PART A

Application for Resource Consent

This application is made under Section 88 of the Resource Management Act 1991 (Form 9)

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

1. Applicant(s) Details

A resource consent can only be held by a legal organisation or fully named individual(s).

1.1. Applicant's name (*full name of proposed consent holder*). *Please complete either (a) OR (b) to whom consent is to be issued*

First Name Middle Name Surname

(a) Individual(s) _____

_____

OR

(b) Registered company name Cashmere Bay Dairy Limited

Company number _____

1.2. Applicant's address *[not consultant's address]*

(a) Individual(s)

Postal Address 145 Jaffray Road, RD 7, Gore

Email otamadairy@gmail.com

Phone 0272997259 Mobile _____ Fax _____

(b) Company

Contact Person _____

Postal Address _____

Email _____

Phone _____ Mobile _____ Fax _____

2. Consultant/ Agent details (if applicable)

Contact person: Matilda Ballinger

Company: Landpro Ltd

Postal Address: 13 Pinot Noir Drive, Cromwell

Email: matilda@landpro.co.nz

Phone: 0275888069 Mobile: _____ Fax: _____

Note: *All correspondence during the consent process will be directed to this contact person, unless instructed otherwise. Final decision documents will be sent to the applicant.*

Are you the owner or occupier at the site? [x] Yes [ ] No

If not, please complete the following information

Name of owner or occupier at the site (*if different from 1.1.*) _____

Address of the owner or occupier at the site (*if different from 1.2.*) _____

2 Site Details

Location of activity (*including street/road name, number, and locality*) 145 Jaffray Road, RD 7, Gore

Map Co-ordinates (NZTM 2000)

NZTM 1279598E E 4899990N N(NZTM 2000)

Legal description of property at site of activity (*refer to land title or rates notice*) See AEE

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

3. Consents required in relation to this proposal:

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

Water

	Take and use surface water		Divert water
x	Take and use groundwater		Dam water

Land Use

	Bore/ Well		Effluent storage
x	New or expanded dairy farming		Cultivation
	Intensive winter grazing		Gravel extraction
x	Feed-pad, wintering pad, calving pad or silage pad		Riverbed activity
	Bridges and culverts		Tree planting

Discharge

	To air		To water
x	To Land		

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		

What is the purpose of this application?

New resource consent	x
Renew resource consent	x
Variation of conditions according to S 127 RMA	
Certificate of compliance	

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

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

AUTH-301811-V2 and AUTH-301812-V1

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:

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

Pre application advise- Have you discussed this proposal with a council staff member?

[x] Yes [ ] No

If yes, please provide name of staff member if known

Any further comments you would like to advise us about this application?

Rachel Beaton and Jade McRae

5 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.

6 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.

Local iwi have been contacted for approval

7 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. We find that applications that have an on-site visit are processed with less congestion and at a similar or lesser overall cost. We will contact you if we consider a site visit to be advantageous in processing your application.

8 How much will it cost to process my application?

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.

User Charges

Please note that additional Annual User Charges will apply to all consents.

How to pay

Environment Southland accepts payment in the forms of cash, Eftpos, 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 or online at www.es.govt.nz/online-services/online-payments.

9 Checklist: Have you included the following?

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

Notes:

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

(b) Under S35 of the Resource Management Act 1991 your application will be publicly available information and subject to the relevant provisions of the Local Government Official Information and Meetings Act 1987.

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) MATILDA BALLINGER

Signed Matilda Ballinger **Date** 06/10/2021

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

LANDPRO

Make the most of your land

Resource Consent Application to Environment Southland

Prepared for Cashmere Bay Dairy Limited

Prepared For

Cashmere Bay Dairy Limited

Prepared By

Landpro Ltd
13 Pinot Noir Drive
PO Box 302
Cromwell
Tel +64 3 445 9905

QUALITY INFORMATION

Reference:	
Date:	6 October 2021
Prepared by:	Matilda Ballinger
Reviewed by:	Christina Bright
Client Review:	George Raymond
Version Number:	FINAL

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We have done our best to ensure the information is fit for purpose at the date of preparation and meets the specific needs of our client. Sometimes things change or new information comes to light. This can affect our recommendations and findings.

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1. INTRODUCTION

1.1 Overview of proposal

Cashmere Bay Dairy Ltd (the applicant) own a 1,000-cow dairy farm located approximately 12km north-west of Gore. Discharge Permit 301811-V2 authorises the discharge of farm dairy effluent (FDE) to up to154 ha of land, and Water Permit 301812-V1 authorises the taking of groundwater at this farm for dairy operation. These consents do not expire until 19 December 2022. The applicant runs three blocks of land:

- Dairy platform
- Support block 1
- Support block 2

The applicant wishes to incorporate support block 2 (SB2) into the existing dairy platform as shown on the attached plan (Figure 1). 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. Currently SB2 is used as a predominantly winter grazing block. By including this land as part of the milking platform it will allow for wintering to be spread over the entire area (milking platform and SB2) allowing for a more sustainable crop rotation.

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, the applicant wishes to increase this number to 1,140. Currently the applicant has 120 beef calves/yearlings on the property and 90-120 beef R2s. As part of the proposal the applicant wishes to exchange the beef cattle for milking cows, increasing the consented number to 1,140. Whilst this is an increase in the number of milking cows and therefore Rule 20 of the PSWLP is triggered, it is not an increase in the number of cows on the property, i.e., the stock units/ha remains unchanged as a result of this proposal.

Consent is hereby sought for the following:

- **to use land for dairy farming (that did not exist as of May 2016).**
- **to replace Discharge Consent AUTH- 301811-V2 with a new discharge consent to discharge FDE from the seasonal milking of up to 1,140 cows and feed pad effluent, with an increase effluent discharge area.**
- **to replace Water Permit AUTH-301812-V2 with a new water permit that allows for enough water to be taken to support the proposed farming operation.**
- **conversion of land on farm to dairy farm land**
- **land use consent for a feed pad**

This assessment has been guided by advice from Environment Southland, relevant policies of the proposed Southland Water and Land Plan (pSWLP) and the Regional Water Plan for Southland (RWPS) and the Regional

Effluent Land Application Plan (RELAP) and the incorporated water quality technical assessment. This assessment also considers the recent National Environment Standards for Freshwater (NESFW) and the National Policy Statement for Freshwater Management (NPS-FM). The proposal includes the implementation of a wide range of good management practices and mitigation measures which avoid, remedy and mitigate adverse effects on the environment. These are described in detail in this proposal and are also included in the attached Farm Environmental Management Plan (FEMP).

1.2 The Applicant

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

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

1.3 Purpose of documentation

Under Section 88 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 RMA.

2. DETAILS OF PROPOSAL

2.1 Location

The farm is located at 145 Jaffray Road, north-west of Gore. The farm as well as the support blocks are shown on the figure below.

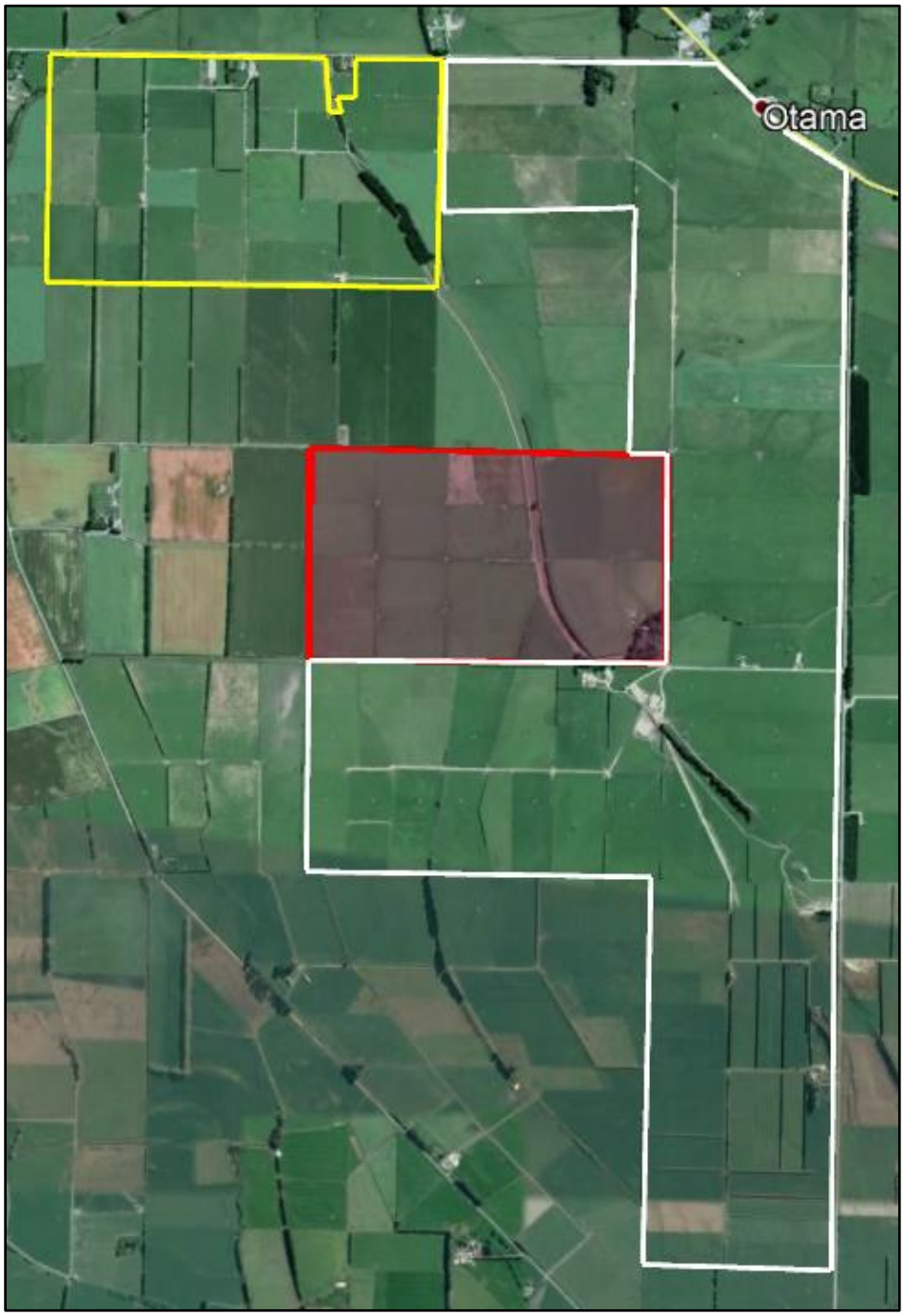

Figure 1: Map showing the locations of the Dairy platform (white), Support Block 1 (yellow) and Support Block 2 (red).

2.2 Details of consents sought

The following provides further details of the farming system proposed.

Details of the changes to the farm system and relevant consents are listed in the tables below. Cow numbers discussed throughout this proposal refer to the peak milking cows on farm. Stock numbers throughout the year are relative to the peak number of cows able to be milked, i.e., only so many replacements and young stock are raised to maintain the milking herd number over time. Complete details of the stock numbers can be found in the attached nutrient budget report (Appendix B).

2.2.1 Land Use Consent for Farming

Summary of matters that relate to the land use consent for farming sought under this proposal:

- The use of 159.4ha of land for dairy farming (Figure 4).
- Milking up to 1140 dairy cows twice per day.
- The use of a feed pad for 174 cows
- The consent holder has a Farm Environment Management Plan that is appended to this application (Appendix A).

There is a proportion of the dairy platform proposed to be used for intensive winter grazing (IWG) and this occurs within permitted thresholds as discussed later in this report. The proposed farm system includes 57.5 ha of winter crop.

Table 1: Land Use consent for Farming.

Farm Details		
Farming Operation	Dairy	
Address	145 Jaffray Road	
Legal Description	Section 5 BLK II Otama SD Section 2 BLK II Otama SD Section 4 BLK I Otama SD Pt Section 10 Blk II Otama SD Pt Section 10 Blk II Otama SD Pt Section 10 Blk II Otama SD Closed Road Blk II Otama SD Closed Road Blk II Otama SD Pt Section 9 Blk II Otama SD	Original Farm
	Lot 2 DP 12628 Lot 2 DP 324253	Support Block 1
	Section 14 BLK II Otama SD	Support Block 2
Area	353 ha	
Effective area	344.4 ha	

2.2.2 Discharge Permit

The dairy shed discharges effluent through a stone trap which gravity feeds to a concrete sump pump. The stone trap is emptied periodically once sediment has built up in it. To reduce the organic component in the stone trap, water from the adjacent water hydrant is used to mix organics into a slurry with the heavier stones/sand dropping out and the organics flowing out in suspension to the concrete sump. Effluent is then pumped into the effluent storage pond. Liquid effluent feeds into the 1943 m^3 effluent pond.

The effluent pond was constructed with a resource consent, is synthetically lined and contains a leak detection chamber. The applicant has conducted a pond drop test and no issues were found. Results of the pond drop test can be found in Appendix D. A visual assessment of the sump has been conducted and no issues were found, Appendix E.

Changes to effluent system proposed:

- Authorise the use of the current standoff pad for use during adverse weather conditions and feeding, making it a feed pad. Consent is sought to discharge effluent collected from the use of the feedpad for up 176 cows.
- Increase the effluent disposal area to 264 ha.
- Use of umbilical and slurry tanker as contingency measure

Table 2: Summary of discharge permit.

