goodger, Fonterra
Client:	G Raymond
Program version:	1.49
Report date:	Monday, 26 November 2018

General description:

Storage Pond Disclaimer
Climate for rainfall was taken at the Mandeville site to give a mean annual rainfall of 950 mm, farm location actual rainfall is 854mm (from 30yr Overseer climate data)

The farm entered as having an 186ha effluent irrigation area,127ha high risk due to drainage on Mataura/Fleming and Jacobstown soils and 58ha low risk soils due to slope and drainage on Oreti and Gore soils, topography is all flat.
For the purpose of this calculation an estimate of 63 litres/cow/day of wash down water is generated on the dairy and directed into the effluent system, this is an industry average not an actual measurement.

No emergency storage allowed for, as all effluent gravity feeds to the 152,000lt concrete sump.

Storage volumes have been based on using a low depth/rate Cobra travelling irrigator applying 21,000 litres/hour at 5.6mm depth in winter/spring for a 4 hour run (speed setting 2, travelling 1.1m/minute or 66m in one hour) putting out 84,000 liters.
The Pivot entered as applying at 6mm depth (actually 2.5mm), 43,000lt/hr running for 4 hours, total applied 173,000lt
These figures need to be confirmed by an irrigation specialist/designer to ensure they are achievable.

Based on the input data, the previous 30 years rainfall and soil moisture deficit data, the storage capacity you would require to meet the industry standard of a 90% probability the pond would be 1175 cubic meters (this DOES NOT INCLUDE freeboard and sludge allowances, this is the pump-able volume)

The maximum storage capacity that would have covered you for all climatic events in the last 30 years is 1671 cubic meters, this DOES NOT include freeboard and sludge allowances (refer to yellow bar on graph indicating 1981 as having the worst conditions for effluent application)
Other assumptions include: 1) 1000 cows 2) shed roof water is diverted away from the effluent pond all year 3) all concrete around the dairy is diverted in the winter 4) water use at 63lt /cow/day 5) effluent block is 127ha of high risk soils and 58ha of low risk soils.

Otama Dairy Ltd storage pond with the dimensions of 33m x 33m x 3m deep with a 2.0:1 batter was used in this calculation to give an actual size and surface area, a pond with these dimensions would provide a total capacity of 2223 cubic meters, (including freeboard and sludge) and 1710 cubic meters pump-able pond volume.
This gives the farm 535 cubic meters of storage above what is required.

According to the calculator, this is sufficient storage for your farm when the system is managed as per the input data provided. Please CHECK THE INPUT DATA in this report to ensure it is accurate.

Climate

Rainfall site: Mandeville

Mean annual rainfall: 950 mm/year

Effluent Block

Area of low risk soil: 58.0 hectares

Minimum area of high risk soil: 22.0 hectares

Surplus area of high risk soil: 106.0 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	940	5.0	59.2
February	940	5.0	59.2
March	940	5.0	59.2
April	780	5.0	49.1
May	780	5.0	49.1
June	0	0.0	0.0
July	0	0.0	0.0
August	1000	5.0	63.0
September	1000	5.0	63.0
October	1000	5.0	63.0
November	1000	5.0	63.0
December	1000	5.0	63.0

Irrigation

Winter-spring depth: 5 mm

Spring-autumn depth: 6 mm

Winter-spring volume: 84 cubic metres

Spring-autumn volume: 173 cubic metres

Irrigate all year? Yes

Catchments

Yard Area: 1067 square metres

Diverted? Yes

- diversion start: 01 June

- diversion end: 31 July

Shed Roof Area: 335 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

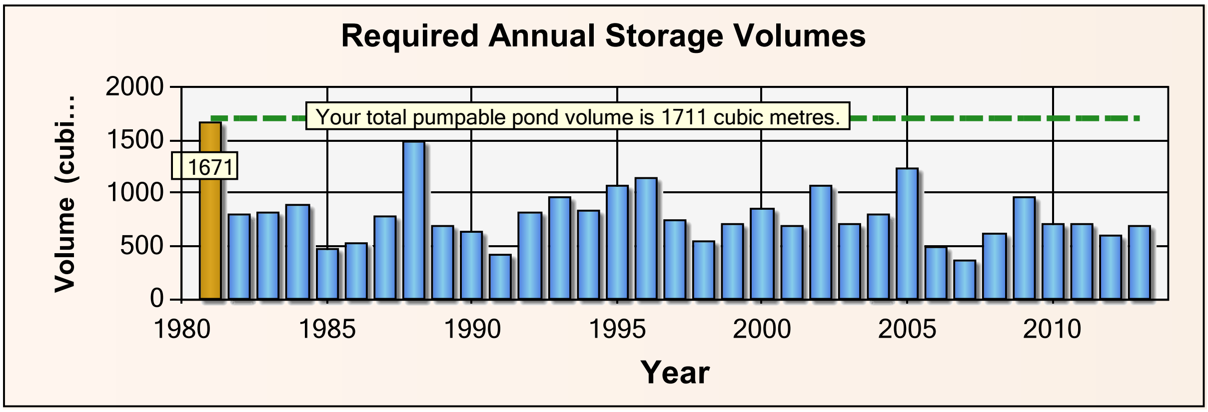
Pond/s present?	Yes
No. of ponds:	1 pond/s
Includes irregular ponds?	No
Pond 1	
- total volume:	2223 cubic metres
- pumpable volume:	1711 cubic metres
- surface area:	1089 square metres
- width:	33.0 metres
- length:	33.0 metres
- batter:	2.0:1
- total height:	3.0 metres
- pumped?	Yes
Tank/s present?	No
Emergency storage period:	0 days

Solids Separation

Solids separator/s present?	No

Outputs

Maximum required storage pond volume:	1671 cubic metres
90 % probability storage pond volume:	1175 cubic metres
During the period from:	01 July 1980
To:	30 June 2013



Required Annual Storage Volumes
Volume (cubi...
2000
1500
1000
500
0
1980
1985
1990
1995
2000
2005
2010
Year
Your total pumpable pond volume is 1711 cubic metres.
1671

APPENDIX 5

POND DESIGN SUMMARY

Type of distribution system proposed	Low application Larall Smart Hydrant System with the option of a low application travelling irrigator in summer	
Coordinates of proposed pond NZMG	E 1279722 : N 4899868	
Maximum cows expected for design	800	
Type of dairy shed	Rotary	
Water use for design (two milkings a day)	70	litres/cow/day
Daily volume FDE produced	56	m^3
Stormwater catchment area of yard and other areas	880	m^2
Stormwater catchment area of ponds	1,199	m^2
Total catchment area for inclusion in pond design	2,079	m^2
Massey Calculator Design requirement (30 years)	1,758	m^3
TOTAL OPERABLE STORAGE volume of ponds proposed	2,410	m^3
ESCOP Calc. 60 day storage requirement	2,400	m^3
Proposed length at top of bank	33	m
Proposed width at top of bank	33	m
Proposed average depth	3	m

The larger than required pond size is to allow for a possible increase in cow numbers in the future.

During the winter months of no milking the yard stormwater will be diverted via a pipe to the nearest gully or soakpit.

The shed roof water is to be diverted all year round.

The discharge consent will need to include the flexibility to irrigate during the winter months when conditions allow, maintaining storage capacity for the following spring period.

1. INTRODUCTION

1.1 Scope

This report describes the design and assessment conducted at the above site for an existing dairy farm that is upgrading their dairy effluent systems to the current Farm Dairy Effluent (FDE) deferred storage requirements. It has been produced utilising the Massey effluent calculator, the Dairy NZ (FDE) Code of Practice, the IPENZ Practice Note 21 and current industry best management practices.

1.2 Description of Proposal

The existing infrastructure for the site involves an existing rotary shed and 880m^2 yard discharging through a stonetrap, which in turn discharges into an existing pump sump. From the sump the FDE is currently irrigated to land via a travelling irrigator. A new low application Larall Smart Hydrant irrigation system is proposed.

The new proposed system will gravity feed effluent to a new 2,223 m^3 storage pond, then pump directly out to the FDE application area.

The site and soil constraints combined with the farm managers' requirements have resulted in the following proposal.

- Effluent will gravity feed from the shed into the existing stonetrap, then into the existing concrete pump sump, and then into the new, 2,223m^3 effluent storage pond. Shed roof water will be diverted all year round, with the yard stormwater diverted to a soak pit or gully in the off-season.
- A new 4m x 4m blockwork solids bunker will be installed adjacent to the existing pump sump to be used as a solids drying bunker. The existing stonetrap will need emptying periodically once sediment has built up in it. To reduce the organic component in this trap, it can be agitated by using a hose from a newly installed water hydrant to mix the organics to slurry in order to flush them out, with the heavier stones/sand dropping out. The solids can then be cleaned out using a tractor mounted loader and dumped into the solids bunker to dry before dispersal to paddock. This will greatly reduce the organics being dumped into the stone dump. Any liquid remaining in the solids will flow into the existing sump via a new open drain. A small catch pit is to be installed in the new drain to prevent stones from entering the pump sump. An all-weather apron will be installed to allow for vehicle access to the solids hardstand bunker.
- The existing stirrer in the smaller sump is to remain.
- A new low application Larall Smart Hydrant irrigation system is to be installed with the existing low application traveling irrigator also able to be used during the drier months.
- A new Submersible Pond Floor Agitator (SPFA) horizontal stirrer will be installed in the new storage pond. This stirrer will help to keep solids within the pond in suspension, allowing them to more easily be irrigated to the pasture. These stirrers act to reduce solids build-up within the pond, while also allowing all of the nutrients contained within the solids to be irrigated to the pasture.
- With the proposed operation of the effluent and irrigation system, the new storage pond will have additional capacity. This additional capacity has been designed into

the pond to give additional storage should a possible future expansion in cow numbers occur.

The majority of fill material for the pond construction will be from the proposed pond excavation however; a small amount of additional fill may also be required.

Both the existing sump and the new pond will be fitted with pump outage and high and low level alarms to ensure that the shed operator is aware of failure and can immediately investigate the problem.

In order to know what the soil moisture conditions are prior to effluent discharge and as part of best management practice, we recommend the installation of soil moisture and temperature monitoring equipment (not aquaflex strips) and a weather station to record rainfall and ambient temperature across the effluent irrigation area. High and low level alarms in pump sumps and irrigator monitors and alarms are to be installed as needed. Proprietary monitoring systems such as Smart Farm and Regen systems would be ideal.

Local pump suppliers have quoted a maximum 8 hour response time should pumps fail and for a replacement to be installed. However, in the mean time, backup generators and/ or pumps could be used to ensure effluent is still able to transfer to the pond or paddock.

A synthetic liner has been specified as the most robust solution for leakage containment of the pond. For the purpose of providing clear drawings, a 1.5mm HDPE liner has been shown on the drawings. Other products would be allowed only if written engineering approval was given by the designer. A 100mm thick concrete based sump hole in the pond is proposed to ensure no damage to the base where pumps and stirrers are to be fitted. The pump pontoons, suction intake, or stirrer support will be able to rest on the base if necessary.

If pumps and stirrers are to be fitted at other locations in the pond, then we must be advised prior to pond construction.

Liner suppliers will need to provide a minimum 20-year warranty on durability, with installation of their systems in full accordance with their installation instructions. The liner installer is to install a uPVC inlet pipe as per the plans even if the shed pipe work is not installed at the time of installation.

Under all concrete pads within the storage pond, a non-welded square of liner is to act as a slip joint to protect the main liner from damage. It is essential no stones or foreign objects be between the two contact surfaces.

2. SITE ASSESSMENT

2.1 Soils Investigation

An initial soils investigation was undertaken on 1st September 2011 with one test pit conducted near the proposed pond site. Further investigations on the 11th May 2012 included a site walkover to inspect existing soil exposures, soil permeability testing and a desktop study to identify soil types from the Environment Southland database.

The test pits encountered a thin layer of topsoil overlying the soils which were generally a SAND, with varying ratios of silt and sub-rounded to sub-angular gravels. The test pit logs show these relationships and depths in more detail. Groundwater was not encountered in the test pits.

Environment Southland identified two main soil types across the effluent application area, Mataura soils and Oreti soils. A third soil type, the Jacobstown is present in the northern third of the farm, the technical data sheets for all three soils are contained within Appendix C. The Mataura soils are generally found in the western part of the effluent block, while the Oreti soils are towards the north east of the block. From the Topoclimate soils information technical data sheets, the Mataura soils are known for very severe structural compaction and slight waterlogging, while the Oreti soils are known for slight structural compaction and nil waterlogging. All of these soils respond well to aeration.

From the Massey Dairy Effluent Storage Calculator (DESC), the Mataura soils are classed as low risk however our soils permeability testing showed that these soils had low saturated conductivities. For this reason, the Mataura soils have been classed as high risk for the purposes of pond sizing calculations.

The table below shows each of the soils identified by the database and some of their relevant properties.