Discharge Permit Details	
Replacement of permit no.	AUTH-301811-V2
Number of dairy cows	1000 (1,140 proposed)
Stocking rate (cows/ha)	2.8 (2.6 proposed)
Winter milking?	No milking between 20 June and 20 July other than slipped cows
Wintering barn?	No
Feed pad/standoff pad?	Yes
Type of shed	50 bale rotary shed
Effluent treatment	Stone trap and concrete sump
Storage available	1943 m^3 synthetically lined pond
Storage required	892 m^3(as per attached dairy effluent storage calculator)
Disposal area	~187.7 (264 ha proposed)
Irrigator proposed	Centre pivot, low rate cobra gun, k-line, umbilical and slurry tanker as contingencies
Application rate and depth	10mm/hr rate and 10mm depth per application

Figure 2: Overview of effluent infrastructure.

2.2.3 Water Permit

Water is abstracted for the stock drinking needs and washdown needs of the property by way of Bore F45/1073. This bore is located on the applicant's own property, and Table 3 summarises the relevant details of the water abstraction activity relevant to the proposal.

Section 6.4 demonstrates that there is capacity within the Aquifer's annual allocation to accommodate the increase (10,798 m^3/year) in annual water use.

Changes to water abstraction proposed:

- Increase daily and seasonal water to match DairyNZ guidelines for 1,140 cows at 120 L/cow/day.

Table 3: Summary of water permit.

Water Permit Details	
Replacement of permit no.	AUTH-301812-V2
Freshwater Management Unit	Mataura
Groundwater Zone	Croydon/Knapdale
Average rate of take of 24 hours	<2L/s
Daily volume	136,800
Annual volume	49,932 m^3
Allocation per cow	120
Location of point of take	Well number F45/1073 NZTM 1279598E 4899990N

3. ACTIVITY CLASSIFICATION

We have carefully considered all the applicable regional rules that may be relevant to the activities on the land used by the applicants that are relevant to these farming activities. We consider that it is unlikely that any critical rules have been missed or additional consents required. If a rule or consent requirement has been overlooked, we do not consider that it would be critical to the primary suite of resource consent applications. Given the level of detail provided throughout the entire application it is unlikely that relevant effects are not assessed in this document and therefore the applications are considered to meet Section 88 requirements under the RMA.

3.1 Consents required

The following table summarises the resource consents required.

Table 7: Consents required.

Consent	Plan	Rule	Activity Status
Discharge Permit	PSWLP	35(c)	*Discretionary*
	RWPS	50(d)	*Restricted Discretionary*
Water Permit	PSWLP	54(f)	*Discretionary*
	RWPS	23(d)	*Discretionary*
Land use Consent for Farming	PSWLP	20(d)	*Restricted Discretionary*
Conversion of land on farm to Dairy farm land	NES-FW	Regulation 19	*Discretionary*
Discharge permit for the conversion of land on farm to dairy farm land	NES-FW	Regulation 19	*Discretionary*
Land use consent for a feed pad	PSWLP	35A	*Permitted*
	NES-FW	Regulation 11	*Non-complying*

Overall, the proposal is 'bundled' to mean that the consent applications are considered as **discretionary activities.**

3.2 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 activity rules.
Intensive Winter Grazing under the NES-FW	A Land Use Consent for Intensive Winter Grazing under the NES-FW is determined to not be needed at this current point in time. The applicant adheres by the area threshold for both the NES-FW and PSWLP. Additional requirements to be a permitted activity are met by the applicant.
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 is a permitted activity providing the construction of the facility was authorised by a resource consent).
Incidental discharges from farming (Rule 24 pSWLP)	The land use associated with this discharge is or will be authorised under Rule 20, 25 or 70.
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 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 trap and sludge beds will be dried as much as reasonably practical before applying to land when conditions are suitable, observing appropriate separation distances, and there will be no disposal of solids to any waterway.
Cleanfill, Farm Landfills and Offal Holes (Rules 53, 54 & 55 of the RWPS, and Rule 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.
Stock exclusion from waterbodies (Rule 70 PSWLP)	All water bodies are fenced, and crossings are bridged over unnamed tributaries. Bed disturbance from stock is thus avoided and dairy cattle on the dairy platform are excluded from water bodies.
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.

4. DESCRIPTION OF EXISTING ENVIRONMENT

4.1 Land use and topography

The property currently operates as a dairy farm with a 353ha (344 ha effective) dairy platform and using two adjacent blocks as a support blocks.

Support Block 1, 90ha effective, is currently used for grazing heifers and young stock (R1 and R2s), beef animals and cut-and-carry baleage which is fed out onto the existing dairy platform. The applicant will continue to utilise the Support Block 1 as dairy support (for young stock) upon granting of the consent in this way.

Support Block 2, 80 ha effective, is currently used for predominantly winter grazing.

The applicant is applying to incorporate Support Block 2 into the dairy platform. The proposed dairy platform will be made up of the existing 344 ha dairy platform and the 80 ha SB2, bring the total dairy platform size to 424ha.

The inclusion of SB2 into the existing dairy farm will enable significant efficiencies for cows to graze closer to the milking shed and will enable winter grazing to occur over a less concentrated area, allowing for a more sustainable crop rotation.
The farm is generally at or about 100 meters above sea level. The property is generally flat, with some rolling areas.

4.2 Climate

The area receives on average 829-859mm of rain per annum and is a moderately wet part of the Southland Region that experiences modest climate extremes with wet and dry conditions. Temperatures are on average 10 degrees Celsius and range from 4.5 degrees Celsius in winter to 15 degrees Celsius in the summer. The

area experiences early frosts in April to May, with late frosts uncommon, although these can occur in early October.

4.3 Soils and physiographic zones

4.3.1 Soils

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.

Table 4: Soil type summary on the dairy platform with vulnerability factors (Source: S-Map).

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
Support Block 1 (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
Support Block 2 (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

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%).

4.3.2 Physiographic zones

The proposed dairy farming occurs within the Oxidising, Gleyed, Old Mataura and Bedrock/Hill Country Physiographic Zones.

The information below has been sourced from the Environment Southland Physiographic Zone Fact Sheets (2015).

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 both support blocks. 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.

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 support blocks 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.

4.4 Water resources

4.4.1 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, the Mataura River, and the 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 western 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 SB2 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 SB2, all waterways and open drains have been fenced from stock and the applicant proposes to implement an extensive native planting project across the entire proposed dairy platform. This is detailed in the attached Farm Environmental Management Plan (FEMP) (Appendix A).

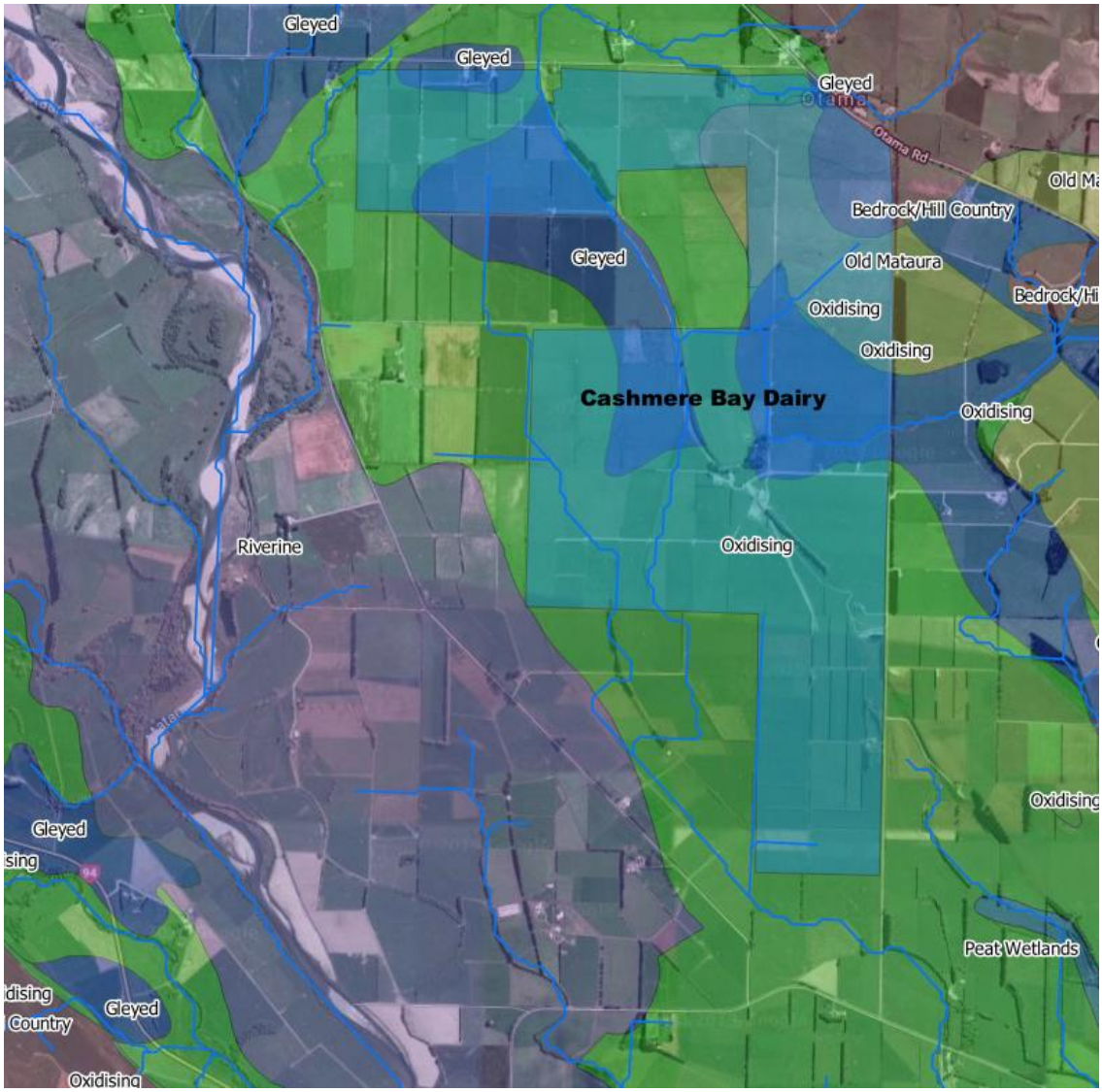

Figure 2: Existing and proposed farm boundary, the location of stream and drains (NIWA stream GIS data) and physiographic zones (ES GIS data).

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 3: 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 4: Summary of State and Trend at the Waikaia River at Waipounamu Bridge Monitoring Site (nearest upstream LAWA monitoring site[1]) and Gore Monitoring Site (nearest downstream LAWA monitoring site). Source: LAWA data – sourced 10/08/2021.

	State	NOF Band Annual Median	Trend
Waikaia River at Waipounamu Bridge Road			
E. Coli	In the worst 50% of all lowland rural sites	D – For 20-30% of the time, the estimated risk to waders/boaters is >5% 5-year median = 130 n/100 ml	Indeterminate
Clarity (Black disc)	In the worst 50% of all lowland rural sites	5-year median = 1.46 metres	Very Likely Degrading
Total Oxidised N	In the worst 50% of all lowland rural sites	5-year median = 0.545 g/m^3 Exceeds ANZECC[3] trigger value of ≤0.444 g/m^3	Very 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	N/a
Dissolved Reactive P	In the best 50% of all lowland rural sites	A- Ecological communities and ecosystem processes are similar to those of natural reference conditions. Meets ANZECC[2] criterion of <0.01 g/m^3 5-year median = 0.006 g/m^3	Very Likely Improving
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 = 380 n/100ml	Likely Improving

[1] 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.

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

Clarity (Black disc)	In the worst 50% of all lowland sites	5-year median = 1.2 metres	Indeterminate
Total Oxidised N	In the worst 25% of all lowland sites	5-year median = 0.915 g/m^3 Exceeds ANZECC^3 trigger value of ≤0.444 g/m^3	Very 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	B-Ecological communities are slightly impacted by minor DRP elevation above natural reference conditions. Meets ANZECC^3 criterion of <0.01 g/m3 5-year median = 0.006 g/m^3	Likely improving
Macroinvertebrate Community Index	Fair. MCI is between 80 - 99.	5-year median = 99	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 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*."

4.4.2 Groundwater

The property is classified as overlying the Knapdale Groundwater Management Zone[3] (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 Quaternary 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[4].

For the Knapdale GMZ, the amount currently allocated under the RWPS is 44%. However, under the PSWLP, 47% and 7.1% 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 August 2021.

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

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

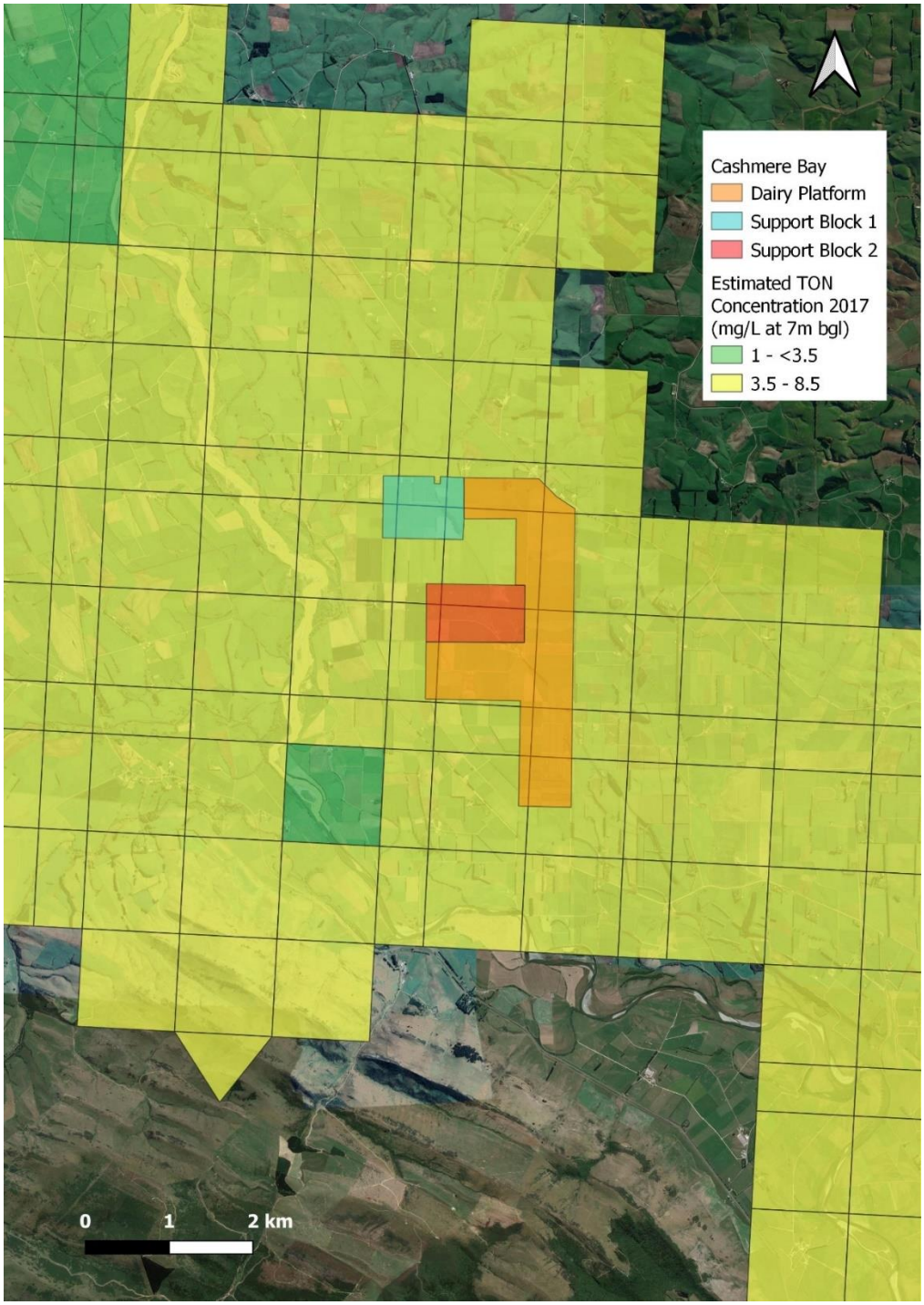

Figure 3: Estimated Total Oxidised Nitrogen Concentration 2017 (mg/L at 7m bgl)

Figure 3 shows data from Environment Southland's Beacon showing the estimated total oxidised nitrogen (TON) concentration under the property varies from between 3.6 and 7.8 mg/L. The TON estimates are higher towards the northwest corner and the south-east corners of the property.

Past groundwater quality sampling has shown elevated contaminant concentrations from bore F45/0172 at the south east of the property. With the location of the bore and the topography of the land these elevated concentrations are likely from neighbouring activities, not what is occurring on farm. The applicant plans to

decommission this bore.

Allocation

The applications seek groundwater abstraction from bore F45/0173. AUTH-301812-V1 authorises the abstraction of 120,000 L per day. This allocation is based on the milking of 1,000 cows. The applicant seeks to increase this abstraction to 136,800 L/day to be in line with the increase to 1,140 cows. This would allow the recommended 120 L/cow/day.

The average rate of take at the increased abstraction would be <2L/s. At an abstraction rate of <2L/s the effects on stream depletion and interference of other neighbouring bores are negligible.

The groundwater abstraction is from the Knapdale and Croydon groundwater zones. The applicant's proposed increased abstraction represents a negligible portion of the allocation of both the Knapdale and the Cryodon Groundwater Management Zones. Therefore, there will be less than minor impacts on current allocation volumes.

Under the RWP the property falls 100% within the Knapdale GWMZ. Under the RWP this zone is currently 7% allocated.

Under the PSWLP the property is within both the Croydon and Knapdale GWMZ. These zones are currently 47% and 7.1% allocated respectively. An increase of 16,800L per day will have a less than minor effect on these allocations. These figures are up to date as of the Environment Southland allocation tables from August 2021.

4.4.3 Estuary

The Toetoes/Fortrose Harbour is a shallow tidal estuary that is 4.7 km^2 in size and located approximately 74km 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 rates as outstanding in the "wetlands of National Importance of Fisheries Database.

A coastal risk assessment undertaken by Wriggle Coastal Management in 2008 shows that while eutrophication and sedimentation may be poor in some arms of the estuary, overall vulnerability and susceptibility ranges from very low to moderate, as shown below.

Table 5: Risk assessment for the Toetoes Harbour (Source: Wriggle Coastal management, 2008[5]).

	Existing condition rating	Susceptibility rating	Vulnerability rating
Sedimentation	Fair	Low	Moderate
Eutrophication	Fair	Low	Moderate
Disease Risk	Good	Low	Low
Contaminants	Very Good	Very Low	Very low
Habitat Loss	Fair	Low	Moderate
Invaders	Good	Low	Low
Shellfish	Good	Very Low	Very Low

Estimated nitrogen loadings to the estuary are low (being a key driver of eutrophication) and the susceptibility of the estuary to stressors is assessed as low-moderate due to the estuary being well flushed (with low residence time) and a wide range of habitat types[6]. More recent estimates of nitrogen loads show they are relatively high, especially when compared to other estuaries in Southland, yet despite this nutrient enrichment condition is still very good due to the high assimilative capacity for this estuary type.

The Toetoes/Fortrose Harbour is listed as part of the Awarua Plain as a regionally significant wetland under Appendix A of the PSWLP, but this is not listed in Appendix Q of the PSWLP as a sensitive waterbody.

5. NON-NOTIFICATION & CONSULTATION

A consent authority has the discretion whether to publicly notify an application unless a rule or National Environmental Standard (NES) precludes public notification (in which case the consent authority must not publicly notify) or section 95A(2) applies.

The effects of the activities will be no more than minor, the applicants do 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.

Clause 6(1)(f) of Schedule 4 of the RMA requires the identification of, and any consultation undertaken with, persons affected by the activity. No persons are considered to be adversely affected by the proposal, as determined by the larger assessment of environmental effects (Section 6 below). However, Council must

[5] Robertson B & Stevens L (2008) Southland Coast Te Waewae to the Catlins Habitat Mapping, Risk Assessment and Monitoring Recommendations, Report for Environment Southland.
[6] Robertson B & Stevens L (2009) Fortrose (Toestoes) Estuary Fine Scale Monitoring 2008/09, Report for Environment Southland.

decide that a person is affected pursuant to Section 95E of the RMA.

Overall, it is considered that this application should be processed non-notified and without the need for written approvals.

6. ASSESSMENT OF ENVIRONMENTAL EFFECTS

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.

6.1 Use of land for dairy farming

This assessment of environmental effects (AEE) describes the risks to the environment resulting from the inclusion of SB2 as part of the dairy platform, and the proposed increase in dairy cows.

This assessment below considers the specific surface water quality issues in the existing receiving environment at the nearest monitoring sites. It looks at the property scale and within the property at specific management/landscape blocks, and the likely contaminant pathways that may impact any water quality issues identified. Any potential water quality issue is considered relative to the proposal, including farm system changes proposed and OVERSEER nutrient budgets, GMPs and mitigations, including their effectiveness and appropriateness, and the contribution that these measures would provide to water quality improvements at the catchment scale.

Section 6.1.1 below presents the modelled nutrient losses for the current farm system and presents a table that summarises the estimated nutrient loads from the proposed activity.

6.1.1 OVERSEER Nutrient Budgeting

OVERSEER nutrient budgets have been prepared by Miranda Hunter of Roslin Consultancy who is a Certified Nutrient Management Advisor (CNMA). These OVERSEER budgets have been used to estimate the annual amount of nitrogen and phosphorus discharged from the property.

Overseer FM modelling using version 6.4.0 have been included to support this application. OverseerFM has been used to model the farm system to estimate nutrient outputs associated to the proposal. Nutrient inputs have been carefully considered to ensure viable farm systems are modelled.

Overseer modelling has been included to support this application for activities on the property. The overseer models provide two purposes:

1. To describe the activities currently occurring and describe the proposed activities in a concise manner; and

2. To compare the relative change in nutrient losses between the existing and proposed farm scenario to inform the AEE. The relative change comparison is enabled by ensuring that the existing and proposed Overseer nutrient budgets are comparing 'apples with apples' i.e., uncertainty is significantly reduced when comparing two scenarios for one farm at one location where many of the critical inputs remain unchanged, e.g., soils, climate etc.

Therefore, the following assessment of the nutrient budgets refers to the 'existing baseline' being the present system/s and 'proposed baseline' that is the estimated nutrient losses for the proposed and future farm system.

Three existing farm system budgets are modelled, i.e., the 'existing baseline'. Each of these represents the 2019/2020 season based on actual inputs and stock numbers. After discussions with Environment Southland, it was considered appropriate that only the 2019/2020 season was modelled. A change in farm systems over the previous year's means that if additional years were modelled the current scenario would not be accurately reflected in the nutrient budgets.

1. The first budget includes the land referred to as the 'milking platform. OverseerFM file 'Year Ending 2020'
2. The second budget includes the land referred to as 'Support Block 1'. OverseerFM file 'Year Ending 2020 Support 1'
3. The third budget includes the land referred to as 'Support Block 2'. OverseerFM file 'Year Ending 2020 Support 2'.

Two proposed farm system budgets are modelling, i.e., the 'proposed baseline.

1. The first budget includes the land referred to as 'proposed milking platform'. OverseerFM file 'Proposed Milking Platform'.
2. The second budget includes the proposed Support Block 1. 'OverseerFM file 'Proposed Support Block 1'.

A copy of all OVERSEER Nutrient Budget Farm Scenario Reports can be found attached to this application (Appendix B). Some of the assumptions and limitations of Overseer are described as below.

Full details on the modelling can be found in the attached reports. Due to the application needing consents under the NES-FM it was considered appropriate that the 19/20 year was modelled. Due to changes in farm systems (permitted activity) it was considered appropriate to only model the one year, as this was most representative of what was occurring on farm and a relatively stable farm system. This method has been agreed with the Environment Southland Consents Manager as an appropriate method to create baseline nutrient budgets. Table 9 presents the summary of the overall N and P losses.

Please refer to the Overseer Modelling Report contained in Appendix B for full copies of the existing nutrient budget models and a summary of the model inputs and nutrient loss to water estimates.

Overseer Assumptions

- Long term annual average model- the model uses annual average input and produces annual average outputs
- Near equilibrium conditions- the 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 in line with accepted industry good management practices.

Overseer Limitations

- Overseer does not predict transformations, attenuation or dilution of nutrients between the root zone of farm boundary and the eventual receiving water body. A catchment model is needed to estimate the effects of the nutrient losses from farms on groundwater, river or lake water quality.
- Overseer does not calculate outcomes from extreme events (floods and droughts) but provides a typical year's result based on long-term averages.
- Overseer does not calculate the impacts of a conversion process, rather it predicts the long-term annual average nutrient budgets for 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.

Current scenario nutrient budget modelling

Table 9: Summary N and P loss estimates for the existing scenario model.

Land Use	Milking Platform	Support Block 1	Support Block 2	Total current existing environment
Area	353 ha	89.6 ha	80.3 ha	522.9
Kg N/yr	18053	2186	3760	23999
N Loss/ha	51	24	47	
Kg P/yr	333	32	40	405
P Loss/ha	0.9	0.3	0.5	

Proposed scenario nutrient budget modelling

Table 10: Summary of Overseer N and P loss estimates outputs for the proposed model.

Land Use	Proposed Milking Platform	Proposed Support 1	Proposed Total
Kg N/yr	19563	2344	21907
N Loss/ha	45	26	
Kg P/yr	357	27	384
P loss/ha	0.8	0.3	

Comparison between existing scenario and proposed scenario modelling

The nutrient budgets contained within the application have been completed to compare the predicted nutrient losses from the proposed self-contained dairy farm, with the existing consented land use.

Table 11: Comparison of the relative changes in nutrient loses between the existing and proposed farm scenarios.

	Total current existing environment	Proposed Total	Difference	Percentage difference
Kg N /yr	23,999	21,907	-2,092	-8.7%
Kg P/yr	405	384	-21	-5.2%

Overall, modelling of the proposed scenario indicated that at a farm system/landholding level nitrogen losses are estimated to reduce by 2,092 kg N/yr (8.7% reduction) and reduce by 21 kg P/yr (5.2% reduction) compared to the existing baseline.

The reduction in nutrient losses of nitrogen and phosphorus under the proposed scenario reflects several positive mitigations. These are discussed further below.

In recent years, there have been two publications of note regarding the use of Overseer in both a regulatory framework and for water management planning. These include the Parliamentary Commissioner for the Environment's Report on Overseer[7] and Overseer Ltd's review contracted to Enfocus titled Using Overseer in Water Management Planning.[8] Both reports highlight various issues associated with using Overseer models in a regulatory context, as a decision-making tool and for compliance. The Enfocus report specifically provides for a solution to some of these known limitations and issues by advising that nitrogen loss output figures are used in a regulatory context. Using an output figure in regulation enables Overseer version changes to be accounted for and allows the applicant to demonstrate the improvement in nitrogen loss outputs whilst still maintaining the flexibility to farm to environmental, political and economic conditions as well as provide for innovations on farm. We concur with these recommendations and note that the RMA is an effects-based piece of legislation.

6.1.2 Changes driving nutrient loss reduction

The 8.7% reduction in nitrogen losses and the 5.2% reduction in phosphorus losses is a result of many changes to the farm system.