SOIL NAME	AREA (Ha)	STRUCTURAL COMPACTION	WATER LOGGING	SOIL RISK (flat terrain)	MEASURED Ksat (mm/hr)
Mataura	63	Very severe	Slight	High (due to low Ksat)	3,4
Jacobstown		Severe	Severe	High	-
Oreti	23	Slight	Nil	Low	14

Current industry research and accepted practice would suggest that deferred irrigation systems at low application rates would suit this particular farm and the soils present. Pulse/very low application irrigation can be utilised during the wetter months of autumn, winter and spring to keep the pond level low to maintain the deferral storage capacity if required. This irrigation should be balanced with the recommended soil monitoring.

2.2 Rainfall

The Massey pond calculator is able to analyse the last 30 years of rainfall data and provide calculations on the maximum pond size that would have been required, based on the depth of application and the volume of effluent discharged. When rainfall events of high intensity or long duration occur, these will cause surface water runoff and matrix, or piston flow drainage of the soil. In situations such as this, deferred storage is required.

Industry research has shown that very low (pulse), to low irrigation rates of FDE at, or near saturated soil conditions (or field capacity) has minimal, or no effect of nutrient leaching within artificially drained high-risk soils. Combined with aeration of soil structure, the soils are able to process the nutrients applied more readily, hence reducing or eliminating nutrient losses. The research reports are available at;

http://www.greenbeing.co.nz/news/latest.html.

While we have allowed for irrigation to occur below saturation, if extreme events occur outside the design capacity of this system (which require irrigation at saturated conditions to prevent overtopping of the pond), then provided irrigation rates lower than the saturated conductivities are used, research indicates that minimal, to no overland flow or leaching of nutrients would be expected.

DESIGN CONSIDERATIONS

3.1 Design Rationale

The current pond sizing selected is based on the Massey calculator utilising a 1 in 30 year capacity limit, and we have used this as a more accurate measure of storage requirement than the ESCOP. As can be seen on the summary sheet, we have increased the pond size calculated by the Massey Pond Calculator in order to accommodate an increase in cow numbers in the future.

The new Dairy NZ COP only requires a 1 in 10 year event to be considered, however we do not consider this suitable for these types of ponds. The calculator doesn't allow irrigation at field capacity but is an industry-accepted method of determining the storage volume. The calculator also doesn't currently give an output for the amount of stormwater included in the design on the summary report; however, it is accounted for in the design sizing.

Currently, the calculator works on the depth applied in a single pass by a travelling irrigator, or a daily depth event for that particular discharge event, and not on the saturated conductivities of the soil. The conditions shown in the summary report assumes the soil has reached saturation after the desired depth has been applied and not the real time state with the soil draining at the Ksat value of the soil. This would mean that a soil with a Ksat of 5mm/hr can absorb 5mm every hour at a rate that does not exceed 5mm per hour. If the instantaneous irrigation rate is higher than the Ksat value, the soil cannot absorb it fast enough. This will instigate ponding at the surface or drainage/sheet flow on the surface.

During the wetter parts of the year, the system can be pulsed to 1.5 mm depth application rates. These low application depths allow a greater opportunity to irrigate during the wetter times of the year when the soil water deficit is likely to be low. These regimes will be utilised to maintain storage as required. Typically, irrigation would occur until the nutrient limit for the soil is reached or the depth application specified in the Discharge Permit for an event is reached, whichever occurs first. On reaching this trigger level the guns would be moved to the next area. The irrigation contractor will determine the irrigation rationale in more detail and provide onsite training of staff to ensure they are suitable trained on its use.

Generally the creation of deferred storage in the form of ponds will allow the farmer to discharge when conditions suit, to avoid having to irrigate using such a regime. However the pond and discharge parameters have been set to allow the above worst-case situation to be sustainably managed.

The storage ponds are expected to be emptied daily or when conditions allow and should not be used to defer irrigation when an irrigation potential is present. The current design does not allow for deliberate storing of effluent in the pond if an irrigation potential is available and irrigation should occur on every available day. This includes the winter months when, if no winter milking is taking place, the pond is predominantly full of collected stormwater.

Ponds of this size will stagnate and cause nuisance odour, as well as Biological Oxygen Demand problems in the soil resulting in increased de-nitrification of the soil, unless oxygenation by means of mechanical stirring or aeration of the fluid is conducted. Separation of the solids from the fluid fraction of the FDE before it is stored in the pond will greatly reduce this problem, and if the pond is properly managed stirring and aeration may not be required. This is also another reason why it is important to keep the pond as empty as possible. Outlet nozzles discharging into sumps or ponds should be flared to provide a flat stream to maximise air contact.

3.2 Irrigation Rationale

Approximately 63Ha of effluent disposal area is being utilised at this stage, however we would recommend the entire farm is applied for disposal of effluent to accommodate the posible increase in cow numbers and to allow the farmer the greatest potential to irrigate when possible.

During the spring, autumn and winter wet months the irrigation system will be set to pulse application rates of 1.5 mm/hr to discharge the daily FDE production and to continue to reduce the volume in storage when possible. These application rates will be dialled in by the farmer to suit the conditions. During the summer months the rate will be increased to the averaged maximum achievable by the low application irrigation setup.

While daily effluent of 56m^3 is expected for the design, we have specified an irrigation volume of 180m^3 as the system must be capable of these outputs (within a 24 hour period), in order to reduce any deferred volume. The successful irrigation supply company will be providing the irrigation system details and components to meet the volume required. At this stage a Larall Smart Hydrant setup is proposed for the low application irrigation system. The number and configuration of the pods is subject to design by the irrigation contractor.

On no account should FDE be applied when surface water is ponding or during, 6 hours before, or 12 hours after heavy rainfall intensities of greater than 3mm/hr. Combined with the soil moisture monitoring information, visual inspection of the proposed application areas must be conducted before each application to ensure conditions are suitable. Irrigation is to cease or be moved to a new area if adverse conditions are present.

3.3 Cleaning and Removal of Solids

Solids from the blockwork solids dump bunker will be spread on the paddocks as required, observing best practice separation distances from sensitive areas and avoiding spreading of solids during adverse climatic conditions.

A water hydrant connection is to be installed near the pond crest to allow washing down of sludge into the sump in the base of the pond. The wash down hoses from the yard should be used to agitate the effluent in the stonetrap either by connection to the pond system or by installing a new hydrant connection near the stonetrap. A recycling pump/diversion valve from an existing pump sump/pond may also suffice.

The frequency of cleaning is dependent on use. It may take a few seasons to establish a suitable cleaning regime.

APPENDIX 1

Cnr North Road and Price Street
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Invercargill

Telephone (03) 211 5115
Fax No. (03) 211 5252
Southland Freephone No. 0800 76 88 45

Discharge Permit

Pursuant to Section 104B of the Resource Management Act 1991, a resource consent is hereby granted by the Southland Regional Council (the "Council") to **Otama Dairy Ltd** (the "consent holder") of **197 Jaffray Road, R D 7, Gore 9777** from 19 December 2012

Please read this Consent carefully, and ensure that any staff or contractors carrying out activities under this Consent on your behalf are aware of all the conditions of the Consent.

Details of Permit

Purpose for which permit is granted:		To discharge dairy shed effluent to land
Location	- site locality	Jaffray Road, Otama
	- map reference	F45:896-619
	- receiving environment	Land
	- catchment	Mataura River/Okapua Stream/Otama Creek
Legal description of land at the site:		Section 2 Block II Otama SD, Section 4 Block I Otama SD and Section 5 Block II Otama SD
Expiry date:		19 December 2022

Consent Amended

- Conditions amended on 2 September 2013
- Condition 2(a) varied on 22 September 2017

Schedule of Conditions

These conditions should be read in conjunction with the best practice recommendations that are appended. These will reduce the risk of non-compliance with the consent conditions.

1. This consent is granted for a period of 10 years.

*(**Note**: Pursuant to Sections 123 and 124 of the Resource Management Act 1991, a new consent will be required at the expiration of this consent. The application will be considered in accordance with the plans in effect at that time, and the adverse effects of the proposed activity.)*

2. (a) This consent authorises the discharge of dairy shed effluent onto land, via Centre Pivot, Cobra Rain Gun, K-line , Umbilical System and/or any other low rate effluent application method, as described in application APP-301811-V2, at the locations described above.

   (b) This consent excludes effluent from winter milking, or any feedlot or wintering pad.

3. (a) No dairy shed effluent shall be discharged to any surface watercourse by overland flow, run-off, or via a pipe, nor shall there be any surface run-off/overland flow, ponding or contamination of water resulting from the exercise of this consent. ***See Best Practice Notes 1, 2 & 3***

   (b) The land disposal system shall be operated and maintained to ensure that there is no offensive or objectionable odour beyond the property boundary, or any spray drift into or beyond the buffer zones specified in condition 5.

   (c) The consent holder shall install and maintain an alarm and automatic switch-off system as a contingency measure in the event of an effluent system failure such as a sudden pressure drop, irrigator stoppage or breakdown. ***See Best Practice Note 4***

   (d) Between 1 May and 31 August each year, no dairy shed effluent shall be discharged to areas of Oreti and Jacobstown soils marked as 'Area A' on the Appendix 1 Plan.

4. Subject to condition 3(a), the land disposal system is limited to the following:

   (a) Between 1 September and 30 April each year a maximum depth of application of 10 mm for each individual application, at an instantaneous rate not exceeding 10 mm/hour;

   (b) Between 1 May and 31 August each year, a maximum depth of application of 5mm for each individual application, at an instantaneous rate not exceeding 1.5mm/hour on the land marked as 'Area B' on the Appendix 1 Plan;

   *(**Note:** The application depth needs to be less than the soil-water deficit (i.e. the depths above are maximum depths and as soil moisture levels approach field capacity, smaller depths will be necessary to avoid losses of contaminants from the root zone. When soil moisture levels reach field capacity, irrigation will need to cease completely to prevent these losses.)*

   (c) the maximum loading rate of nitrogen onto any land area shall not exceed 150 kg of nitrogen per hectare per year from dairy shed effluent. ***See Best Practice Note 5***

5. Effluent may be applied to the land as described in the application and generally as shown in Appendix 1, but the following specific buffers shall be observed:

   (a) 20 metres of any surface watercourse;
   (b) 100 metres of any potable water abstraction point;
   (c) 20 metres of any property boundary (unless the adjoining landowner's consent is obtained to do otherwise); and
   (d) 100 metres of any residential dwelling other than residential dwellings on the property.

   Where there is conflict between Appendix 1 and these specified buffers, the latter shall apply.

6. The amount of dairy shed effluent disposed of onto land shall not exceed that from 1000 cows.

7. By 30 June 2013, the consent holder shall provide at least 2,223 m^3 of effluent storage for the purpose of:

   (a) avoiding irrigation of effluent when soils are at or above field capacity; ***see Best Practice Note 8***.
   (b) providing a contingency measure when the irrigation system is inoperative; and/or
   (c) primary treatment when it is necessary for the proper operation of the effluent disposal system.

8. The consent holder shall maintain daily records of the location and method of effluent discharge. These records shall be provided to the Consent Authority upon request.

9. The consent holder shall notify the Council, by 31 March 2013, of the person who is in charge of the operation of the effluent disposal system. If the person in charge of the effluent system changes during the term of this consent, the consent holder shall notify the Council of the new operator no later than five working days after that person takes responsibility. ***See Best Practice Notes 6 & 7***

   *(**Note**: The person identified by condition 8 will be the primary contact for Council staff for monitoring purposes and/or in the event of an incident. Nothing in this condition removes or limits the consent holder's liability to ensure compliance with the consent and its conditions.)*

10. The Southland Regional Council may serve notice of its intention to review the conditions of this consent, in accordance with the conditions of this resource consent and Sections 128 and 129 of the Resource Management Act 1991, during the period 1 February to 30 September each year, or within two calendar months of the completion of any enforcement action (prosecution or infringement notice), for the purposes of:

    (a) dealing with any adverse or cumulative effects, including the adverse effects of high stocking rates, on the environment which may arise from the exercise of this consent;
    (b) considering any changes to information on the effects of land disposal of dairy shed effluent;
    (c) complying with the requirements of a regional plan;
    (d) amending monitoring requirements; or
    (e) imposing a notification requirement for potential effects on registered drinking water supplies.

11. By 31 December 2014, the consent holder shall drill or access a bore (or well) for the purposes of monitoring groundwater in the unconfined aquifer. Unless otherwise agreed in writing by Environment Southland's Compliance Manager the bore shall conform with the following requirements:

    (a) the bore shall be located within the south eastern corner of the effluent disposal field, but within 300m of Jaffray Road

    (b) The depth of the bore shall be between 6.5 and 9.5 metres below the static groundwater level, and no more than 12 metres deep in total;

    (c) The internal diameter of the bore shall be between 50 and 100 mm.

(d) The bore is to be used solely for monitoring purposes. This may include abstraction to take samples or to flush the bore prior to sampling, but excludes abstraction of water for domestic or farm supply.

Note 1: *Construction of a bore will require a separate land use consent. However the land use consent is a controlled activity and should not pose an impediment to the exercise of the discharge permit. A guideline on monitoring bore construction is available*

Note 2: *If a bore cannot be established in accordance with this condition, the consent holder may seek the Compliance Manager's agreement for an alternative monitoring bore, or may seek amendment to the resource consent.*

Note 3: *If it is necessary to draw water supply from the monitoring bore it may be necessary to install a new monitoring bore.*

12. The consent holder shall pay an annual administration and monitoring charge to the Southland Regional Council, collected in accordance with Section 36 of the Resource Management Act. This charge may include the costs of inspecting the site twice each year (or otherwise as set by the Council's Annual Plan), and:

    (a) until December 31 2014 monitoring the effects of the discharge on groundwater by taking representative samples from bore/well F45/0182 once every six months and analysing for:

    - electrical conductivity
    - nitrate nitrogen concentration
    - Total Nitrogen concentration
    - Dissolved oxygen concentration – field measurement
    - E. coli concentration
    - bromine concentration
    - chloride concentration

    Except that the first sample shall also be analysed for Dissolved Iron concentration.

    (b) From 1 January 2015 monitoring the effects of the discharge on groundwater by taking representative samples from bore established under condition 10 and analysing for:

    - electrical conductivity
    - nitrate nitrogen concentration
    - Total Nitrogen concentration
    - Dissolved oxygen concentration – field measurement
    - E. coli concentration
    - bromine concentration
    - chloride concentration

    Except that the first sample shall also be analysed for Dissolved Iron concentration.

13. If an event (such as effluent overflow to water, significant over-application on a free-draining area or pond collapse) occurs that may have significant adverse effect on water quality at the abstraction point of a registered drinking-water supply, the consent holder shall notify, as soon as reasonably practicable, the following:

- Environment Southland's Compliance Manager (ph 03 211 5115 or 03 211 5225 after hours);
- Gore District Council (ph 03 209 0330).

*(**Note:** The consent holder is advised to contact Environment Southland's Compliance Manager in the event of any unexpected event that may result in non-compliance with the conditions of this resource consent or the rules of a regional plan.)*

for the **Southland Regional Council**

Michael Durand
Consents Manager

Best Practice and Explanatory Notes

1. Dairy shed effluent should not be discharged onto any land area that has been grazed within the previous 5-10 days. Where there has been significant damage to soil during grazing, it is recommended that effluent not be applied until that damage has been repaired.

2. To avoid contaminating water directly or indirectly, the consent holder should not apply effluent to land when the soils are at or above field capacity. Moisture content is to be determined by either actual monitoring on site or by reference to the appropriate Council monitoring site. The Council's soil moisture monitoring sites can be viewed at *http://www.es.govt.nz* and following the "Farming", "Dairy Advisor" and "Soil Moisture Maps" links.

3. For the purposes of this condition, ponding is the accumulation of effluent on the soil surface resulting from the application of effluent to saturated soils, or the application of effluent inducing saturated soil conditions. It does not refer to the temporary accumulation of effluent on the soil surface resulting from the application of effluent at a rate that exceeds the soil infiltration rate.

4. Where the effluent reticulation system is installed in such a way that effluent can be siphoned when pumping ceases, the consent holder should install and maintain an anti-siphon device in the effluent pipe line.

5. A loading of 150 kg N/ha/year is approximately equivalent to a loading of dairy shed effluent to land of 4 ha/100 cows. However, there are significant benefits to having a larger effluent disposal area in terms of managing potassium. Further, scientific research has highlighted decreased nitrogen use efficiency and increased nitrogen leaching losses at annual nitrogen loading rates (from combined fertiliser and effluent N) greater than 150 kg/N/ha/yr. Extreme caution should therefore be taken when applying nitrogen fertiliser to the effluent disposal area. It is recommended that a nutrient budget is used to check that nitrogen and potassium application rates to the effluent disposal area are not excessive.

6. The consent holder should prepare and comply with a Farm Environmental Management Plan. The plan should:

   - specify and implement a nutrient budgeting system for the property;
   - provide for the management of effluent disposal to avoid applications when soils are at or above field capacity;
   - identify, as far as is practicable, the drains in the effluent disposal area, so that appropriate management procedures can be taken to avoid contamination of the drains by effluent;
   - if relevant, provide for the operation and management of any feedlot and/or wintering pad;
   - include the provision for monitoring application rates to ensure the consent requirements are being met;
   - include the monitoring requirements specified in this consent; and
   - address ancillary matters such as protecting well-head(s) from contamination; preventing leachate from any silage pits entering water, including groundwater; preventing soil damage; controlling runoff from lanes; and preventing stock access to and maintaining the riparian margins of any watercourses on the property.

   A template may be viewed at:
   www.es.govt.nz/media/4831/dairy-farm-plan-consent-template.pdf

7. The consent holder should display, in a prominent place in the dairy shed, a copy of the resource consent and relevant limits about the operation of the effluent disposal system that must be complied with. The material to be displayed will be provided by the Council on laminated sheets suitable for display purposes.

8. Storage ponds should be operated at low levels when conditions for effluent disposal are suitable in order to maintain storage for wet weather periods. In particular, storage ponds should be emptied in late summer/early autumn to ensure sufficient storage capacity for the following late winter/early spring period.

9. Storage ponds should not, for practical purposes, leak. This resource consent does not authorise the discharge of contaminants due to leaks or failure of the storage ponds. If an existing storage pond is modified (such as by increasing the embankment height to increase storage), the modification will require resource consent.

Environment Southland*

(03) 211 5115

Toll Free 0800 76 88 45 (Southland only)

or

Emergency After Hours (03) 211 5225

if you have an effluent or pollution problem,
call us

environment
SOUTHLAND

Held by: Otama Dairy Ltd

- the total milking herd cannot exceed 1000 cows.

- effluent may only be applied within the area shown on the attached map, as detailed in the application for the Consent.

- effluent cannot be applied within 20 metres of the property boundary.

- if there are waterways within the approved area, effluent cannot be applied within 20 metres of the waterways and ditches.

- a maximum depth of application of 10 mm for each individual application, at an instantaneous rate not exceeding 10 mm/hour;

  *(**Note:** The application depth needs to be less than the soil-water deficit (i.e. the depths above are maximum depths and as soil moisture levels approach field capacity, smaller depths will be necessary to avoid losses of contaminants from the root zone. When soil moisture levels reach field capacity, irrigation will need to cease completely to prevent these losses.)*

- the contingency plan consists of:

  - 56 days of effluent storage capacity so that the discharge may be deferred during adverse conditions.

(the above is a synopsis. You should ensure you understand the full consent. If you do not have a copy, contact Environment Southland*)

Problem Solving

• the number of cows intended to be milked exceeds the consent limit	**Contact Environment Southland for a Variation to the Consent**

If you have any effluent or pollution problems, please contact Environment Southland at the following numbers: Environment Southland: (03) 211 5115 or 0800 76 88 45 during office hours or 03 211 5225 (emergency response) after hours.

AUTH-20158314

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Southland Freephone No. 0800 76 88 45

environment SOUTHLAND
Te Taiao Tonga

Water Permit

Pursuant to Section 104B of the Resource Management Act 1991, a resource consent is hereby granted by the Southland Regional Council to **Otama Dairy Ltd** of **197 Jaffray Road, RD 7, Gore 9777** from **8 October 2015.**

Please read this Consent carefully, and ensure that any staff or contractors carrying out activities under this Consent on your behalf are aware of all the conditions of the Consent.

Details of Permit

Purpose for which permit is granted: To take and use groundwater for the purpose of irrigation

Location	- site locality	Jaffray Road, Otama
	- map reference	NZTM 2000 1279381E, 4899633N NZTM 2000 1278580E, 4899432N NZTM 2000 1249580E, 4899934N
	- groundwater zone	Knapdale
	- catchment	Mataura River
	- well number	F45/0422, F45/0434 and F45/0426

Legal description of land at the site: Section 5 Blk II Otama SD and Section 2 Blk II Otama SD

Expiry date: **8 October 2025**

Schedule of Conditions

1. The permit authorises the taking of groundwater at the locations specified above. The total rate of abstraction shall not exceed:

   (a) 70 litres per second;
   (b) 6,050 cubic metres per day; and
   (c) 480,000 cubic metres per year.

2. Prior to the first exercise of this consent, the consent holder shall install a backflow prevention device or take other appropriate measures to ensure water and/or contaminants cannot return to the water source.

3. When the flow in the Mataura River, as recorded by the Consent Authority at its Gore flow measurement site, is at or below 11 cubic metres per second:

   (a) the consent holder shall not take water from well F45/0426 (also known as PW2);
   (b) the total rate of abstraction from wells F45/0434 and F45/0422 shall not exceed 33 litres/second or 2,851,200 litres/day.

4.
   (a) Prior to the first exercise of this consent, the consent holder shall install a water meter to record the water take, within an error accuracy range of +/-5% over the meter's nominal flow range, and datalogger with at least 24 months data storage capacity and a telemetry unit to record the rate and volume of take, and the date and time this water was taken. The consent holder shall forward a copy of the installation certificate to the Consent Authority within one month of installing the water meter and datalogger.

   (b) The water meter shall be installed in a straight length of pipe, before any diversion of water occurs. The straight length of pipe shall be part of the pump outlet plumbing, easily accessible, have no fittings and obstructions in it. There shall be a straight length of pipe on either side of the water meter, on the upstream side there shall be a distance that is 10 times the diameter of the pipe and on the downstream side there shall be a distance of 5 times the diameter of the pipe.

   (c) The consent holder shall ensure the full operation of the water meter and datalogger at all times during the exercise of this consent. All malfunctions of the water meter and datalogger during the exercise of this consent shall be reported to the Consent Authority within five working days of observation and appropriate repairs shall be performed within five working days. Once the malfunction has been remedied, a Water Measuring Device Verification Form completed with photographic evidence must be submitted to the Consent Authority within five working days of the completion of repairs.

   (d) (i) If a mechanical insert water meter is installed it shall be verified for accuracy each and every year from the first exercise of this consent.
   (ii) Any electromagnetic or ultrasonic flow meter shall be verified for accuracy every five years from the first exercise of this consent.
   (iii) Each verification shall be undertaken by a Consent Authority approved operator and a Water Measuring Device Verification Form shall be completed and supplied to the Consent Authority with receipts of service. These shall be supplied within five working days of the verification, and at any time upon request.

   (e) The consent holder shall record adequate data to demonstrate compliance with Condition 1. Data from the datalogger shall be provided once daily to the Consent Authority by means of telemetry. The consent holder shall ensure data is compatible with the Consent Authority's time-series database.

5. Prior to the exercise of this consent, the consent holder shall notify the Consent Authority of the person who is in charge of the operation this consent. If the person in charge changes during the term of this consent, the consent holder shall notify the

Consent Authority of the new operator no later than five working days after that person takes responsibility.

6.

(a) Irrigation to land shall not occur when the moisture content of the soils is at field capacity, nor shall irrigation increase soil moisture above field capacity.

(b) To demonstrate compliance with Condition 6(a), the applicant shall monitor on-site soil moisture within the irrigation area as follows:

(i) within one month of the first exercise of this consent, the consent holder shall install an Aquaflex soil-moisture tape, or alternative soil-moisture measurement device or method of similar accuracy as agreed in writing with the Consent Authority;
(ii) soil moisture shall be measured at two sites within the irrigation area on Mataura soils. The exact monitoring location and depth shall be confirmed in writing with the Consent Authority;
(iii) the soil moisture data is to be recorded at 30 minute intervals using an electronic datalogger system and this record shall be provided to the Consent Authority at least once every three months and upon request;
(iv) within six months of the first exercise of this consent, the consent holder shall, from the on-site monitoring record, determine the soil-moisture content that is equivalent to field capacity at the site and shall report this to the Consent Authority;
(v) within six months of the first exercise of this consent, soil moisture content, for the purposes of Condition 6(a), is to be determined by on-site measurement.

(c) Until the on-site soil moisture monitoring system required by Condition 6(b) is installed the consent holder shall demonstrate compliance with Condition 6(a) by making reference to the appropriate Consent Authority soil moisture monitoring site.

7. The consent holder shall pay an administration and monitoring charge to the Consent Authority collected in accordance with Section 36 of the Resource Management Act, payable in advance on 1 July each year.