All of the cows were originally wintered on farm, with 400 wintered on the milking platform and 600 wintered on the SB2. Under the proposed scenario all cows are still being wintered on farm. However, the crop locations are now spread out over the milking platform, allowing for a more sustainable crop rotation.

Reductions in N fertiliser applications are contributing to a reduction in losses. In the baseline scenario 270kg N/ha is applied on the milking platform and 247 kg N and 257 kg N/ha on Support Block 1 and Support Block 2 respectively. This reduces to 189 kgN/ha in the proposed scenario, farm wide. This reduction in N fertiliser applied ensures that uptake by plants is at an optimum, reduces the assumed pasture frown and the resulting N loss.

As part of the proposal the applicant is removing 120 beef calves/yearlings and 90-120 beef R2s from the system. These are proposed to be replaced by 140 dairy cattle. This stock class change results in a net positive impact on nutrient losses. Effluent that was being produced by the beef cattle is now produced by a lower amount of dairy cattle and is able to be collected and disposed of when conditions are suitable.

Current Olsen P of 32, reducing to agronomic optimum of 30 and applying fertiliser at maintenance levels reduces P loss.

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[7] Parliamentary Commissioner for the Environment, Overseer and regulatory oversight: Models, uncertainty and cleaning up our waterways, December 2018

[8] Enfocus, Using Overseer in Water Management Planning, October 2018.

6.1.3 OverseerFM Uncertainty

OverseerFM is a complex model of inherently complex biological systems and like all such models has inherent uncertainties. In the context of the application, under the pSWLP policy framework, OverseerFM is not being used to assess compliance with a catchment-based nutrient loss property target. Rather OverseerFM is being used to establish a comparative baseline for one farm system and a compare a proposed scenario with the baseline. Many of the concerns about uncertainties involved in Overseer estimates are focused particularly on the former situation, and not this specific application. Where the reference point is one existing property, particularly one that is located in a situation that is similar to those used to calibrate key components (or sub-models) of OverseerFM, the uncertainties are significantly reduced[9]. Comparisons of modelled and measured nitrate losses for dairy farms in Southland found[10]:

- "Given the inherent uncertainty associated with measuring and modelling nitrogen leaching, there was good agreement between Overseer estimates and measured values reported for 3 key experimental sites in Southland.
- Estimates of drainage volumes based on annual rainfall inputs to the model also agreed reasonably well with those derived from a daily soil water balance model.
- The agreement between measured and modelled values indicates that the Overseer model is performing well for this combination of soil-climate-management factors."

Therefore, given that the Overseer nitrogen and phosphorus loss estimates are being used to compare losses for one property on a relative and not absolute basis, there will be a very low level of uncertainty about the extent to which estimated reductions or increases reflect real reductions or increases.

As the use of Overseer here has been to compare one farm system with another at the same location, the inherent uncertainty is likely the same between the two scenarios and therefore does not limit use of this comparison.

In addition, while there may be a relatively high level of uncertainty about nutrient loss estimates, if there are clear, measurable and verifiable changes to one farm system there will be a high level of certainty about the relative changes to long-term annual average nutrient loss estimates[11]. Therefore, provided that there is assurance that the farm system changes have occurred there will be a high level of certainty there will be relative reduction in long-term annual average nitrogen and phosphorus losses to water.

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[9] Shepherd M et al (2013) Overseer: accuracy, precision, error and uncertainty, FLRC workshop proceedings

[10] Smith, C & Monaghan R (2013) Comparing OVERSEER estimates of N leaching from grazed winter forage crops with results from Southland trial sites, Report for Environment Southland, RE500/2013/123

[11] Freeman, M, Robson, M, Lilburne L, McCallum-Clark, M, Cooke, A, & McNae, D. (2016) Using OVERSEER in regulation - technical resources and guidance for the appropriate and consistent use of OVERSEER by regional councils, August 2016. Report prepared by Freeman Environmental Ltd for the OVERSEER Guidance Project Board.

6.1.4 Mitigations and GMPs

OVERSEER estimates what the losses of N and P to water will be, but not what the potential or actual effects of that loss on water quality would be. The effects of the proposal on water quality are assessed in this section.

The contaminants of concern are N, P and sediment and microbiological contaminants. These contaminants and potential effects of those contaminants are outlined below.

- **Nitrogen (N) and phosphorus (P)** (nutrients) are needed by plants for growth but when the concentrations of nutrients in water are high, they can result in excessive growth of plants, e.g., periphyton, macrophytes and phytoplankton. High concentrations of nitrate in water can make it unsafe to drink for humans and can be toxic for sensitive organisms (like young trout and salmon). Ammonia at sufficiently high concentrations can be highly toxic to fish and other aquatic organisms that live in water.
- **Sediment** (as indicated by water clarity) refers to particles or eroded soil and rock. Sediment is also a major source of phosphorus because phosphorus sticks to the surface of soil particles carried to water. When erosion rates are excessive, sediment can smother stream and estuary bed macroinvertebrates and can damage the gills of fish. Finer sediment suspended in water can also reduce light penetration (visibility) which plants need to grow and some creatures need to find food.
- **Faecal indicator micro-organisms** (indicators of microbial pathogens) which can have a detrimental effect on human and animal health, particularly when ingested. The main source of pathogens in fresh water in New Zealand are human sewage and animal manure[12].

Assessing the environmental impact of modelled nutrient losses from a property is complex because these nutrients travel via a number of different pathways through the receiving environment undergoing attenuation, mixing, dilution and dispersion processes which can significantly affect the loading and concentrations that results in the receiving water bodies.

Table 12 below summaries the potential effects of each individual farm activity. Then the applicant presents GMPs and mitigations that will/or have been applied to each activity in order to avoid, mitigate or remedy the effects of each activity of the receiving environment. The outcome column is the resulting likely implications for the consequential environmental effects. The table below forms only one part of the application and assessment and is presented below to give the Consent Authority an overview of each of the individual components of the proposal and to demonstrate that the effects at each individual scale will be avoided, mitigated or remedied. The table below needs to be read in conjunction with the overall broad scale/cumulative effects assessment in Section 6.

[12] Parliamentary Commissioner for the Environment, 2012. *Water quality in New Zealand: Understanding the science.* New Zealand Government, Wellington. 76p.

A combination of the farm system changes, and GMPs/mitigation measures as demonstrated by the nutrient modelling undertaken will result in significantly less nutrients making their way into water bodies which will make a very small contribution to improving the quality of groundwater and surface water.

N Mitigations

OverseerFM proposed nutrient budget includes the followings that are key drivers that reduce N loss:

- Larger crop rotation
- Reduced nitrogen fertiliser use
- Larger area for spreading liquid effluent
- Removal of beef cattle
- Synthetic N fertiliser 190 kg N/ha/year
- Use of feed pad

P Mitigations

OverseerFM proposed nutrient budget includes the followings that are key drivers that reduce P loss:

- Reducing the farm average Olsen P to 30 and therefore reduce maintenance fertiliser P requirements
- Removal of beef cattle
- Larger crop rotation
- Use of feed pad

Table 12: Potential effects of individual farming activities and mitigations.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
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 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 to include a loss of excess nutrients to enter 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.	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 Celsius, 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 levels between 25 and 35. 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.	Applications on all blocks occur using a little and often approach. Decreased use of N fertiliser over whole landholding corresponding decrease in yield	Adverse effects both avoided and mitigated with use of GMPs for fertiliser usage and further mitigations to better manage fertiliser application across the entire landholding.
Discharge of liquid effluent to land via low-rate application predominantly using pods (or equivalent low rate application method) to effluent discharge	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.	Effluent will always be applied at a depth less than the soil water deficit which ensure nutrients remain in the root zone to be taken up and utilised by plants for pasture production.	The effluent discharge area of 264 ha is large enough to cater for the effluent generated and maintain effluent N loadings at less	The current effluent pond has a sub soil drain inspection sump. The structural integrity of the pond has been deemed to be fit for purpose.

area.	Potential for contaminant losses to cause excess nutrients in surface water and groundwater bodies in the vicinity of the property. In general, excess nutrients result in water quality degradation causing ecological stress for plants and animals.	Effluent area receiving liquid FDE is sized to ensure nutrient loadings from the application of effluent are maintained at less than 150 kg N/ha/year to avoid excess nutrient loading. Utilising low-rate effluent application (<10mm/hr) is appropriate to ensure nutrients in effluent are able to be taken up by plants. Use of deferred storage of effluent to allow effluent to be stored when it is unsafe to apply to land. Buffer zones created from effluent application areas to critical source areas and other sensitive receptors such as bores, property boundaries and dwellings.	than 150 kg N/ha/year. This area has been assessed as appropriate.	
Sludge effluent application across entire milking platform.	The nutrient concentration of sludge is higher than liquid of FDE due to the lack of dilution from rainwater or washdown water. Due to the higher concentration of nutrients, application of sludge to land needs to be carefully managed to ensure that nutrient loadings on any particular land area do not exceed the recommended level of 150 kg N/ha/year	The maximum loading rate of nitrogen from the application of effluent (both sludge and liquid) to land is 150 kg N/ha/year. Sludge is not discharged onto the same area any more frequently than once every two months. Sludge is only discharged to land when soil temperature is greater		Adverse effects to the environment from the discharge of slurry effluent will be no more than minor. The discharge of sludge is governed by permitted activity rules giving certainty that the activity will be regulated. Application of sludge to paddocks

	of effluent. This loading is achieved by ensuring the land area is large enough and the application depth is restricted to 10mm. If nutrient loadings exceed 150 kg N/ha/year or nutrients are applied in excess then there is a risk of contaminant loss (N, P, sediment and microbial) to groundwater and surface water bodies. Adverse effects from contaminant loss to water include water quality degradation which can adversely impact aquatic ecosystems and the overall health of water bodies. Sludge will be applied to areas within the proposed liquid discharge area. Sludge is generally considered lower risk to apply to land because it doesn't have the same risks of leaching, overland flow/runoff that purely liquid effluent has.	than 5 degrees Celsius in winter and 7 degrees Celsius in spring. Effluent will always be applied at a depth less than the soil water deficit which ensures nutrients remain in the root zone to be taken up and utilized by plants for pasture production. Effluent area receiving sludge is sized to ensure nutrient loadings from the application of effluent are maintained at less than 150 kg N/ha/year to avoid excess nutrient loading. Use of deferred storage of effluent to allow effluent to be stored when it is unsafe to apply to land. Buffer zones created from effluent application areas to critical source areas and other sensitive receptors such as bored, property boundaries and dwellings.		low in P and K can act as a capital fertiliser application and bring soil test levels up to agronomical optimum which will increase pasture productivity.

6.1.5 Potential water quality effects

Assessing the environmental impact of modelled nutrient losses from a subject property is complex because these nutrients travel via a number of different pathways through the receiving environment undergoing attenuation, mixing, dilution and dispersion processes which can significantly change the quantity and nature of these nutrients in the receiving water bodies.

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. Given the estimated reduction in contaminant losses it is highly unlikely that there would be any adverse effects associated with nutrient losses from the proposed activity on this drinking water supply or any other bores that may be nearby. There will be further attenuation, dilution and dispersion processes that will further reduce the concentration of nitrate nitrogen in groundwater between the discharge location and any sensitive receptors.

Groundwater nitrate concentrations are of particular concern to human health. The risk of bottle-fed infants getting 'blue baby syndrome' (methemoglobinemia) from consuming high nitrate nitrogen water is the primary driver for the current NZ Drinking water standard (Maximum Acceptable Value) for nitrate nitrogen (11.3 mg N/l).

In summary, the evidence about the current state of nitrate-nitrogen concentrations in groundwater in this area of Southland, the OVERSEER® modelling and the proposed farm system changes/mitigations strongly indicate that drainage nitrogen concentrations at the level predicted by OVERSEER® (Appendix B) are highly likely to result in an extremely small improvement in existing groundwater quality.

Sediment and microbiological contaminants are not modelled within OVERSEER® so attempting to demonstrate a reduction in the annual amount of sediment and microbiological contaminants in the proposed scenario compared to the amount which has been lawfully discharged currently is challenging. P loss modelling can be used as a proxy for sediment and microbiological contaminant losses. The reason being is that phosphorus in the soil readily bonds to fine soil particles and is therefore lost to the environment via the same contaminant pathways: runoff/overland flow and erosion. Microbiological contaminants are also lost to the environment by the mechanics of water flow via these same pathways. The P loss modelling in this application indicates sediment and microbiological contaminants will reduce under the proposal. However, P loss prediction is not exactly the same as microbial and sediment losses, and therefore the assessment cannot be absolute, but provides the best indication of likely losses and risks to the environment. Additionally,

the proposed farm system changes/mitigations are highly likely to result in a reduction of sediment, microbiological contaminants and phosphorus.

Because of the significant reduction in nitrogen and phosphorus loss from the proposal it is highly likely to result in a real but small overall improvement on local surface water quality. Quantification of the improvement has not been completed because the contaminant load reductions are so small in the context of the wider receiving water catchment and the resulting changes in concentrations would not be measurable with the current surface water quality monitoring programme at the local scale.

The attached FEMP and GMPs detail various management practices which will be adopted in order to reduce sediment, and bacteria losses via overland flow, artificial drainage channels. The primary mechanisms of mitigating and avoiding these losses is by appropriate management of critical source areas (CSAs) on the farm, efficient effluent management, stock exclusion from riparian margins and CSAs and the adoption of best management practices for intensive winter grazing. These mechanisms are likely to have the greatest impact in reducing sediment losses and microbiological contamination of waterways.

6.1.6 Cumulative Effects

As described above, the proposal is very likely to achieve an 8.7% reduction in average annual N loss to water and a 5.2% reduction in average annual P loss to water.