8. The Consent Authority may, in accordance with Sections 128 and 129 of the Resource Management Act 1991, serve notice on the consent holder of its intention to review the conditions of this consent during the period 1 February to 30 September each year, or within two months of any enforcement action being taken by the Consent Authority in relation to the exercise of this consent, or on receiving monitoring results, for the purposes of:

(a) adjusting the consented rate or volume of water under Condition 1, should monitoring under Condition 4 or future changes in water use indicate that the consented rate or volume is not able to be fully utilised;
(b) determining whether the conditions of this consent are adequate to deal with any adverse effect on the environment which may arise from the exercise of the consent and which it is appropriate to deal with at a later stage;
(c) ensuring the conditions of this consent are consistent with any National Environmental Standards Regulations, relevant plans and/or the Environment Southland Regional Policy Statement; or
(d) adjusting or altering the method of water take data recording and transmission

Reisssed on the 16th of October 2015 after an administrative correction
for the **Southland Regional Council**

Michael Durand
Acting Consents Manager

Notes:

1. *In accordance with Section 125(1)(a) of the Resource Management Act, this consent shall lapse after a period of five years after the date of commencement unless it is given effect to or an application is made to extend the lapse period before the consent lapses.*
2. *Section 126 of the Resource Management Act provides for this resource consent to be cancelled if the consent has been exercised in the past but has not been exercised during the preceding five years.*
3. *If you require a replacement permit upon the expiry date of this permit, any new application should be lodged at least six months prior to the expiry date of this permit. Applying at least six months before the expiry date may enable you to continue to exercise this permit until a decision is made, and any appeals are resolved, on the replacement application.*

environment SOUTHLAND

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Telephone (03) 211 5115
Fax No. (03) 211 5252
Southland Freephone No. 0800 76 88 45

Water Permit

Pursuant to Section 104B of the Resource Management Act 1991, a resource consent is hereby granted by the Southland Regional Council (the "Council") to **Otama Dairy Ltd** (the "consent holder") of **197 Jaffray Road, R D 7, Gore 9777** from 19 December 2012.

Please read this Consent carefully, and ensure that any staff or contractors carrying out activities under this Consent on your behalf are aware of all the conditions of the Consent.

Details of Permit

Purpose for which permit is granted:		To take groundwater for a dairy operation
Location	- site locality	Jaffray Road, Otama
	- map reference	F45:894-619
	- groundwater zone	Knapdale
	- catchment	Mataura River/Okapua Stream/Otama Creek
Legal description of land at the site:		Section 2 Block II Otama Survey District
Expiry date:		19 December 2022

Consent Amended

Conditions amended on 2 September 2013 as follows

Schedule of Conditions

1. This consent is granted for a period of 10 years.

   (Note: Pursuant to Sections 123 and 124 of the Resource Management Act 1991, a new consent will be required at the expiration of this consent. The application will be considered in accordance with the plans in effect at that time, and the adverse effects of the proposed activity).

2. This consent authorises the abstraction of water from bore/well F45/0173 at about NZMS 260 F45: 894-619.

3. The rate of abstraction shall not exceed 120,000 litres per day.

   Under delegated authority, and in accordance with Section 127 of the Resource Management Act 1991, this application has not been notified and is approved

4. The consent holder shall install a backflow prevention device or take other appropriate measures to ensure water and/or contaminants cannot return to the water source.

5. From the commencement of the exercise of this resource consent, the consent holder shall monitor water usage to ensure compliance with condition 3 of this consent, as follows:

   (a) the consent holder shall install a flow meter(s):
      (i) able to continuously measure the amount of water taken;
      (ii) capable of accuracy to within 5% of the true flow rate, on each abstraction;
      (iii) capable of providing output in a form suitable for electronic data storage;
      (iv) that records volumes in litres or cubic metres;
      (v) in accordance with the manufacturer's instructions;
      (vi) that is sealed and as tamper proof as practicable;
      (vii) in a location that measures all water taken;

   (b) the consent holder shall install a datalogger and record the volume of water taken each day;

   (c) at least once every three months the consent holder shall report the record of the daily rate of abstraction to Environment Southland in Hilltop format, or XML formatted as required by Hilltop software.

6. The consent holder shall pay an administration and monitoring charge to the Southland Regional Council collected in accordance with Section 36 of the Resource Management Act, payable in advance on the first day of July each year.

7. The Council may, in accordance with Sections 128 and 129 of the Act, serve notice, during the period 1 February to 30 September each year, of its intention to review conditions for the purpose of:

   (i) dealing with any adverse effects on the environment which may arise from the exercise of this consent;
   (ii) requiring monitoring of the rate of, or the effects of, the abstraction;
   (iii) requiring efficiency of water use; and/or
   (iv) complying with the requirements of a regional plan.

for the **Southland Regional Council**

W J Tuckey
Director of Environmental Management

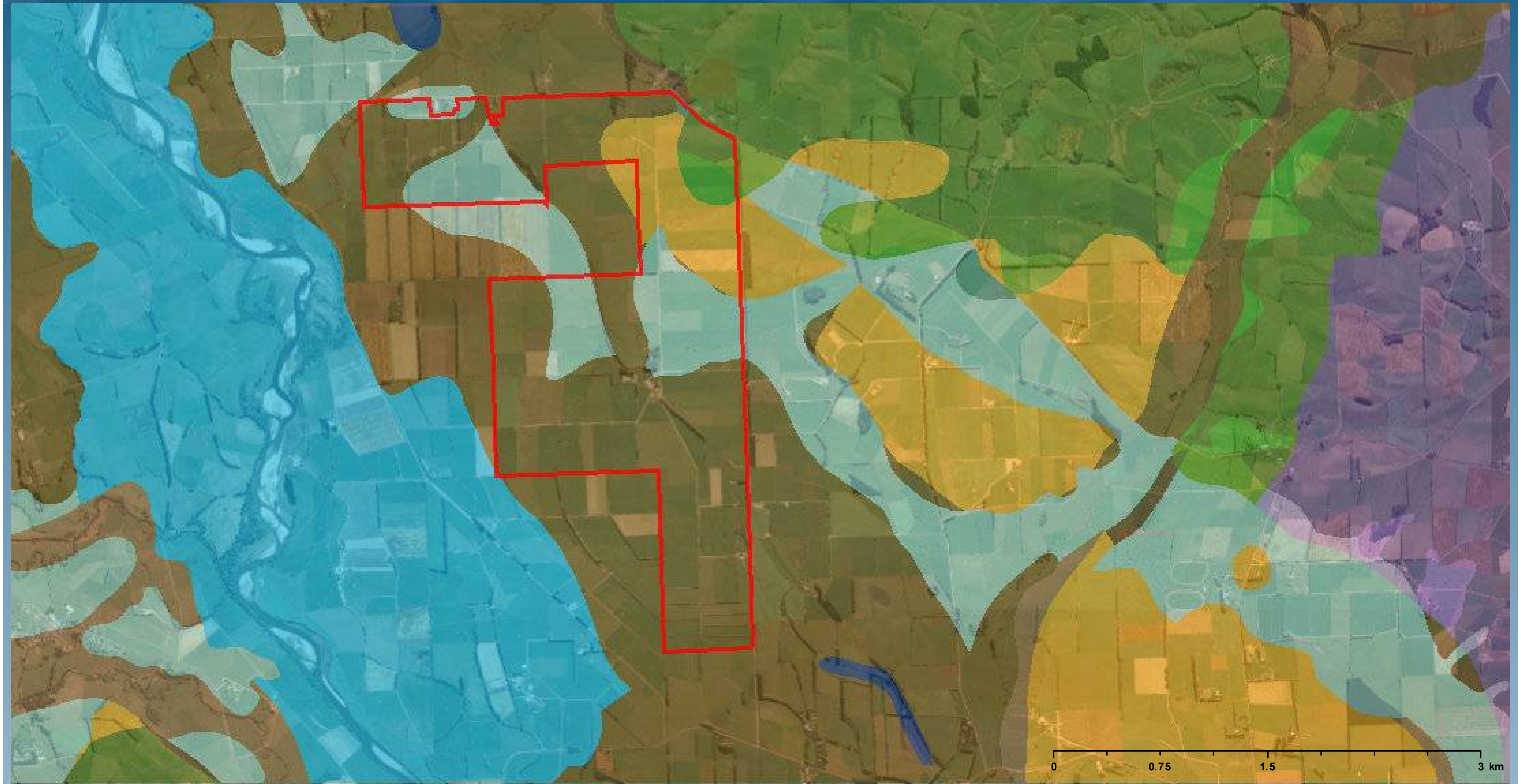
APPENDIX 2

BEACON

Environment Southland Mapping Service

Otama Dairy Ltd

February 25, 2019



polylineLayer

Override 1

Alerts

Blue

Green

Yellow

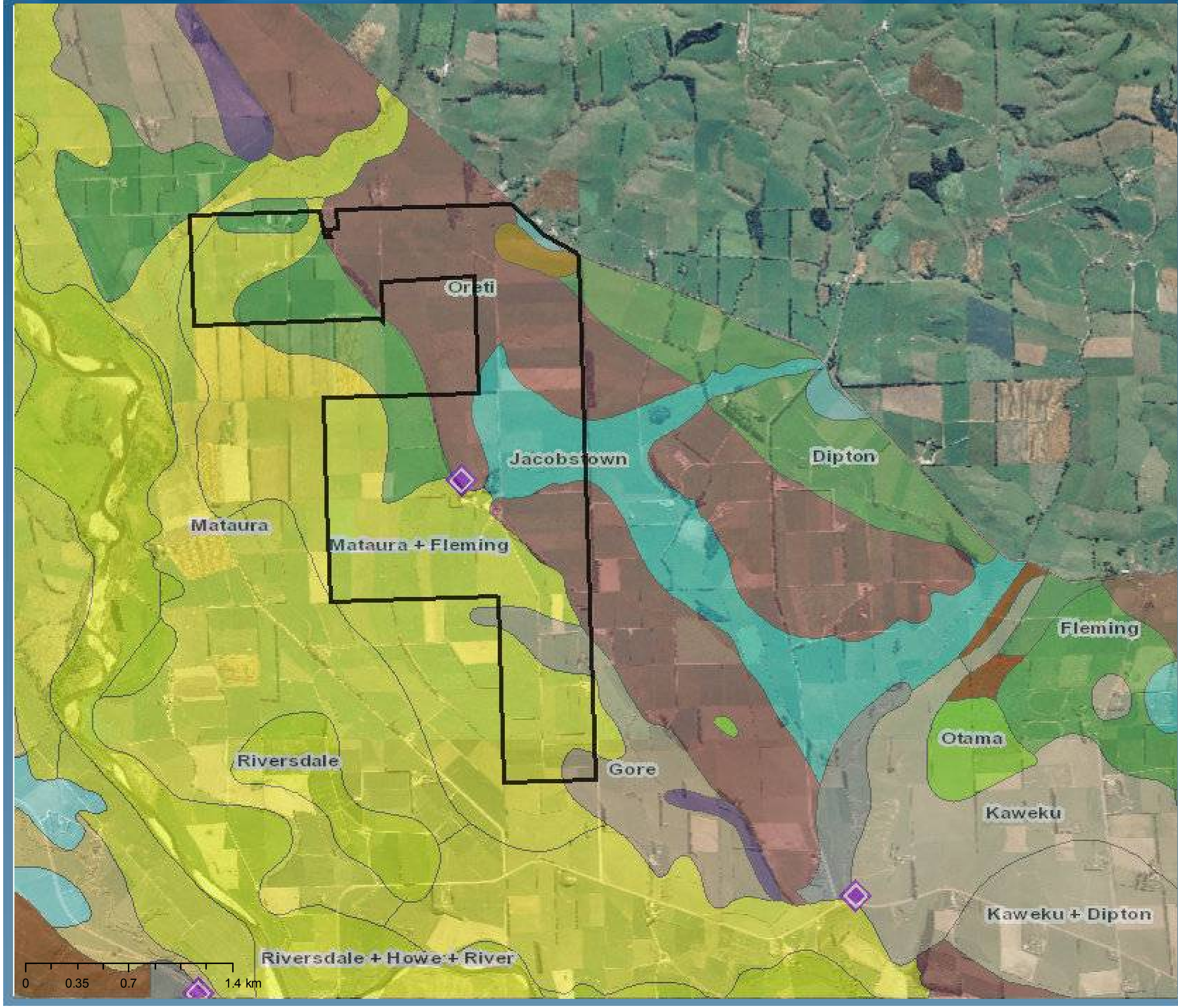
Red

APPENDIX 3

BEACON
Environment Southland Mapping Service

Otama Dairy Pro-Posed Land Area

September 20, 2018



polylineLayer
- Override 1

Alerts
- Blue
- Green
- Yellow
- Red
- Soil Profile

Soil Types
- Andrews
- Arthurton
- Chatton
- Dipton
- Fleming
- Glenure
- Gore
- Jacobstown
- Kaihiku
- Kaweku
- Kaweku Scarp
- Makarewa
- Mandeville
- Mataura
- Oreti
- Oreti Scarp
- Otama
- Otikerama
- Pyramid
- Riversdale
- Tailings

APPENDIX 4

Dairy Effluent Storage Calculator
Summary Report

Regional authority:	Environment Southland Regional Council
Authorised agent:	Brian Goodger, Fonterra
Client:	G Raymond
Program version:	1.49
Report date:	Monday, 26 November 2018

General description:

Storage Pond Disclaimer
Climate for rainfall was taken at the Mandeville site to give a mean annual rainfall of 950 mm, farm location actual rainfall is 854mm (from 30yr Overseer climate data)

The farm entered as having an 186ha effluent irrigation area,127ha high risk due to drainage on Mataura/Fleming and Jacobstown soils and 58ha low risk soils due to slope and drainage on Oreti and Gore soils, topography is all flat.
For the purpose of this calculation an estimate of 63 litres/cow/day of wash down water is generated on the dairy and directed into the effluent system, this is an industry average not an actual measurement.

No emergency storage allowed for, as all effluent gravity feeds to the 152,000lt concrete sump.

Storage volumes have been based on using a low depth/rate Cobra travelling irrigator applying 21,000 litres/hour at 5.6mm depth in winter/spring for a 4 hour run (speed setting 2, travelling 1.1m/minute or 66m in one hour) putting out 84,000 liters.
The Pivot entered as applying at 6mm depth (actually 2.5mm), 43,000lt/hr running for 4 hours, total applied 173,000lt
These figures need to be confirmed by an irrigation specialist/designer to ensure they are achievable.

Based on the input data, the previous 30 years rainfall and soil moisture deficit data, the storage capacity you would require to meet the industry standard of a 90% probability the pond would be 1175 cubic meters (this DOES NOT INCLUDE freeboard and sludge allowances, this is the pump-able volume)

The maximum storage capacity that would have covered you for all climatic events in the last 30 years is 1671 cubic meters, this DOES NOT include freeboard and sludge allowances (refer to yellow bar on graph indicating 1981 as having the worst conditions for effluent application)
Other assumptions include: 1) 1000 cows 2) shed roof water is diverted away from the effluent pond all year 3) all concrete around the dairy is diverted in the winter 4) water use at 63lt /cow/day 5) effluent block is 127ha of high risk soils and 58ha of low risk soils.

Otama Dairy Ltd storage pond with the dimensions of 33m x 33m x 3m deep with a 2.0:1 batter was used in this calculation to give an actual size and surface area, a pond with these dimensions would provide a total capacity of 2223 cubic meters, (including freeboard and sludge) and 1710 cubic meters pump-able pond volume.
This gives the farm 535 cubic meters of storage above what is required.

According to the calculator, this is sufficient storage for your farm when the system is managed as per the input data provided. Please CHECK THE INPUT DATA in this report to ensure it is accurate.

Climate

Rainfall site: Mandeville

Mean annual rainfall: 950 mm/year

Effluent Block

Area of low risk soil: 58.0 hectares

Minimum area of high risk soil: 22.0 hectares

Surplus area of high risk soil: 106.0 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	940	5.0	59.2
February	940	5.0	59.2
March	940	5.0	59.2
April	780	5.0	49.1
May	780	5.0	49.1
June	0	0.0	0.0
July	0	0.0	0.0
August	1000	5.0	63.0
September	1000	5.0	63.0
October	1000	5.0	63.0
November	1000	5.0	63.0
December	1000	5.0	63.0

Irrigation

Winter-spring depth: 5 mm

Spring-autumn depth: 6 mm

Winter-spring volume: 84 cubic metres

Spring-autumn volume: 173 cubic metres

Irrigate all year? Yes

Catchments

Yard Area: 1067 square metres

Diverted? Yes

- diversion start: 01 June

- diversion end: 31 July

Shed Roof Area: 335 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

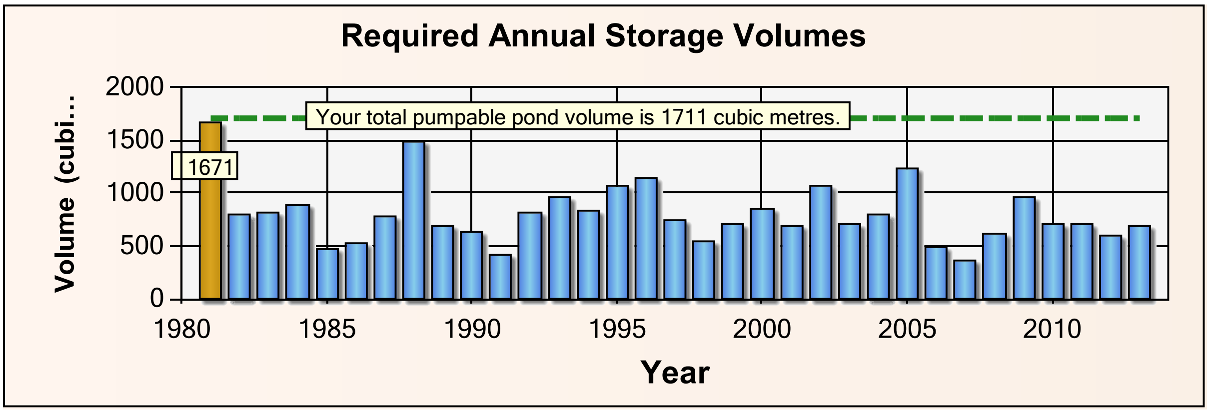
Pond/s present?	Yes
No. of ponds:	1 pond/s
Includes irregular ponds?	No
Pond 1	
- total volume:	2223 cubic metres
- pumpable volume:	1711 cubic metres
- surface area:	1089 square metres
- width:	33.0 metres
- length:	33.0 metres
- batter:	2.0:1
- total height:	3.0 metres
- pumped?	Yes
Tank/s present?	No
Emergency storage period:	0 days

Solids Separation

Solids separator/s present?	No

Outputs

Maximum required storage pond volume:	1671 cubic metres
90 % probability storage pond volume:	1175 cubic metres
During the period from:	01 July 1980
To:	30 June 2013


Required Annual Storage Volumes
Your total pumpable pond volume is 1711 cubic metres.
1671
Volume (cubi...
2000
1500
1000
500
0
1980
1985
1990
1995
2000
2005
2010
Year

APPENDIX 5

POND DESIGN SUMMARY

Type of distribution system proposed	Low application Larall Smart Hydrant System with the option of a low application travelling irrigator in summer	
Coordinates of proposed pond NZMG	E 1279722 : N 4899868	
Maximum cows expected for design	800	
Type of dairy shed	Rotary	
Water use for design (two milkings a day)	70	litres/cow/day
Daily volume FDE produced	56	m^3
Stormwater catchment area of yard and other areas	880	m^2
Stormwater catchment area of ponds	1,199	m^2
Total catchment area for inclusion in pond design	2,079	m^2
Massey Calculator Design requirement (30 years)	1,758	m^3
TOTAL OPERABLE STORAGE volume of ponds proposed	2,410	m^3
ESCOP Calc. 60 day storage requirement	2,400	m^3
Proposed length at top of bank	33	m
Proposed width at top of bank	33	m
Proposed average depth	3	m

The larger than required pond size is to allow for a possible increase in cow numbers in the future.

During the winter months of no milking the yard stormwater will be diverted via a pipe to the nearest gully or soakpit.

The shed roof water is to be diverted all year round.

The discharge consent will need to include the flexibility to irrigate during the winter months when conditions allow, maintaining storage capacity for the following spring period.

4. RECOMMENDATIONS FOR PASTURE MANAGEMENT

As part of best management practice, a pasture management regime involving aerating of effluent paddocks should be introduced, particularly if pugging and/or waterlogging of the soils has occurred in paddocks. As shown in the research reporting mentioned above, aeration greatly improves the soils' ability to hold and process nutrients from FDE, which also provides for a 'healthier' soil matrix.

We recommend that aeration, or re-pasturing of the topsoil profile should be carried out immediately on any effluent paddocks that have suffered compaction, or pugging due to stock. This will re-establish the permeability of the soil and reduce overland drainage runoff.

5. APPLICABILITY

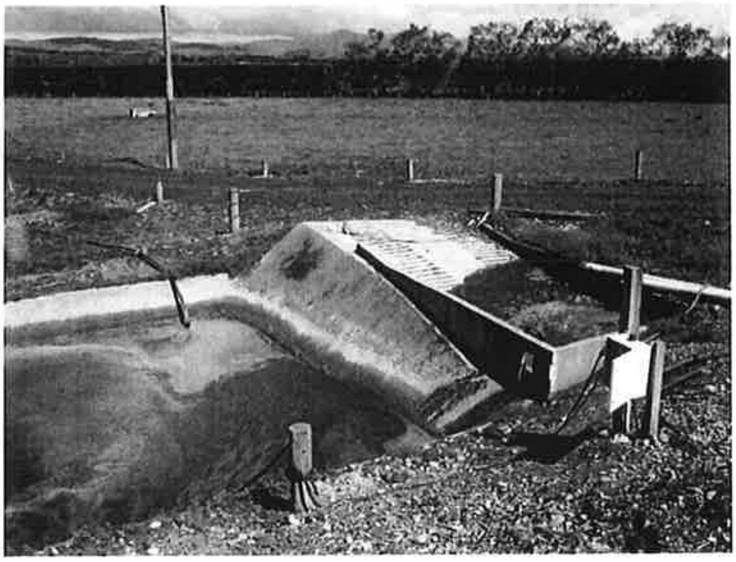
This report has been prepared based on the information provided to us by the Client or their representative. The design is iterative whereby changes can affect the entire design outcome. We must be notified of any potential changes to confirm the design is not compromised.

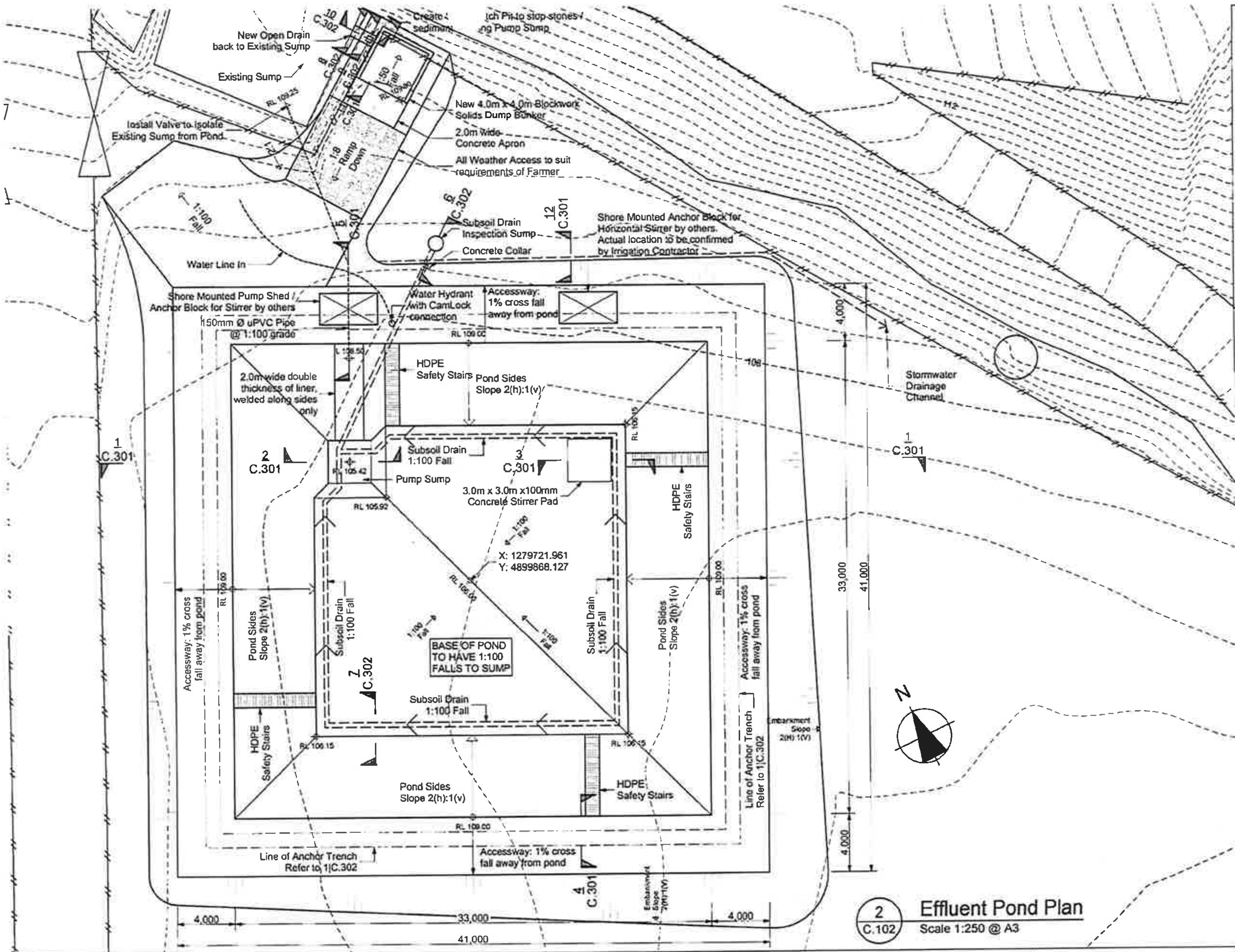
While we have exercised due care in assessing the pond size, we take no responsibility for the Massey pond calculator results. This is a proprietary software package still under development and is subject to vetting by its developers and reviewers.