Improvements made under the proposal in isolation from other farms will have a small impact on long-term water quality. This highlights the importance of catchment wide implementation in water quality mitigation measures and the ongoing restriction on the applicants' operation in accordance with the nutrient output limits will give certainty that water quality will be improved in the long term.

The proposal will result in a reduction in N and P and a likely reduction in sediment and microbiological contaminants lost to the environment and a concurrent reduction in the resulting concentration of contaminants in receiving waters, albeit at an extremely low level. The overall effects on water quality will be positive and make a very small contribution to improving water quality at the local and catchment scale.

The purpose of the dairy expansion is to authorise a self-contained dairy unit by allowing a more sustainable crop rotation, with therefore minimises the cumulative effects of IWG in the Mataura Catchment. Furthermore, the increase in cows is facilitated by removing beef stock, these cows are not being moved elsewhere and this is a direct swap, and therefore by being a self-contained dairy unit there are no off-site effects to consider.

6.1.7 Other effects

Overall, the proposal will have positive effects on the environment seeing a reduction in modelled contaminant losses.

The conversion of the property to a dairy farm will enable the applicants to operate a sound and relatively secure dairy farm operation, that is as close to a self-contained farm system as possible. The property will directly employ 5 full time equivalents which will support families and local schools. The continuation and prosperity of the business will have economic and social benefits to the landowner and the wider community.

6.2 Discharge of agricultural effluent to land

This assessment of environmental effects (AEE) describes the risks to the environment resulting from the proposed discharge of farm dairy effluent to land from the proposed milking of dairy cows.

Under the Regional Water Plan Southland (RWPS) the restrictions of discretion for the discharge activity include:

(a) The application depth and rate, storage requirements, nutrient loading (in particular nitrogen) and contingency plans;

(b) The separation distance (beyond that required under conditions 1,2,3 above) of the discharge from surface water bodies, artificial watercourses, subsurface drains, the coastal marine area, residential dwellings, places of assembly, urban areas, property boundaries, water abstraction points and registered drinking water-supplies;

(c) Other measures to avoid, remedy or mitigate adverse effects (including cumulative effects directly related to the discharge of farm dairy effluent) on water quality taking into account the nature and sensitivity of the receiving environment.

The current discharge permit does not include the discharge collected from the calving pad. In reality the amount of effluent collected from the calving pad is negligible, the wood chip/bark base collects the effluent, and this is scraped and spread as a solid. However, any potential excess will be collected and therefore the applicant is seeking for this to be included in the discharge permit.

6.2.1 Application Rate/Depth/Timing

This application seeks to apply agricultural effluent to land centre pivot irrigation or cobra-rain gun/k line at a rate not exceeding a maximum 10mm/hr and a maximum depth of 10mm, that is consistent with low-rate application methods. An umbilical system is proposed as a contingency. In Southland, soil water deficits mainly occur between the months of October to May, which may make it difficult to accurately schedule the application of effluent to coincide with soil moisture deficit over the entire milking season, which usually begins in August. The applicants will check weather forecasts and check paddocks before application to ensure that effluent is applied only when a soil moisture deficit exists. For periods when effluent cannot be applied, the applicant has ensured there is sufficient deferred storage available, see below section.

Careful irrigation scheduling will ensure that low application rates and depths will maintain nutrients within

the top 200mm of soil, enabling the assimilation of nutrients into a form which can be used by plants, while facilitating the avoidance of actual or potential effects such as ponding, odour, overland flow and/or nutrient leaching and microbial leaching to groundwater and surface water.

Ensuring that effluent is not applied at depths greater than those specified above will ensure that when there is a soil moisture deficit, the nutrients should remain in the top 200mm of the soil.

Effluent discharge will observe a 28-day return period. Effluent will be discharged to land year-round on days when conditions are suitable. Furthermore 'proof of placement' of irrigators provides a record of effluent application and the required information to make informed decisions daily and seasonably regarding the forecasting of FDE disposal.

Provided that FDE is applied to land in the manner described then any potential adverse effects associated with ponding, odour, overland flow and/or nutrient leaching and microbial leaching to groundwater and surface water should be avoided as far as reasonably practicable.

6.2.2 Storage

DESC assessment shows that the current effluent storage facility is sized appropriately to milk 1,140 cows.

The DESC attached (Appendix C) shows that **893 m^3 of pumpable liquid storage is required** (90th percentile probability) to enable effective deferred irrigation of liquid FDE and liquid components for the milking of 1,140 cows. The existing pond has a **pumpable liquid storage volume of 1,943m^3** which is more than adequate to meet the requirements of the DESC.

6.2.3 Discharge area

The total discharge area is approximately 264ha minus any exclusion zones. This is an increase from the 183-ha consented under AUTH-301811-V2. The increase in effluent area is the spreading of effluent on the SB2. The use of effluent as an organic fertiliser reduces the need for synthetic fertiliser.

Liquid effluent will be applied to land all year around when soil conditions permit safe application. As per the existing discharge permit, from 1 May – 31 August, effluent will only be applied to 'Area B' land at a reduced depth of 5mm and reduced rate of 1.5mm/hr.

The soils on the property are a mix of low and high-risk soils making areas suitable for effluent disposal when conditions are right.

Effluent will not be applied within the following buffer zones:

- to any drain or water race that goes to a lake, river, Regionally Significant Wetland or coastal marine area;
- to or within 20m of any bed of any lake, river, or Regionally Significant Wetland; and
- within 200m of any place of assembly or dwelling not on the property

- within 20m of the boundary of any other landholding or public road
- within 100m of any authorised water abstraction point

There are no other sensitive receptors that require separation measures to be implemented. Provided that these buffer zones are maintained, there should be no significant adverse effects resulting from the location of the disposal area.

6.2.4 Effects on Water Quality from FDE Disposal

As assessed above in Section 6.1.2, effluent management GMPs and mitigations proposed will ensure that the effects of effluent discharge are avoided, mitigated, or remedied so that they are less than minor.

6.2.5 Odour

The effects of odour are most likely to occur from the storage and/or discharge of FDE and/or slurry effluent. The effluent pond and slurry ponds are located within 625m of the site boundary. The physical location of the effluent infrastructure coupled with the proposed low application rate irrigation and effluent discharge buffers mean there is no significant risk of adverse effects from odour and spray drift on surrounding landowners and occupiers. As such, the effects of odour are avoided.

6.2.6 Contingency Plans

An alarm and automatic switch-off system will be installed, and this will act as a contingency measure in the event of an effluent system failure such as sudden pressure drop, irrigator stoppage or breakdown.

The effluent pond is usually kept at half full when possible to allow for rainstorms or breakdowns.

6.3 Use of Land for Intensive Winter Grazing

The applicant proposes to grow 57.5 ha of winter crop. This is within the permitted thresholds for both the pSWLP and NES-FW land area criteria. The applicant has prepared a FEMP which includes a description of the winter grazing practices and Good Management Practices (GMPs). As part of the FEMP the applicant will prepare a winter grazing plan. This aims to manage potential environmental effects associated with the farm and IWG activities. This contains details of GMPs adopted by the applicant to ensure that the farm is operated in accordance with industry and promoted good practice.

An assessment of the soils and likely contaminant pathways has identified the GMPs recommended, and this has informed the preparation of the below grazing management GMPs and general farming GMPs included in the table below.

The applicant has been grazing following a top to bottom approach and will continue to do so.

Paddocks grazed will not have a slope of greater than 10 degrees.

To ensure that less animal movement across already grazed soils, portable water troughs will be used, and back fencing set up to ensure limited transport. This will avoid excess pugging.

By selecting appropriate paddocks for winter grazing, at risk paddocks are avoided. Spreading the winter grazing over the milking platform allows for greater paddock selection. Avoiding at risk paddocks will help protect soil structure and erosion, minimising sediment runoff and P loss. N losses are minimised by keeping the N in the root zone ready for a spring uptake.

The following GMPs are implemented for intensive winter grazing.

Table 13: Good management practices for intensive winter grazing.

Activity	Good Management Practices adopted	Outcome
Winter crop	Reduce periods of bare soil between crops and pasture to reduce erosion and leaching. Bare paddocks are re-sown as soon as possible. Erosion damage areas are rest and re-sown. Compacted soils are subsoil, ripped or cultivated.	By reducing periods of bare soil, soil structure is protected, and erosion damage minimised. Nutrient losses are reduced, especially P loss.
	Minimise losses of sediment and nutrient to water and maintain soil structure. Pugging and compaction of soil is avoided as much as reasonably practical. No tillage or low impact cultivation methods and timing are considered. Supplement feed-out areas are located away from waterways and critical source areas. Riparian margins or buffer strips are left beside waterways and other areas where sediment and nutrients may flow such as gullies or swales.	By reducing pugging and compaction, soil structure is protected, and erosion damage minimised. This will help minimise sediment and nutrients from entering waterways. Nutrient losses are reduced, especially P loss.
	Use appropriate paddocks for intensive winter grazing. Low risk paddocks are selected for intensive winter grazing, ideally further away from waterways, with soil least likely to pug and compact. Ideally flatter with as few gullies and swales as possible.	By selecting appropriate paddocks for intensive winter grazing, at risk paddocks are avoided. Avoiding these paddocks will help protect soil structure and erosion, minimising the sediment runoff and P loss. N losses are minimised by keeping the N in the root zone ready for a spring uptake. Spreading IWG over the extended milking platform will allow for greater paddock selection.
Winter Management Plan	Winter Management Plan to outline the grazing policy and the grazing plan for each paddock. Showing how the paddock is to be grazed in regard to direction for waterways. CSAs identified and how they are managed.	An appropriate winter management plan will maximise the potential good winter grazing standards. Nutrient losses will be minimised.
	Crops grazed on sloping ground, to graze from top of slope to bottom. A 20m last bite strip is used.	The remaining crop acts as a sediment and contaminant buffer, minimising P loss.
	Stock to be back fenced to prevent stock entering previously grazed land.	If stock is prevented from entering previously grazed areas this will reduce pugging and sediment compaction and break down, minimising P loss.
	Portable water troughs used where appropriate or necessary. Back fencing accounts for location of existing water troughs.	This will prevent stock moving back to a fixed water trough, leading to pugging and sediment compaction

		and breakdown. Minimises P loss.
	Baleage placed in the breaks prior to the winter and portable ring feeders used where practicable.	This will prevent tractors etc from driving on vulnerable paddocks, contributing to sediment breakdown and erosion.
	Mob sizes are minimized where practicable.	Minimising stock in a paddock will minimise the movement of stock which leads to sediment breakdown and erosion. Minimises P loss.
	Buffer width from any creek/river to the grazed area to be 5m. Where the grazed area is the area of crop set for IWG activities. To be achieved by temporary fencing and crop sowing plan/s.	This acts as a buffer, filtering sediment before it enters the waterways. Reduced P losses to waterways.
	Straw to be on-hand for bedding in extreme conditions and for possible sediment runoff mitigations.	Reduced erosion during extreme conditions, reducing P loss.
	CSAs to be managed during grazing. Necessary to prevent degraded water quality leaving the farm and stop cows from standing in mud. Last break grazed in the paddock if need to be grazed at all.	Managing CSAs will reduce soil break down and erosion and reduce P losses.

6.4 Groundwater Abstraction

6.4.1 Allocation

The applicant's proposed abstraction represents a negligible portion of the allocation of the area. Abstraction is from the Knapdale groundwater management zone, however the bore is located very close to the estimated boundary of the Knapdale and Croydon GWMZs so it would be realistic to assume that abstraction is from both zones. Under the PSWLP allocation of the Croydon GWMZ is 1,203,490 m^3/yr, 47% of the discretionary limit. Allocation of the Knapdale GWMZ is 195,233 m^3/yr, 5% of the discretionary limit. A slight increase in the abstraction would have minimal impacts on this allocation. These figures were up to date as on the August 2021 allocation update from council.

6.4.2 Stream Depletion and Interference Effects

Policy 29 in the RWPS and Policy 23 of the pSWLP requires a stream depletion assessment when the daily average rate of take is more than 2 L/s because takes less than this are expected to have a minor effect on stream flows. Over 24 hours of pumping, the rate of take is less then 2L/s and therefore does not require a stream depletion assessment.

Significant interference effects on neighbouring bores are not expected. Given that the average rate of take is relatively low, it is unlikely that the radius of interference would affect any of the neighbouring bores. The closest bore is 900m away.

6.4.3 Effects of Groundwater Quality

The low rate of take is highly unlikely to result in the drawdown of contaminants from the upper soil profiles and so the proposed abstraction is highly unlikely to have any adverse effects in terms of groundwater quality. The applicant will need to ensure that the bore head casing is adequately sealed to prevent the ingress of contaminants. Decommissioning F45/0172 will also have improvements on water quality as contaminants will not be able to enter ground water through the bore.

6.4.4 Efficiency of Use

The proposed rate of take is estimated at 120 L/cow/day, which is consistent with Council's recommendations. The applicant is not opposed to the continued monitoring of water abstraction on the property to ensure that use is not excessive.

6.4.5 Monitoring

The proposed abstraction will continue to be monitored with records of water abstraction being kept. These records will be provided to Council annual at the end of the 'water year' and upon request.

6.5 Use of Land for a Feed pad

A calving pad is situated to the south-east of the milking shed. The calving pad is approx. 20m x 100m. A woodchip/bark base is used for bedding and cows are fed bailage. Th woodchip/bark is scrapped each year and soils are applied to the landholding in accordance with the permitted activity requirements. The calving pad is used for short periods in August by under 100 cows. The pad naturally slopes to the north and effluent is captured by drains in the pad and fed into the effluent storage system. The DESC prepared for this application shows there is sufficient capacity for the calving pad liquid effluent collected.

The following table provides further details of the use of each feed pad and an assessment against the Permitted Activity criteria under Rule 35A of the PSWLP and Subpart 1 of the NES-FW 2020. The feed pad is not consistent with Subpart 1 Regulation 9(3) as less than 90% of the cattle held on the calving pad are more than 4 months old. The calving pad does not have a base with a minimum permeability of 10 -9 m/s and therefore is not consistent with Regulation 10(3)(a).

Table 14: Use of feed pad.

Feed Pad Details PSWLP		
PSWLP Rule 35A (a) The use of land for a feed pad/lot is a permitted activity provided the following conditions are met:		
(i) if accommodating cattle or deer, each feed pad/lot services no more than 120 adult cattle, or 250 adult deer, or equivalent numbers of young stock at any one time	Aug	174
	Adverse weather conditions outside of these months	174
Animals not remain on the feed pad/lot for longer than three continuous months	Feed pads are not used for more than 3 continuous months.	
The feed pad/lot is not located (1) within 50 meters from the nearest waterway or another feed pad/lot on the same landholding.	Feed pads are located approx. 340m from the nearest waterway.	
(2) a minimum depth of 500 millimetres of wood-based material across the base of the feed pad/lot	The feed pads have a minimum of 500 millimetres of wood-based material across the base.	
(v) any material scraped from the feed pad/lot including sold animal effluent, is collected and if applied to land is in accordance with Rule 38	Solid effluent is scraped from the feed pad and disposed to land in accordance with Rule 38 of the PSLP. Liquid effluent is collected and stored in the effluent storage pond. In reality there is very little if any liquid effluent to be collected.	
(vi) the overland flow of stormwater or surface runoff from surrounding land is prevented from entering the feed pad/lot.	The feed pad is unlikely to receive overland flow form surrounding land, and all runoff and effluent from each feed pad is gravity fed directly to the	

	effluent storage pond.

Feed Pad Details NES-FW 2020	
(3) The use of land for feed pad/lot is a permitted activity if 90% or more of the cattle held in the feedlot is (a) no more than 4 months old; or (b) no more than 120kg in weight.	Less than 90% of the cattle held on the feedpad are more than 4 months old and more than 120kg in weight.
10(3). The use of land for a feed pad/lot is a discretionary activity if (a) The base area of the feedlot is sealed to a minimum permeability standard of 10^{-9} m/s and	The base of the feedpad is not sealed to a minimum permeability standard of 10^{-9} m/s as the base of the feed pad/lot is woodchips/bark.
(b) Effluent expelled in the feedlot is collected, stored, and disposed of in accordance with the rule in a regional or district plan, or a resource consent and	Effluent is collected and stored in the effluent storage pond and will be disposed of in accordance with the proposed discharge permit.
(c) The feedlot much be at least 50m away from any water body, any water abstraction bore, any drain, and the coastal marine area.	The feed pads/lots are located 340m from any waterway.

6.6 Positive effects

The continuation of dairy farming will contribute significantly to the social and economic wellbeing of the local and regional community. This proposed will result in an 8.7% kg N and 5.2% kg P reduction.

6.7 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 immediate neighbourhood and wider community is a small rural Southland town which is serviced by similar land uses to the proposed activity. Land use of this nature is anticipated and widely supported in this area due to the local economic and cultural benefits that dairy farming brings to small rural economies. The proposed activity will employ additional staff, as well as contractors and consultants from the wider

community as well as support local schools and local rural businesses. In a more general sense, the primary industries in New Zealand 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 entire farming operation 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 effluent infrastructure, other farming equipment and cows is expected within the rural locality and is an existing activity on the applicant's current farm. The proposal will not have any significant physical effects on the locality over and above that currently experienced due to the proposed use of the existing dairy shed and effluent infrastructure on the land which will be converted to dairy farming.

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 modified ecological landscape and the proposal will not have any significant adverse effects on ecosystems. The physical works required to convert the property to a dairy farm does not involve significant physical changes to the landscape and all works are located well away from environments such as waterways, wetlands and natural bush areas which may contain plant and animal habitats. Significant riparian has occurred on the property and will continue in the forthcoming years.

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

It is not considered that the activities will have any effect on aesthetic values, as the proposed dairy platform will be in keeping with the general rural nature of the area. The land in this area is historically known for farming activity and the presence of a dairy operation on this property does not result in any effect contrary to the historical values associated with the natural and physical resources in the vicinity.

The waterways within the proposed dairy platform are non-navigable and public access would be by permission of the applicant only. There is no evidence to suggest popular recreation fishing spots nearby which may be affected by the proposal. The effects on any cultural values are assessed below.

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

Effluent generated on the property will be treated and discharged to land as described earlier in this report

and is consistent with the discharge methods promoted by industry groups, Regional Councils and by the relevant rules and policies for the Southland region. The assessment of alternatives (below) provided in this report has concluded that this is the preferred solution for managing animal waste generated at the property. Various mitigation measures described in this application are designed to avoid or mitigate the loss of contaminants to the wider environment with the aim of applying nutrients in a manner which enables them to be efficiently and effectively used for the benefit of pasture and crop growth.

The proposed activity is anticipated within the rural zone and no aspects of the proposal are likely to result in the emission of an unreasonable and unexpected level of noise.

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 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.

6.8 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.

IWG

If the applicant was to continue as is, wintering the majority of the milking herd on Support Block 2, there would be less opportunity for crop location selection and sustainable crop rotation. Nutrient losses would be higher and adverse effects on the environment would be considered more likely than under the proposed scenario. The purpose of the expansion is to better provide for a sustainable, self-contained dairy unit, and the SB2 being incorporated into dairy platform enables this.

Method of Discharge

Deferred irrigation methods will be utilised on the property to ensure that effluent is only applied when conditions are suitable. Detention in the effluent pond also provides some level of treatment to the effluent before it is applied to land. Alternative methods may include direct discharge of the effluent to land on an as-required basis, regardless of the conditions. This would likely result in over-saturation of soils, ponding, overland flow and/or excessive leaching of contaminants, all of which can lead to significant adverse environmental effects. A slurry tanker could be used as an alternative to the proposed primary method but would likely have a higher operating cost for little gain and would result in a higher application rate to land. Rather the slurry tanker is used as a contingency. There are no other practicable environmentally acceptable

alternatives to applying effluent to land.

Receiving Environment

Discharging effluent to land, if conducted appropriately, enables the reuse of a waste product as a soil conditioner and provides nutrients for plant growth whilst mitigating against the direct loss of contaminants to underlying or nearby water bodies. A direct effluent discharge to water has not been considered because it would result in significant adverse effects on the environment.

Overall, the proposed discharge methods and receiving environment are the most suitable for managing the effluent generated at the farm.

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. The proposal will not adversely affect the land's ability to meet the reasonably foreseeable needs of future generations, or on the life-supporting capacity of the land and any ecosystems associated with them. The proposal includes a suite of carefully considered and designed mitigation measures which 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. The proposal is also consistent with the requirements of Section 7 of the RMA, with particular regard given to the efficient use and development of natural and physical resources. 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.

7.2 Section 104(1) 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 (NES)
- National Environmental Standard for Freshwater Management, 2020 (NESFM)
- National Policy Statement for Freshwater Management, 2020 (NPSFM)
- Region Water Plan Southland (RWPS), 2010

- Proposed Southland Water and Land Plan (PSWLP), 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 plan is adequate as these plans ultimately give effect to the higher order statutory instruments. As such, no individual assessment has been made against the National Environmental Standard for Sources of Human Drinking Water. A brief assessment has been made against the recently released National Policy Statement for Freshwater Management as it contains the most up to date national policy directions that need to be considered.

Relevant policies from the RWPS, and the PSWLP are considered relevant to this application and are assessed below. The rules and policies in PSWLP have legal effect from the date of notification and weight must be given to the policies contained in PSWLP alongside the existing policies in the RWPS.

7.2.1 National Policy Statement for Freshwater Management 2020

The National Policy Statement for Freshwater Management 2020 (NPSFM) recently came into force on 3 September 2020. This document is a national direction for managing freshwater in New Zealand and has been introduced alongside some relevant National Environmental Standards for Freshwater. As both the RWPS and PSWLP were given legal effect prior to the NPSFM coming into effect it is considered appropriate to undertake a brief assessment of the proposal against the objectives and policies of the NPSFM (2020).

The policies of particular relevance to this application for resource consent are outlined below. The proposal has been carefully considered against Te Mana o te Wai, the objective and all relevant policies listed below and in the context of the detailed assessment of effects is strongly considered to be consistent with all the relevant provisions of the NPSFM.

The fundamental concept underpinning the NPSFM (2020) is Te Mana o te Wai, that is recognising the fundamental importance of water and the health of water in protecting the health and well-being of the wider environment. Within the context of the NPSFM this encompasses 6 principles relating to the roles of tangata whenua and New Zealand in the management of freshwater and the implementation of the NPSFM.

The NPSFM (2020) also sets out a hierarchy of obligations and an objective for Te Mana o Te Wai that prioritises first the health and wellbeing of water bodies and freshwater ecosystems over second the health needs of people, and third, the ability of people and communities to provide for their social, economic, cultural well-being.

A number of the principles set out for Te Mana o te Wai are directly relevant to Councils in giving effect to the NPSFM (for example through plan making processes), as they focus on tangata whenua's authority and responsibility and actions, as well as governance by the council. Many of the principles are more difficult for an applicant to give effect to. The two principles that stand out as relevant are the following:

"(e) Stewardship: the obligation of all New Zealanders to manage freshwater in a way that ensures it sustains

present and future generation."

"(f) Care and respect: the responsibility of all New Zealanders to care for freshwater in providing for the health of the nation."

This proposal is consistent with the framework that gives direction to restoring and preserving the balance between water, the environment, and the wider community. For the reasons given in the assessment of effects above in Section 6, this balance will be found by a reduction in nitrogen as proposed by this application and use of GMPs across the dairy farm.

This proposal has been prepared with the wider catchment in mind, and cumulative effects of farming activities in the catchment. This is consistent with the ki uta ki tai integrated management framework, where users, stakeholders, the ORC, and community have been involved in identifying values for protection through

Further discussion of relevant policies within the NPSFW (2020) is provided in the table below.

Table 15: Applicable policies from the NPSFW (2020).

Policy	Wording	Comment
1	Freshwater is managed in a way that gives effect to *Te Mana o te Wai*.	See above discussion.
2	*Tangata whenua* are actively involved in freshwater management (including decision making processes) and Māori freshwater values are identified and provided for.	See above discussion.
3	Freshwater is managed in an integrated way that considers the effects of the use and development of land on a whole-of-catchment basis, including the effects on receiving environments.	Surface water quality in the receiving environment is considered to be generally poor when assessed against the objectives within the NPSFM and the ANZECC guidelines. Trend data indicating improving trends across all parameters. The Overseer modelling of the proposed farm system in its entirety models that nitrogen losses to below the root zone will reduce by 8.7% Phosphorus will reduce by 5.2%. There is also a highly likely reduction in sediment and microbial. The health and well-being of the

		receiving environments is predicted to improve as a result of the proposal as described.
4	Freshwater is managed as part of New Zealand's integrated response to climate change.	Same as for Policy 3.
5	Freshwater is managed through a National Objectives Framework to ensure that the health and well-being of degraded water bodies and freshwater ecosystems is improved, and the health and well-being of all other water bodies and freshwater ecosystems is maintained and (if communities choose) improved.	Same as for Policy 3.
12	The national target (as set out in Appendix 3) for water quality improvement is achieved.	The national targets from primary contact are based on water quality in terms of *E. coli* and cyanobacteria. In terms of these parameters, the effluent discharge activity has been designed to utilise low-rate application, deferred storage of effluent and strategic application to a variety of soil types in order to avoid the loss of contaminants via overland flow, deep drainage or through artificial drainage channels which could adversely impact water quality and the ability of people to come into contact with these water bodies.
13	The condition of water bodies and freshwater ecosystems is systematically monitored over time, and action is taken where freshwater is degraded, and to reverse deteriorating trends.	Water quality monitoring on the Mataura River is currently undertaken under the State of the Environment monitoring programme to ensure continuous monitoring over time to identify trend data. The proposal includes simultaneous monitoring and management of nutrient inputs and outputs

		from the farm in order to identify areas of improvement which could improve water quality in the receiving waters.
15	Communities are enabled to provide for their social, economic, and cultural wellbeing in a way that is consistent with this National Policy Statement."	The continuation of a dairy farm provides greater opportunities of the local economy in terms of permanent jobs and support of local schools and communities. Positive economic, social and cultural well-being should result.

7.2.2 Land Use

Planning Document	Particularly relevant sections
Southland Regional Policy Statement	Objectives RURAL.1, RURAL.2, Policies RURALl.1, RURAL.2
Proposed Southland Water and Land Plan	Policies 6, 13, 16, and 39A
Te Tangi a Tauira	Section 3.5.7, 3, 5, and 13

Policies 6, 13 and 16 of the PSWLP appear to have equal weighing, and the proposal is consistent with each of these.

The proposal represents a sustainable farming operation. Through nutrient modelling the applicants have demonstrated that the loading of nutrients on the property are a negligible proportion of the total loading in the Toetoes Harbour. Furthermore, the expanded dairy platform provides for improved farm systems that will over time contribute to improved environmental outcomes and a small but likely reduction in catchment nutrient loading. The continuation of farming would provide for the economic and social well-being of the applicant and the communities they support. The proposal is consistent with the objectives and policies in the SRPS and Policy 13 of the PSWLP by supporting the sustainable use and development of rural land resources, both environmentally and economically, if undertaken in the manner as proposed.