This report is only to be used by the parties named above for the purpose that it was prepared and shall not be relied upon or used for any other purpose without the express written consent of GREEN Being Ltd.

6. PHOTOS

Test pit 1


Existing pump sump and stonetrap.



Revision History

rev	date	issue
01	28/09/2012	RESOURCE CONSENT

Notes:
1. Check all dimensions on site.
2. All drawings to be read in conjunction with GREEN Being Design Report and Specifications.
3. Cut / Fill volumes solid measure, approximate only, and based on typical pond section. Contractor to confirm volumes.
4. Any variations from the design drawings are to be confirmed by the Engineer in writing.
5. Irrigation Contractor to confirm new watermain details.
6. Coordinates in NZTM.
7. Effluent Line out of Pond to be determined by Irrigation Contractor.
8. All Pipework to have 1:100 grade unless stated otherwise.
9. Gas venting to be installed under the liner, by Liner Installer in accordance with their instructions.
10. Safety Rope System at Stairs to be installed by Principal or Liner Installer

KEY:

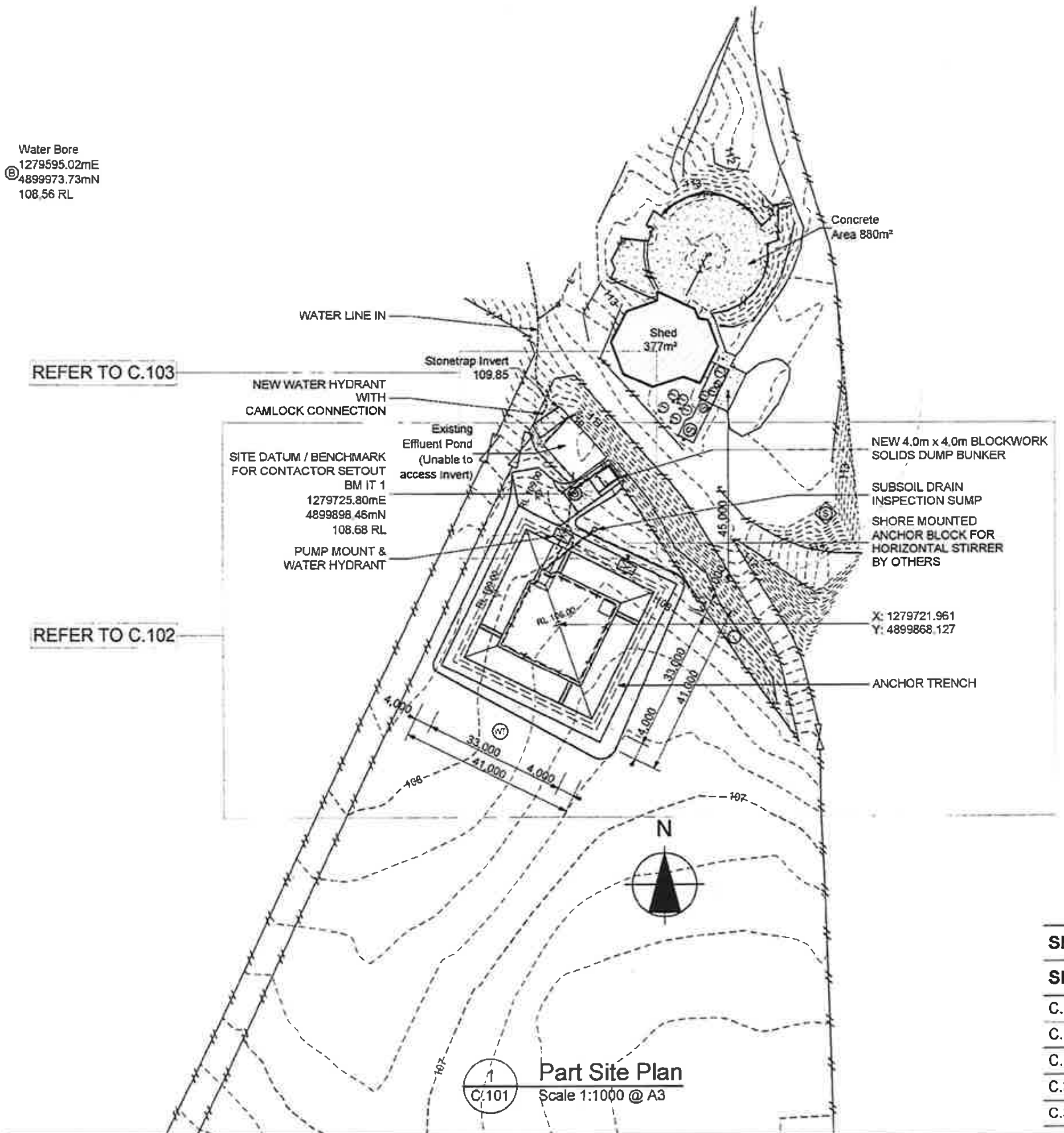
Existing Contours

Top Soil Strip:	250m³
Cut:	1400m³
Fill:	1450m³

Effluent Pond Plan

2 | C.102 — Scale 1:250 @ A3

Engineering Firm	Project Manager	Client		Sheet Title	Scale	Drawing No
GREEN Being Ltd P.O. Box 1298 Queenstown		OTAMA DAIRY LTD 145 JAFFRAY ROAD RD7, GORE	OTAMA EFFLUENT POND DESIGN	EFFLUENT POND PLAN Printed 28/09/2012	as shown Job No. 10124	C.102 Revision 01



Part Site Plan
1 / C.101
Scale 1:1000 @ A3

Revision History

rev	date	issue
01	28/09/2012	RESOURCE CONSENT

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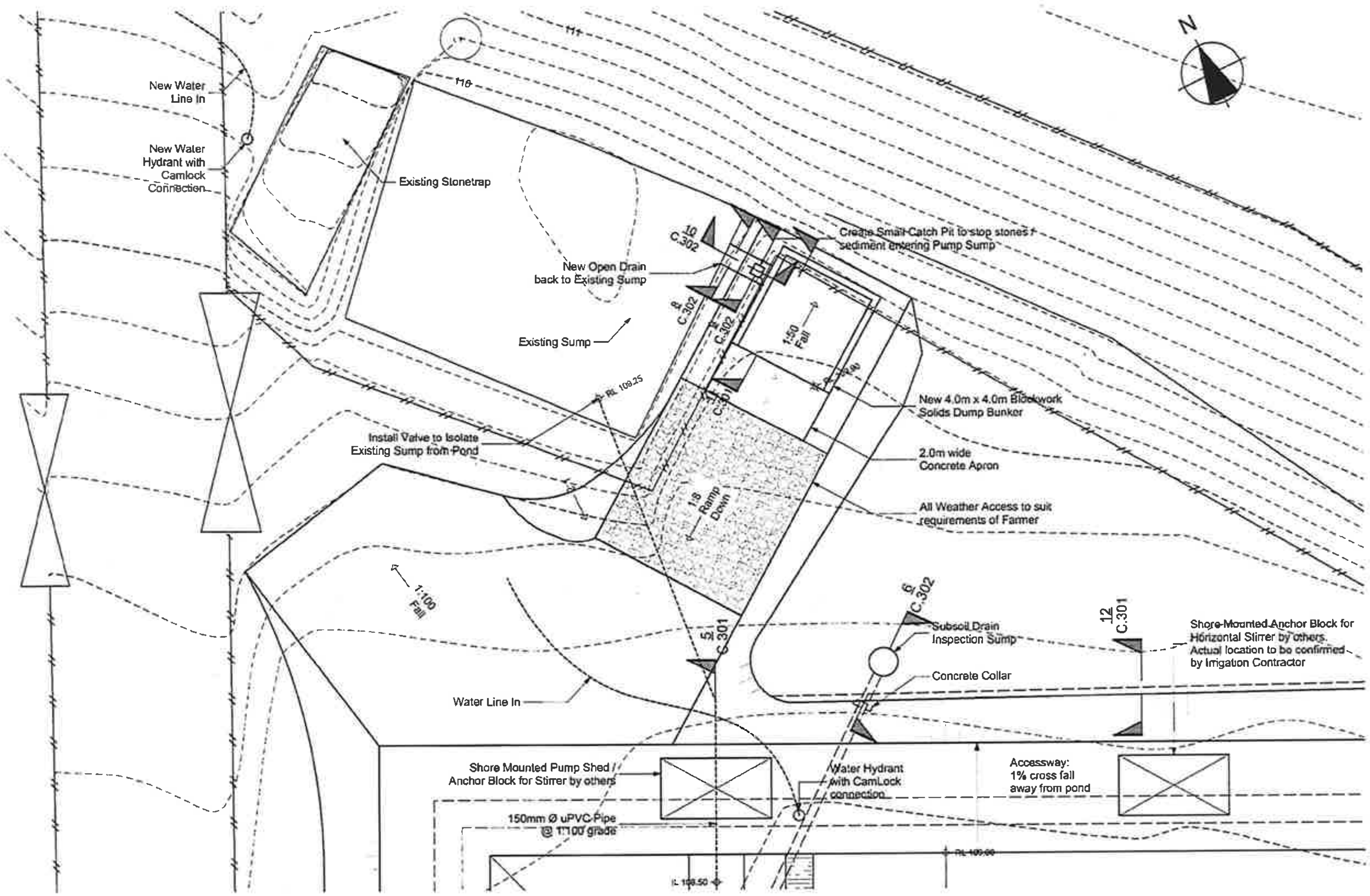
Legend
- Water Bore
- Water Tank
- Contours
- Gravelled Track, Hardstand
- Fenceline

Sheet Index

Sheet No.	Sheet Name	Published	Rev No.
C.101	SYSTEM OVERVIEW	☒	01
C.102	EFFLUENT POND PLAN	☒	01
C.103	SOLIDS BUNKER & EXISTING SUMP PLAN	☒	01
C.301	DETAIL SECTIONS	☒	01
C.302	DETAIL SECTIONS	☒	01

GREEN Being	Engineering Firm: GREEN Being Ltd P.O. Box 1298 Queenstown	Project Manager	Client: OTAMA DAIRY LTD 145 JAFFRAY ROAD RD7, GORE	OTAMA EFFLUENT POND DESIGN	Sheet Title: SYSTEM OVERVIEW Printed: 28/09/2012	Scale: as shown Job No. 10124	Drawing No. C.101 Revision 01



Solids Bunker & Existing Sump Plan

3 C.103 Scale 1:150 @ A3

Revision History		
rev	date	issue
01	28/09/2012	RESOURCE CONSENT

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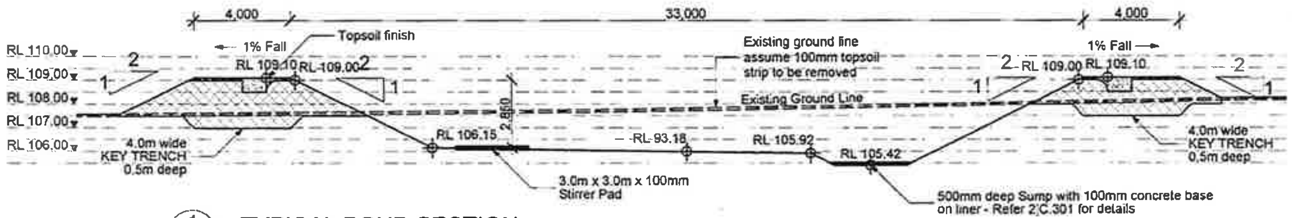
KEY:

Existing Contours

Engineering Firm	Project Manager	Client		Sheet Title	Scale	Drawing No.
GREEN Being Ltd P.O. Box 1298 Queenstown		OTAMA DAIRY LTD 145 JAFFRAY ROAD RD7, GORE	OTAMA EFFLUENT POND DESIGN	SOLIDS BUNKER & EXISTING SUMP PLAN Printed. 28/09/2012	as shown Job No. 10124	C.103 Revision 01



1 / C.102 **TYPICAL POND SECTION**
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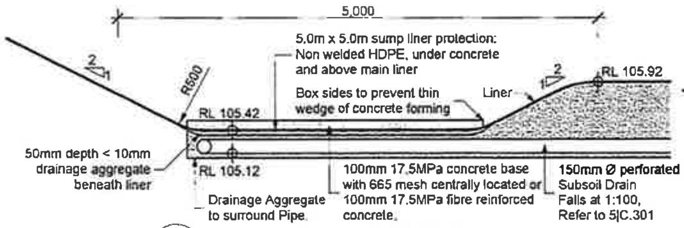