The applicant has implemented a FEMP which is in accordance with Appendix N of the PSWLP. Good Management Practices and mitigations are most effective at the farm scale if they are targeted to the risk area, in this instance the effects of combined deferred FDE storage, greater flexibility to better utilise the less vulnerable areas of the farm, and adherence to the appropriate buffer zones between water bodies and grazed areas, all successfully avoid or mitigate adverse effects to a practical minimum where they are less than minor. Sediment run-off is managed to a level that it is low risk for the farm system proposed. The FEMP

identifies the critical source areas on the landholding and describes how they will be managed by the applicant to minimise nutrient losses at these points.

7.2.3 Water Quality

Planning Document	Particularly relevant sections
Southland Regional Policy Statement	Objectives WQUAL.1, WQUAL.2, Policies WQUAL, 1, 2, 5, 7, 8
Regional Water Plan for Southland	Policies 25, 41 and 42
Proposed Southland Water and Land Plan	Policy A4 of NPSFM Objectives 6 and 8 Policies 6, 12, 15B, 16, 17, 18, and 39A
Te Tangi a Tauira	Section 3.5.13 and 3.6.13

Objective WQUAL.1 is of significant relevance to the proposal as it sets the water quality framework for the management of water quality in Southland. The objective requires four primary things:

- The life supporting capacity of water and related ecosystems is safeguarded;
- The health of people and communities is safeguarded;
- Water quality is maintained or improved in accordance with the National Policy Statement for Freshwater Management 2020; and
- Freshwater quality is managed to meet the reasonably foreseeable social, economic and cultural needs of future generations.

The farm is situated in the Oxidising, Gleyed, Old Mataura and Bedrock/Hill Country physiographic zones. Policy 6, 9 and 10 require the implementation of good management practices to manage adverse effects cumulatively and propose GMPs and mitigations (where appropriate) to mitigate and/or avoid effects of the activities on water quality. These GMPs and mitigations are proposed to be implemented by way of a FEMP that has been prepared by the applicant and appended to this application. Genuine attention and thought have been given to the potential adverse effects of the proposal on water quality, in the context of the most likely contaminant pathways. With regards to Policy 15B, effort has been made to provide an assessment of the likely nutrient loading from the property and shows that nutrient loss is unlikely to have an impact on current nutrient loads in the receiving environment and Toetoes/Fortrose Harbour Estuary. The proposal would result in a reduction in contaminant losses compared to the legal existing environment over time, as the expanded milking platform provides greater opportunity to utilise the total farm area in a way that is more sustainable and results in positive environmental outcomes. Therefore, the proposal is consistent with the relevant policies noted above.

Policy 16 requires the minimising of adverse environmental effects from farming activities. Part (a) applies

as the property is within proximity of the Toetoes/Fortrose Harbour Estuary that is identified as a sensitive waterbody in Appendix A of the PSWLP. As noted elsewhere in this proposal, this proposal does not involve an increase in the total number of cows on farm, just in a stock class change. The proposal does involve new dairy farming however this new dairy farming is less intensive than the previous use of a winter grazing block. Therefore, the proposal is consistent with Policy 16(1) as the assessment here demonstrates the GMPs and mitigation applied to minimise adverse environmental effects on the downstream sensitive receiving environments.

Policy 16(1)(b)(iii) likely applies as it is our assumption that no lowland surface water body in Southland meets the Appendix E water quality standards, and there is no data for the waterways on the property to confirm or prove otherwise. However, in the context of demonstrating that there will be some improvement in water quality over time as a consequence of the amalgamated farm, it is considered that the 'generally' component of the policy applies and Policy 15B and the higher objectives would provide an appropriate approach that would support granting application that have been able to demonstrate that they would result in an improvement in water quality.

Policy 15B requires improvement of water quality where it does not meet Appendix E standards and this proposal is consistent with this policy.

The proposal to expand the dairy platform provides for a variety of measures which either avoid or further mitigate against adverse effects on water quality which are described in detail earlier. For example, the change in stock class and the greater crop rotation is an improvement on what is currently consented and provides an improvement at a catchment level.

7.2.4 Water Quantity

Regulatory Document	Particularly relevant sections
National Policy Statement for Freshwater Management	Objective B5 Policies B1, B2, B4, B7 and B8
Southland Regional Policy Statement	Policies WQUAN.3, WQUAN.6, and WQUAN.7
Regional Water Plan for Southland	Policies 21, 22, 28 and 29
Proposed Southland Water and Land Plan	Policies 20, 21, 22, 23 and 42
Te Tangi a Tauira	Section 3.5.14 Policies 4 and 16

These objectives and policies set a clear direction that freshwater needs to be allocated to safeguard the life supporting capacity of freshwater ecosystems whilst still enabling communities to provide for their economic well-being. The policies of particular relevance from the Southland Policy Statement relate to ensuring that the volume of water abstracted is needed for a particular use and is allocated to it. In this instance, the groundwater abstractions are required for dairy farming purposes and are set at a quantity which is suitable for the intended end use based on nutritional requirements of dairy cows and the infrastructure setup at the

dairy shed. This is supported by Policy 21 of the RWPS. This application is consistent with Policy 28 of the PSWLP and Policy 21 of the RWPS as effects on aquifer storage volumes, existing water users, surface water flows and groundwater quality will not be adversely affected due to the proposed decrease in water quantity sought by the applicants. The proposal is consistent with all water quantity policies in Te Tanga a Tauira specifically Policy 4 preferring groundwater abstractions and Policy 16 requiring monitoring devices.

7.2.5 Effluent discharge

Planning document	Particularly relevant sections
Southland Regional Policy Statement	Objectives WQUAL.1 Policies WQUAL.8, WQUAL.10
Regional Water Plan for Southland	Policies 7, 31A, 31C, 31D and 42A
Proposed Southland Water and Land Plan	Policies 13, 14 and 17
Te Tangi a Tauira	Section 3.5.1

Policies throughout the relevant planning documents stress a preference for the discharge of contaminants to land as it creates less environmental effects, enables an effective and efficient re-use of a waste produce and protects values as described in Te Tangi a Tauira. The management of effluent in the proposal meets best practice and is designed to avoid any surface runoff, overland flow, ponding, contamination of water via, deep drainage or overland flow from the application of effluent to land. The land which will be receiving effluent is considered suitable and the discharge areas are sized appropriately to lower overall nutrient loads from the application of effluent.

7.2.6 Tangata Whenua

Planning Document	Particularly relevant sections
Southland Regional Policy Statement	Policies TW.3, TW.4
Regional Water Plan for Southland	Polices 1A
Proposed Southland Water and Lan Plan	Policies 1 and 2
Te Tangi a Tauira	Entire document

The Southland Regional Policy Statement describes the resource management issues important to Ngai Tahu in the Southland regional and includes ensuring tangata whenua is considered in decision making, iwi management plans are recognised, taonga and sites of special significance are protected and food gathering resources are protected. Te Tangi a Tauira is the iwi management plan recognised by Ngai Tahu which encompasses the Southland region. Policies TW.3 and Policy 2 of the PSWLP require iwi management plans to be taken into account.

This proposal includes activities which are contained within the property boundaries and should not materially impact on tangata whenua values or compromise sites of special significance of food gathering

sites. The cumulative effects assessment concludes that any effects felt outside the boundary of the property will not degrade water quality and not impact on cultural values such as mahinga kai.

In addition, the application provides for the following in accordance with Te tangi a tauira:

- The provision of buffer zones to water abstraction sites and waterways;
- The application effluent is to land rather than water;
- The applicants already adopts best practice for land application of managing farm effluent;
- The existing riparian margins are protected;
- Deferred application of FDE and solid effluent is provided for;
- Nutrient loading from effluent discharges to land is already within industry best practice limits;
- The system and management practices are considered appropriate for the risks associated with the receiving environment;
- Water abstraction is to be monitored with metering results to be submitted to Council;
- Regarding Policies 3.5.14.17 and 3.5.1.17, the consent periods proposed are less than 25 years.

Furthermore, the application recognises proximity to the site of the Toetoes Estuary and the significance of this Regional Significant Wetland within the coastal environment. Therefore, the policies identified in section 3.6.13 have been considered here.

7.3 Sections 105 and 107 of the RMA

In addition to the matters in Section 104(1) of the RMA, if an application is for a discharge permit a consent authority must have regard to the matters as specified in Section 105. The proposed discharge can be undertaken in a manner which avoids contaminants from entering water through controls on application method and conditions of consent. As nutrients can be reused, there is a direct benefit to the property as a method for improving soil fertility. The discharge of effluent to land is the best method for avoiding adverse effects on water as might otherwise occur in the event that the discharge was directly to water, which would result in a worse environmental outcome.

There are no matters under Section 107(1) of the RMA that would require the consent authority to decline this application.

8. Consent Duration, Review and Lapse

8.1 Consent Duration

With regard to consent duration, special consideration has been given to Policies 14A and 43 of the RWPS and Policy 40 of the pSWLP, and Te Tangi a Tauira which have been grouped below for ease of assessment.

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

The environmental effects of the change in land use and farm system proposed are described in this application. The assessment above and contained within the attached documents explains these activities and effects so that Council may have certainty in their nature (what they are), scale (how minor they are in the wider context of the catchment), their duration and frequency of effects (i.e., ongoing positive effects overall). 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.

The existing environment is reasonably well known, and the proposal is very likely to improve water quality beyond that which is observed in the existing environment.

Matching consent duration to the level of risk of adverse effects.

The risk of adverse effects arising from dairy farming land use varies on a case-to-case basis and for the most part the risk level is greatly controlled by human behaviour and farm management. The effluent structures and infrastructure are of sound construction. They have been tested to ensure they are not leaking and will be frequently monitored in future to ensure that the risk of raw effluent discharges to water bodies (adverse effect) is extremely low.

The extent and nature of the actual and potential adverse effects of the activities on the existing environment were assessed in this document and concluded to be no more than occurring historically in the existing baseline.

Overall, the risk of unanticipated or unexpected adverse effects occurring is low because of the mitigations and GMPs. Ongoing development and investigation in new technologies, mitigations and of farm education will ensure that the risks can remain low throughout the consent duration proposed.

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

The applicant seeks a 10-year consent duration for all the applications. We consider that this is a reasonable timeframe which would provide adequate time for the applicants to finalise and implement the amalgamation proposal.

The permanence and economic life of any investment

Significant investment has been required just to get to the point of making the application, with expenditure

on professional services, including business feasibility studies, nutrient advice, effluent system review, water quality and policy and planning assessments.

The investment in both properties is significant and in the order of millions of dollars. The market for dairy products both nationally and globally is strong. Commodity market influence is always a factor and will influence the profitability of the proposed farm. An appropriate consent duration will encourage investment and improvements on farm which can improve environmental outcomes and buffer the applicant's ability to respond to commodity market changes which secures the permanence of the activity. Furthermore, the permanence of the economic life of the activity requires resource consents to be granted from the Council for a reasonable duration.

Common expiry date for permits that affect the same resource

A common expiry date for all the permits applied for is considered appropriate.

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.

Timing and development of FMUs

Granting 10-year duration resource consents will not adversely affect the development and implementation of any revised framework established in the FMU section of the PSWLP, as Council has the ability to have new rules take effect from the date of notification of a plan change and would also be able to review all contents in the catchment collectively.

In conclusion, due to the low level of environmental risk of the proposed activities and substantial value of the investments on the property, 10-year consent durations are considered entirely appropriate.

8.2 Consent Commencement

Any consents granted subject to this application will commence as of the date they are given effect to.

Therefore, the existing consents will need to be surrendered (Section 128 of the RMA) or expire (Section 123 of the RMA) prior to the new consents being given effect to. Therefore, it is appropriate to apply a condition that requires consents must not be exercised until any current consents for the same activity have been surrendered or have expired.

8.3 Review of Lapse

The applicants have no objection to the Environment Southland standard review conditions. In accordance with Section 125 of the RMA, the default 5-year lapse period is appropriate.

9. Conclusion

A decision to grant the resource consent application(s) under Section 104B and 104C is recommended on the basis that:

a) the adverse effects on the environment are likely to be insignificant;
b) The proposal is consistent with the requirements of the RMA, relevant plan objectives and policies and other relevant matters.

Granting the resource consent application(s) will be consistent with the purpose of the RMA for the reasons explained within this report. The proposed activities are highly unlikely to result in further degradation of water quality and potential adverse effects will be avoided or mitigated as far as practicable.

Appendix A: Farm Environmental Management Plan

33254

TIAKI FARM ENVIRONMENT PLAN

ABOUT YOUR TIAKI FARM ENVIRONMENT PLAN

This Tiaki Farm Environment Plan document is the result of a tailored farm environment planning service provided to you through the Co-operative Difference. 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. Farm Source 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

FARM OWNER

Cashmere Bay Dairy Limited
145 Jaffray Road
RD 7
Gore 9777

PLAN OWNER

George Edward Digby Raymond
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otamadairy@gmail.com

145 Jaffray Road RD 7
Gore 9777

FARM ADDRESS

JAFFRAY RD

Riversdale

LOCATION

REGIONAL COUNCIL

Southland

PLAN LAST EDITED

27 September 2021

POINTS OF NOTE

* Southland Physiographic Zones
Bedrock/Hill Country: 1.15 ha - 0.22 %.
Bedrock/Hill Country: 10.41 ha - 1.99 %.
Gleyed: 49.65 ha - 9.48 %.
Gleyed: 55.50 ha - 10.59 %.
Gleyed: 0.03 ha - 0.01 %.
Gleyed: 7.88 ha - 1.50 %.