2 / C.102 **PUMP SUMP SECTION**
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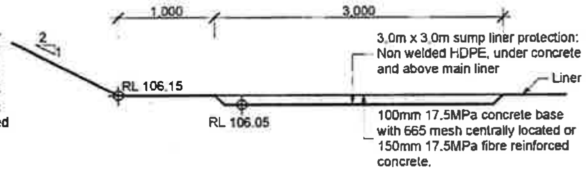

3 / C.102 **STIRRER SUMP SECTION**
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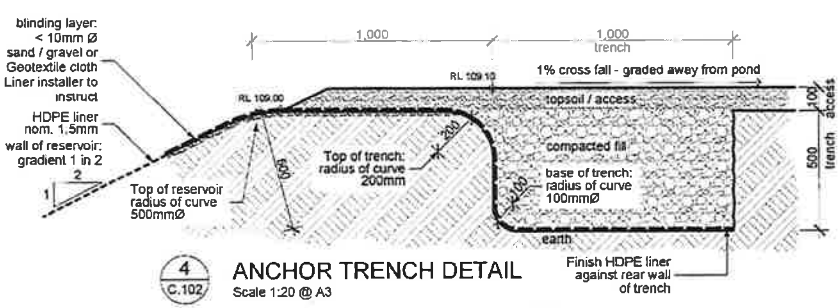
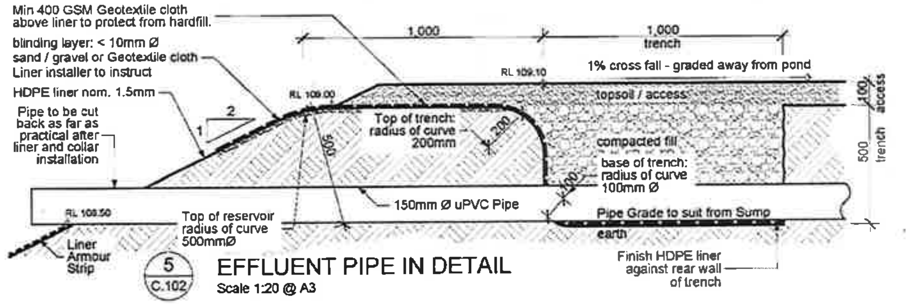
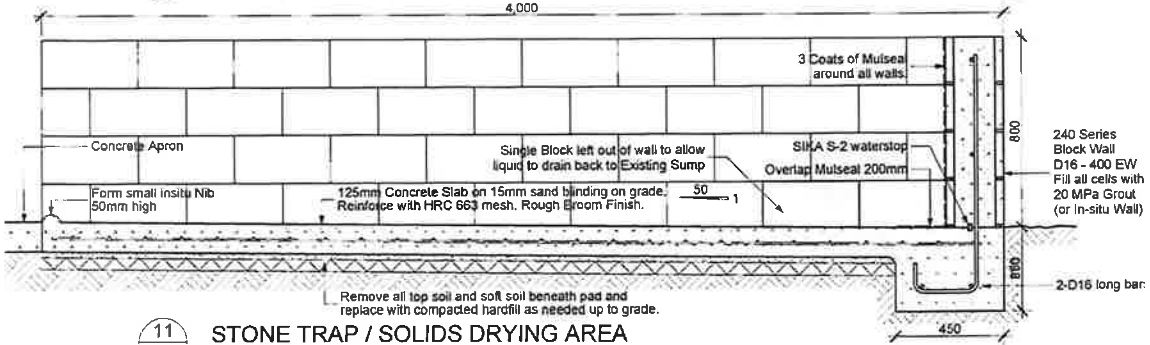


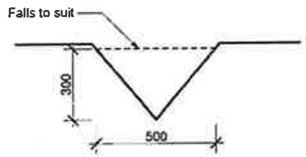
4 / C.102 **ANCHOR TRENCH DETAIL**
Scale 1:20 @ A3



5 / C.102 **EFFLUENT PIPE IN DETAIL**
Scale 1:20 @ A3



11 / C.102 **STONE TRAP / SOLIDS DRYING AREA**
Scale 1:20 @ A3



12 / C.102 **STORMWATER DIVERSION CHANNEL**
Scale 1:20 @ A3

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rev	date	issue
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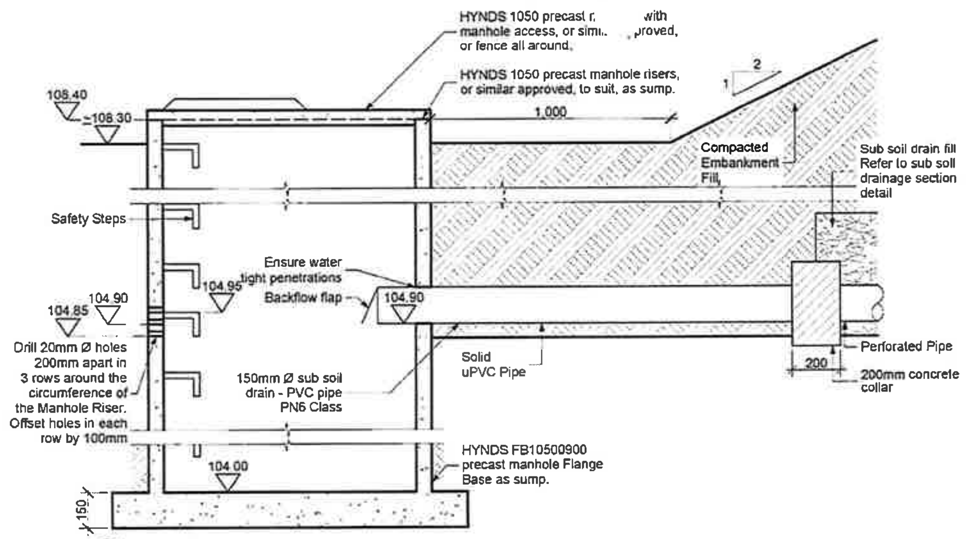
GREENBeing	Engineering Firm: GREEN Being Ltd P.O. Box 1298 Queenstown	Project Manager	Client: OTAMA DAIRY LTD 145 JAFFRAY ROAD RD7, GORE	OTAMA EFFLUENT POND DESIGN	Sheet Title: DETAIL SECTIONS Printed 28/09/2012	Scale: as shown Job No. 10124	Drawing No. C.301 Revision 01



6 / C.102 SUBSOIL DRAIN INSPECTION SUMP DETAIL
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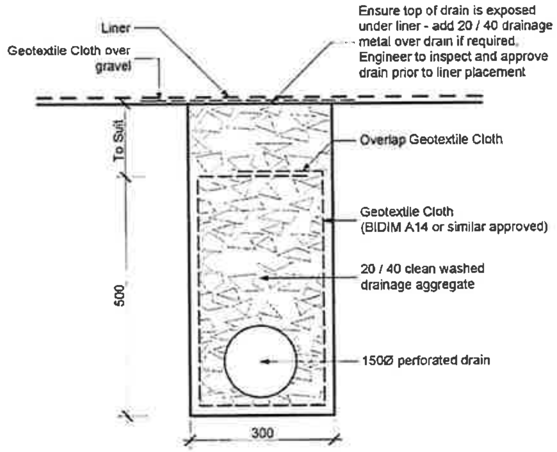
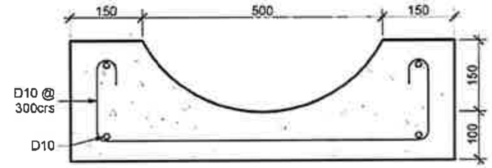


7 / C.102 SUBSOIL DRAIN SECTION
Scale 1:10 @ A3



8 / C.102 DISH DRAIN CHANNEL SECTION
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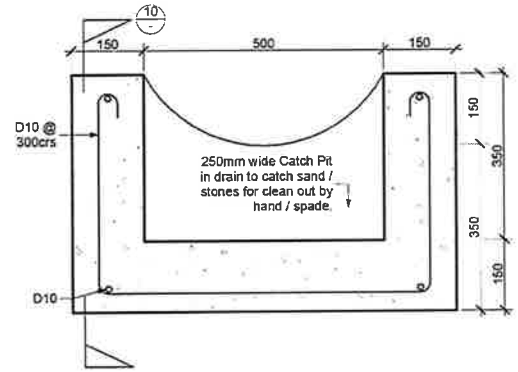

9 / C.102 CATCH PIT SECTION
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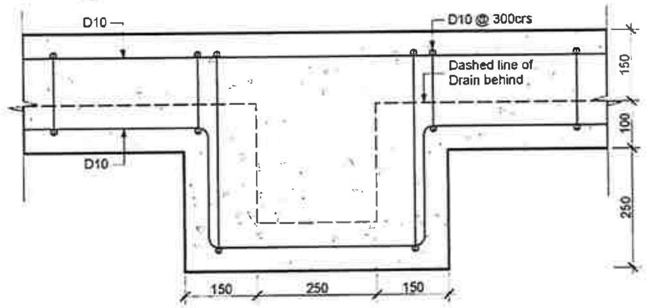

10 / C.102 DISH DRAIN LONG SECTION
Scale 1:10 @ A3

Revision History

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GREEN Being	Engineering Firm: GREEN Being Ltd, P.O. Box 1298, Queenstown	Project Manager	Client: OTAMA DAIRY LTD, 145 JAFFRAY ROAD, RD7, GORE	OTAMA EFFLUENT POND DESIGN	Sheet Title: DETAIL SECTIONS; Printed 28/09/2012	Scale: as shown; Job No. 10124; Drawing No. C.302; Revision 01

THANK YOU

DISCLAIMER:

*Provision of advice in relation to effluent storage, effluent irrigation systems and the management of other environmental risk areas on farm.

The advice that Fonterra Co-operative Group Ltd (Fonterra, we, us) provides to farmers in relation to effluent storage capacity and other environmental compliance practices, including mitigation actions described in Farm Environment Plans, is based on the information and assumptions that farmers and their agents have provided to us and on our knowledge and understanding of current best practice in the industry. Fonterra does not purport to replace sound engineering or other professional advice and as such we strongly encourage farmers to seek independent expert advice before any construction, upgrades, or other change to your on farm practices. Farmers are ultimately responsible for the environmental compliance of their farm and on farm practices. Fonterra gives no warranties (express or implied) and, to the maximum extent permissible by law, excludes all liability in contract or tort (including, without limitation, liability for negligence) or otherwise in relation to the advice provide

TIAKI
FARM SOURCE SUSTAINABLE DAIRYING

Attachment E: Resource Management Act Schedule 4 Checklist

Schedule 4
Information required in application for resource consent

s 88, Schedule 1

Schedule 4: replaced, on 3 March 2015, by section 125 of the Resource Management Amendment Act 2013 (2013 No 63).

1 Information must be specified in sufficient detail

Any information required by this schedule, including an assessment under clause 2(1)(f) or (g), must be specified in sufficient detail to satisfy the purpose for which it is required.

Schedule 4 clause 1: replaced, on 3 March 2015, by section 125 of the Resource Management Amendment Act 2013 (2013 No 63).

1AA

[Repealed]

Schedule 4 clause 1AA: repealed, on 3 March 2015, by section 125 of the Resource Management Amendment Act 2013 (2013 No 63).

1A Matters to be included in assessment of effects on environment

[Repealed]

Schedule 4 clause 1A: repealed, on 3 March 2015, by section 125 of the Resource Management Amendment Act 2013 (2013 No 63).

2 Information required in all applications

(1) An application for a resource consent for an activity (the **activity**) must include the following:

(a) a description of the activity:

(b) a description of the site at which the activity is to occur:

(c) the full name and address of each owner or occupier of the site:

(d) a description of any other activities that are part of the proposal to which the application relates:

(e) a description of any other resource consents required for the proposal to which the application relates:

(f) an assessment of the activity against the matters set out in Part 2:

(g) an assessment of the activity against any relevant provisions of a document referred to in section 104(1)(b).

(2) The assessment under subclause (1)(g) must include an assessment of the activity against—

(a) any relevant objectives, policies, or rules in a document; and

(b) any relevant requirements, conditions, or permissions in any rules in a document; and

(c) any other relevant requirements in a document (for example, in a national environmental standard or other regulations).

(3) An application must also include an assessment of the activity's effects on the environment that—

(a) includes the information required by clause 6; and

(b) addresses the matters specified in clause 7; and

(c) includes such detail as corresponds with the scale and significance of the effects that the activity may have on the environment.

Schedule 4 clause 2: replaced, on 3 March 2015, by section 125 of the Resource Management Amendment Act 2013 (2013 No 63).

3 Additional information required in some applications

An application must also include any of the following that apply:

(a) if any permitted activity is part of the proposal to which the application relates, a description of the permitted activity that demonstrates that it complies with the requirements, conditions, and permissions for the permitted activity (so that a resource consent is not required for that activity under section 87A(1)):

(b) if the application is affected by section 124 or 165ZH(1)(c) (which relate to existing resource consents), an assessment of the value of the investment of the existing consent holder (for the purposes of section 104(2A)):

(c) if the activity is to occur in an area within the scope of a planning document prepared by a customary marine title group under section 85 of the Marine and Coastal Area (Takutai Moana) Act 2011, an assessment of the activity against any resource management matters set out in that planning document (for the purposes of section 104(2B)).

Schedule 4 clause 3: inserted, on 3 March 2015, by section 125 of the Resource Management Amendment Act 2013 (2013 No 63).

4 Additional information required in application for subdivision consent

An application for a subdivision consent must also include information that adequately defines the following:

(a) the position of all new boundaries:

(b) the areas of all new allotments, unless the subdivision involves a cross lease, company lease, or unit plan:

(c) the locations and areas of new reserves to be created, including any esplanade reserves and esplanade strips:

(d) the locations and areas of any existing esplanade reserves, esplanade strips, and access strips:

(e) the locations and areas of any part of the bed of a river or lake to be vested in a territorial authority under section 237A:

(f) the locations and areas of any land within the coastal marine area (which is to become part of the common marine and coastal area under section 237A):

(g) the locations and areas of land to be set aside as new roads.

Schedule 4 clause 4: inserted, on 3 March 2015, by section 125 of the Resource Management Amendment Act 2013 (2013 No 63).

5 Additional information required in application for reclamation

An application for a resource consent for reclamation must also include information to show the area to be reclaimed, including the following:

(a) the location of the area:

(b) if practicable, the position of all new boundaries:

(c) any part of the area to be set aside as an esplanade reserve or esplanade strip.

Schedule 4 clause 5: inserted, on 3 March 2015, by section 125 of the Resource Management Amendment Act 2013 (2013 No 63).

Assessment of environmental effects

Heading: inserted, on 3 March 2015, by section 125 of the Resource Management Amendment Act 2013 (2013 No 63).

6 Information required in assessment of environmental effects

(1) An assessment of the activity's effects on the environment must include the following information:

(a) if it is likely that the activity will result in any significant adverse effect on the environment, a description of any possible alternative locations or methods for undertaking the activity:

(b) an assessment of the actual or potential effect on the environment of the activity:

(c) if the activity includes the use of hazardous installations, an assessment of any risks to the environment that are likely to arise from such use:

(d) if the activity includes the discharge of any contaminant, a description of—

(i) the nature of the discharge and the sensitivity of the receiving environment to adverse effects; and

(ii) any possible alternative methods of discharge, including discharge into any other receiving environment:

(e) a description of the mitigation measures (including safeguards and contingency plans where relevant) to be undertaken to help prevent or reduce the actual or potential effect:

(f) identification of the persons affected by the activity, any consultation undertaken, and any response to the views of any person consulted:

(g) if the scale and significance of the activity's effects are such that monitoring is required, a description of how and by whom the effects will be monitored if the activity is approved:

(h) if the activity will, or is likely to, have adverse effects that are more than minor on the exercise of a protected customary right, a description of possible alternative locations or methods for the exercise of the activity (unless written approval for the activity is given by the protected customary rights group).

(2) A requirement to include information in the assessment of environmental effects is subject to the provisions of any policy statement or plan.

(3) To avoid doubt, subclause (1)(f) obliges an applicant to report as to the persons identified as being affected by the proposal, but does not—

(a) oblige the applicant to consult any person; or

(b) create any ground for expecting that the applicant will consult any person.

Schedule 4 clause 6: inserted, on 3 March 2015, by section 125 of the Resource Management Amendment Act 2013 (2013 No 63).

Schedule 4 clause 6(1)(c): amended, on 19 April 2017, by section 121(a) of the Resource Legislation Amendment Act 2017 (2017 No 15).

7 Matters that must be addressed by assessment of environmental effects

(1) An assessment of the activity's effects on the environment must address the following matters:

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

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

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

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

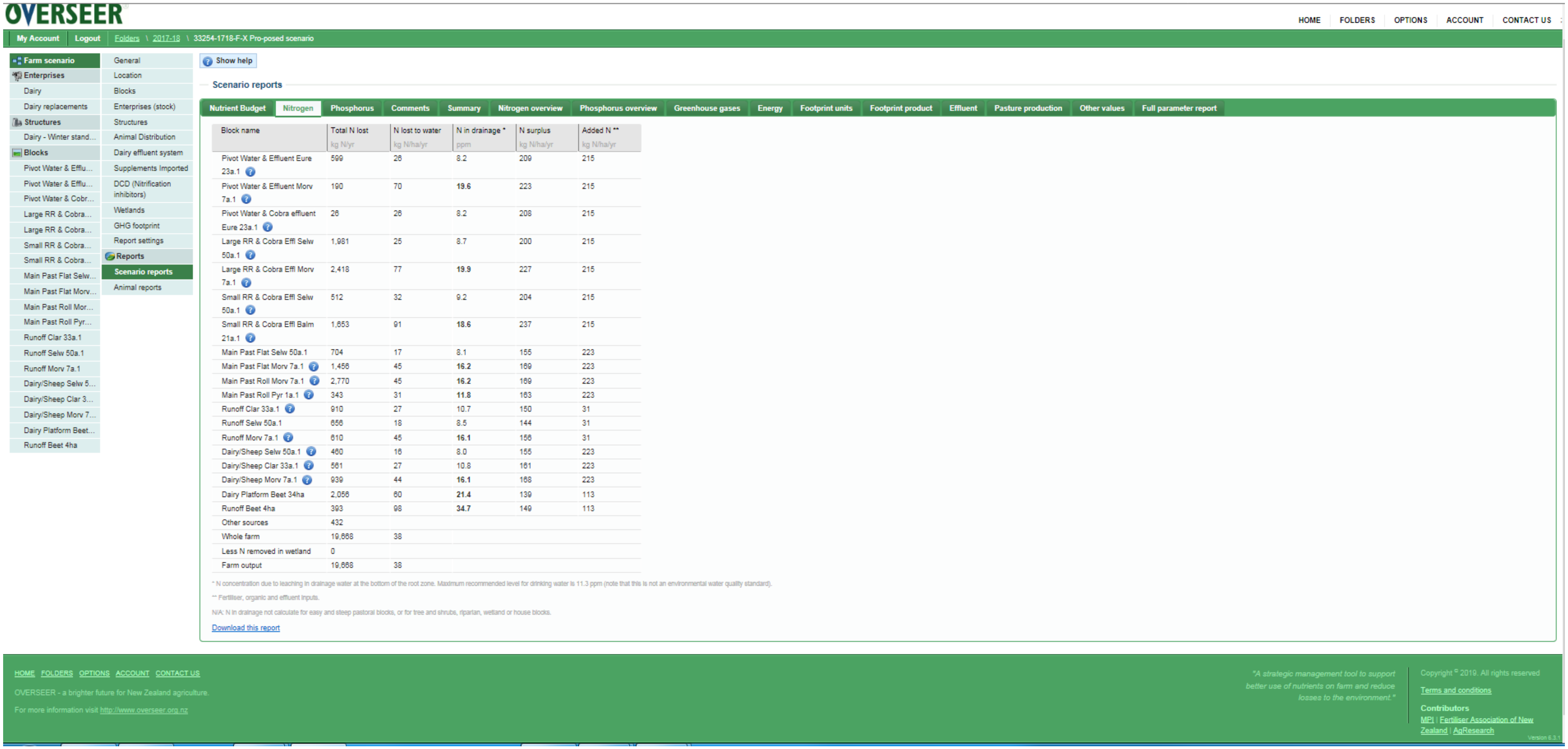
(e) any discharge of contaminants into the environment, including any unreasonable emission of noise, and options for the treatment and disposal of contaminants:

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

(2) The requirement to address a matter in the assessment of environmental effects is subject to the provisions of any policy statement or plan.

Attachment F: Updated Overseer results with version 6.3.1

Attached to demonstrate that the N and P losses to water don't change with the version change from 6.3.0 to 6.3.1. Version number is specified in the bottom right corner of the screenshots.



Scenario reports

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
Pivot Water & Effluent Eure 23a.1	599	26	8.2	209	215
Pivot Water & Effluent Morv 7a.1	190	70	**19.6**	223	215
Pivot Water & Cobra effluent Eure 23a.1	26	26	8.2	208	215
Large RR & Cobra Effl Selw 50a.1	1,981	25	8.7	200	215
Large RR & Cobra Effl Morv 7a.1	2,418	77	**19.9**	227	215
Small RR & Cobra Effl Selw 50a.1	512	32	9.2	204	215
Small RR & Cobra Effl Balm 21a.1	1,653	91	**18.6**	237	215
Main Past Flat Selw 50a.1	704	17	8.1	155	223
Main Past Flat Morv 7a.1	1,456	45	**16.2**	169	223
Main Past Roll Morv 7a.1	2,770	45	**16.2**	169	223
Main Past Roll Pyr 1a.1	343	31	**11.8**	163	223
Runoff Clar 33a.1	910	27	10.7	150	31
Runoff Selw 50a.1	656	18	8.5	144	31
Runoff Morv 7a.1	610	45	**16.1**	156	31
Dairy/Sheep Selw 50a.1	460	16	8.0	155	223
Dairy/Sheep Clar 33a.1	561	27	10.8	161	223
Dairy/Sheep Morv 7a.1	939	44	**16.1**	168	223
Dairy Platform Beet 34ha	2,056	60	**21.4**	139	113
Runoff Beet 4ha	393	98	**34.7**	149	113
Other sources	432				
Whole farm	19,668	38			
Less N removed in wetland	0				
Farm output	19,668	38			

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

** Fertiliser, organic and effluent inputs.

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

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- Farm scenario
- Enterprises
  - Dairy
  - Dairy replacements
- Structures
  - Dairy - Winter stand...
- Blocks
  - Pivot Water & Efflu...
  - Pivot Water & Efflu...
  - Pivot Water & Cobr...
  - Large RR & Cobra...
  - Large RR & Cobra...
  - Small RR & Cobra...
  - Small RR & Cobra...
  - Main Past Flat Selw...
  - Main Past Flat Morv...
  - Main Past Roll Mor...
  - Main Past Roll Pyr...
  - Runoff Clar 33a.1
  - Runoff Selw 50a.1
  - Runoff Morv 7a.1
  - Dairy/Sheep Selw 5...
  - Dairy/Sheep Clar 3...
  - Dairy/Sheep Morv 7...
  - Dairy Platform Beet...
  - Runoff Beet 4ha

- General
- Location
- Blocks
- Enterprises (stock)
- Structures
- Animal Distribution
- Dairy effluent system
- Supplements Imported
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Scenario reports

Nutrient Budget | Nitrogen | Phosphorus | Comments | Summary | Nitrogen overview | Phosphorus overview | Greenhouse gases | Energy | Footprint units | Footprint product | Effluent | Pasture production | Other values | Full parameter report

Block name	Total P lost	P lost to water	P loss categories		
	kg P/yr	kg P/ha/yr	Soil	Fertiliser	Effluent
Pivot Water & Effluent Eure 23a.1	10	0.4	Low	Low	Low
Pivot Water & Effluent Morv 7a.1	0	0.1	Low	Low	Low
Pivot Water & Cobra effluent Eure 23a.1	0	0.4	Low	Low	Low
Large RR & Cobra Effl Selw 50a.1	30	0.4	Low	Low	Low
Large RR & Cobra Effl Morv 7a.1	5	0.1	Low	Low	Low
Small RR & Cobra Effl Selw 50a.1	7	0.5	Low	Low	Low
Small RR & Cobra Effl Balm 21a.1	3	0.2	Low	Low	Low
Main Past Flat Selw 50a.1	8	0.2	Low	Low	N/A
Main Past Flat Morv 7a.1	2	0.1	Low	Low	N/A
Main Past Roll Morv 7a.1	12	0.2	Low	Low	N/A
Main Past Roll Pyr 1a.1	9	0.8	Low	Medium	N/A
Runoff Clar 33a.1	11	0.3	Low	Low	N/A
Runoff Selw 50a.1	7	0.2	Low	Low	N/A
Runoff Morv 7a.1	1	0.1	Low	Low	N/A
Dairy/Sheep Selw 50a.1	5	0.2	Low	Low	N/A
Dairy/Sheep Clar 33a.1	7	0.3	Low	Low	N/A
Dairy/Sheep Morv 7a.1	1	0.1	Low	Low	N/A
Dairy Platform Beet 34ha	14	0.4	N/A	N/A	N/A
Runoff Beet 4ha	2	0.4	N/A	N/A	N/A
Other sources	183				
Whole farm	317	0.6			

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"A strategic management tool to support better use of nutrients on farm and reduce losses to the environment."

Contributors
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Version 6.3.1