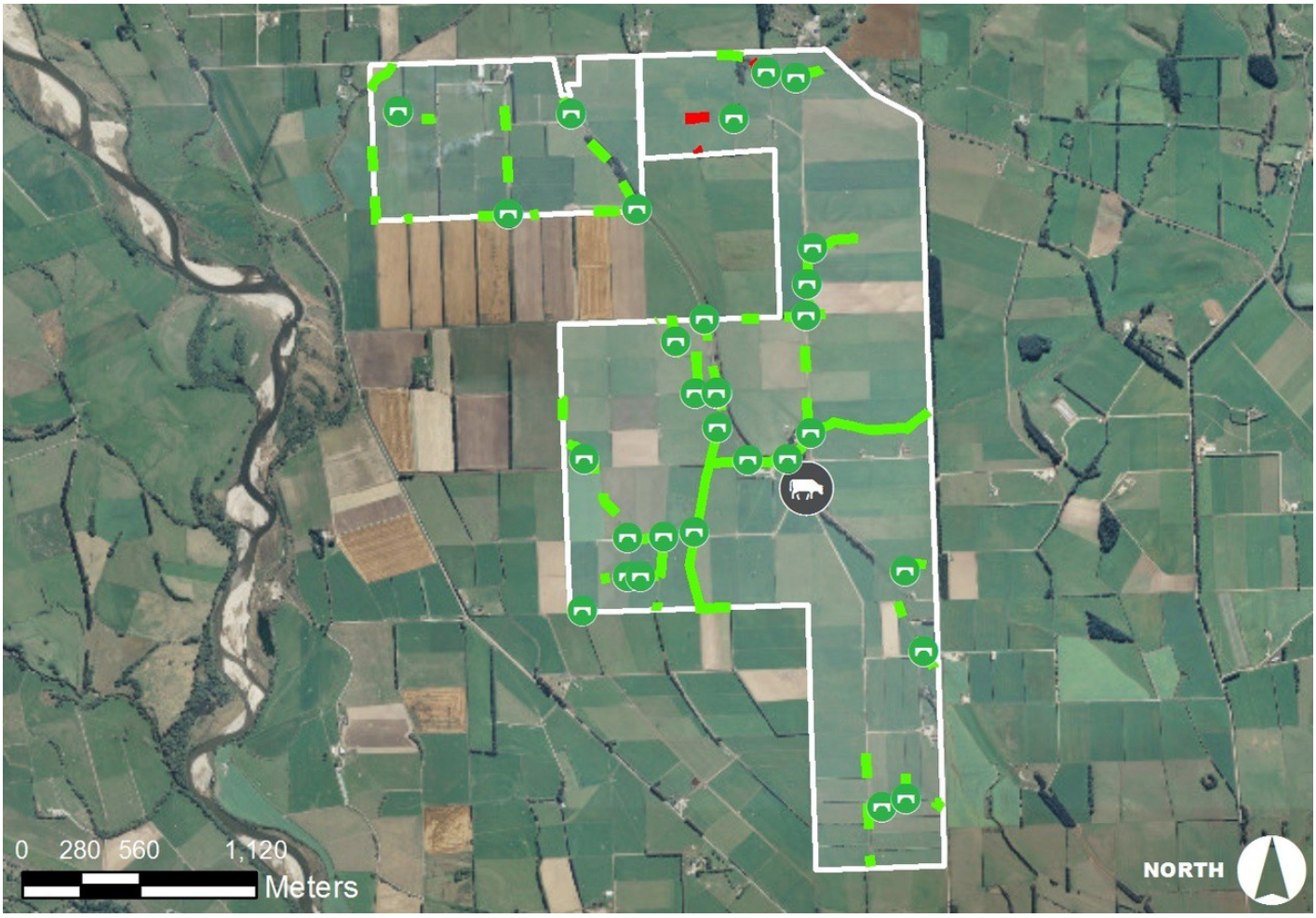
Old Mataura: 57.09 ha - 10.90 %.
Oxidising: 331.43 ha - 63.26 %.
Oxidising: 0.32 ha - 0.06 %.
Oxidising: 0.14 ha - 0.03 %.
Riverine: 0.02 ha - 0.00 %.
Gleyed: 0.88 ha - 0.17 %.
Bedrock/Hill Country: 9.09 ha - 1.73 %.
Oxidising: 0.37 ha - 0.07 %.
* Southland Consents
Type:Water Permit,ID:AUTH-20158314,Expiry:2025-10-08: 0.01 ha - 0.00 %.
Type:Water Permit,ID:AUTH-20158314,Expiry:2025-10-08: 0.01 ha - 0.00 %.
Type:Water Permit,ID:AUTH-20158314,Expiry:2025-10-08: 0.01 ha - 0.00 %.
Type:Dairy Consent,ID:AUTH-301811-V2,Expiry:2022-12-19: 0.01 ha - 0.00 %.
Type:Water Permit,ID:AUTH-301812-V1,Expiry:2022-12-19: 0.01 ha - 0.00 %.
* NZLRI Land Use Capability
3s 2: 0.35 ha - 0.07 %.
3s12: 5.85 ha - 1.12 %.
4s 1: 276.70 ha - 52.81 %.
3e12: 20.03 ha - 3.82 %.
4s 4: 221.02 ha - 42.18 %.

LAND PARCELS

Fee Simple, 1/1, Part Section 10 Block II Otama Survey District, 410,124 m2,Fee Simple, 1/1, Section 5 Block II Otama Survey District, 805,324 m2,Fee Simple, 1/1, Section 4 Block I Otama Survey District, 783,901 m2,Fee Simple, 1/1, Section 2 Block II Otama Survey District, 809,371 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 Simple, 1/1, Part Section 10 Block II Otama Survey District, 27,238 m2,Fee Simple, 1/1, Part Section 10 Block II Otama Survey District, 356,705 m2,Fee Simple, 1/1, Section 4 Block II Otama Survey District, 809,371 m2

FARM OVERVIEW MAP

The map below presents the land in 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.



- Major Stock Excluded Waterway
- Major Stock Not Excluded Waterway
- Minor Stock Excluded Waterway
- Minor Stock Not Excluded Waterway
- Farm Boundary
- Compliant Crossing
- Non-Compliant Crossing
- Non-Compliant Non-Regular Crossing
- Dispensation Crossing
- Dairy Shed

GOOD FARMING PRACTICES

This section provides an overall snapshot of the farm's Good Farming Practices (GFPs). Based on industry-agreed identified practices, the GFPs in this Farm Environment Plan are grouped by the six core management areas on farm. Each management area below displays the farm's progress towards achieving all the GFPs within that area. This section also includes additional GFPs relevant to the dairy industry goals.

ACHIEVED	NOT ACHIEVED	N/A
12	11	3

GENERAL FARM

67% ACHIEVED
2 ACTIONS

LAND & SOIL

33% ACHIEVED
2 ACTIONS

IRRIGATION

50% ACHIEVED
1 ACTION

EFFLUENT

60% ACHIEVED
2 ACTIONS

WATERWAYS & BIODIVERSITY

33% ACHIEVED
4 ACTIONS

NUTRIENT

50% ACHIEVED
2 ACTIONS

GOOD FARMING PRACTICES

The tables below assess the GFPs recorded in this Farm Environment Plan. GFPs already in place on this farm, will be listed as “Achieved”. GFPs yet to be achieved or in progress, will show the number of open actions required to achieve the GFP. GFPs that are not applicable in this Farm Environment Plan will be listed as “N/A”

GENERAL FARM MANAGEMENT

Identify the physical and biophysical characteristics of the farm system, assess the risk factors to water quality associated with the farm system, and manage appropriately	ACHIEVED
Maintain accurate and auditable records of annual farm inputs, outputs and management practices	ACHIEVED
Store and load fertiliser with minimal spillage and leaching	ACHIEVED
Store, transport and distribute feed to minimise wastage, leachate and soil damage	1 ACTION(S)
*Farm waste is minimised and managed properly	1 ACTION(S)
*Water use for the dairy shed and stock water is efficient	ACHIEVED

LAND & SOIL MANAGEMENT

Manage farming operations to minimise direct and indirect losses of sediment and nutrients to water, and maintain or enhance soil structure, where agronomically appropriate	1 ACTION(S)
Reduce periods of bare soil between crops and pasture to reduce erosion and leaching	ACHIEVED
Retire all LUC 8 land and retire LUC 7e land or ensure that it has soil conservation measures in place	N/A
Use appropriate paddocks for intensive grazing	N/A
Manage grazing to minimise nutrient loss from risk areas	1 ACTION(S)

IRRIGATION MANAGEMENT

Irrigation rates and timing match plant requirements	ACHIEVED
Design, calibrate and operate irrigation systems to use water efficiently	1 ACTION(S)

*Additional GFP relevant to the dairy industry goals

GOOD FARMING PRACTICES

EFFLUENT MANAGEMENT

Effluent system meets code of practice	ACHIEVED
Sufficient suitable storage available	ACHIEVED
Spreading equipment is well maintained and calibrated	1 ACTION(S)
Effluent applied at correct depth, rate and time	ACHIEVED
*All effluent systems	1 ACTION(S)

WATERWAYS & BIODIVERSITY MANAGEMENT

Identify areas where runoff may occur and manage to avoid runoff entering waterways	2 ACTION(S)
Tracks, feed areas, gateways and troughs are located away from waterways	ACHIEVED
Stock are excluded from waterways	2 ACTION(S)
*Areas of native plants or significant biodiversity are protected	N/A

NUTRIENT MANAGEMENT

Monitor and maintain P levels at the economic optimum	ACHIEVED
Fertiliser application matches plant requirements and minimises losses	1 ACTION(S)
Spreading equipment is well maintained and calibrated	1 ACTION(S)
*General Nutrient Management	ACHIEVED

*Additional GFP relevant to the dairy industry goals

ACTIONS & RECOMMENDATIONS

This list includes all actions and recommendations that have been agreed as part of this Farm Environment Plan. Actions are required to achieve Good Farming Practices. Actions that have a target date within 2 years are captured as “Current Actions”. Actions with a target set more than 2 years in the future are captured as “Future Actions”. “Recommendations” cover all other actions that are not related to a GFP.

CURRENT ACTIONS

	Target Date
Nitrogen - Assess Requirements before Applying	01 Oct 2021
Calibrate the Cobra Rain Gun	01 Feb 2022
Provide a Winter Grazing Paddock Plan	01 May 2022
Recycle Farm Waste	01 Aug 2022
Culvert Repairs	01 Aug 2023
Provide an Effluent Management Plan	01 Aug 2023
Manage High-risk Laneway Areas	01 Aug 2023
Permanently Fence/Drain Waterway Sections	01 Sep 2023

FUTURE ACTIONS

	Target Date
Calibrate Pivots & Rotorainers	01 Oct 2023
Develop a Riparian Plan	01 Jun 2024
Manage the Critical Source Areas	01 Aug 2024
Use Spreadmark Accredited Contractors	01 Aug 2024
Improve Silage Storage	01 Oct 2028

RECOMMENDATIONS

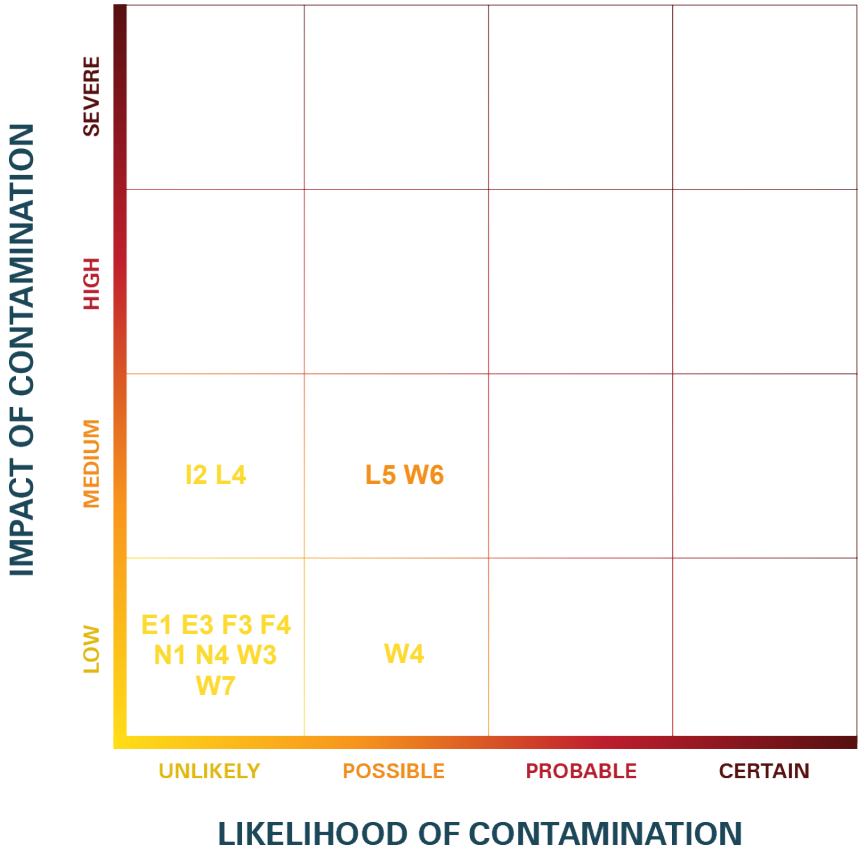
	Target Date
Consent for the Calving pad	
Maintain/Enhance Mahinga Kai Values	
Investigate Installing Tile Drain Treatment Methods	
Review Nitrogen Efficiency Improvements / Loss Reduction Section of this Plan	
Reduce Nitrogen Fertiliser Use	30 Jun 2022

Key: Action Priority

Low Medium High Critical

UNDERSTANDING THE RISKS ON YOUR FARM

This section provides some context to help understand the relative impact and likelihood of environmental risks that have been identified on your farm. The chart on this page together with the map on the following page can be useful when thinking about what environmental risk areas on your farm need the most focus.



HOW ARE RISK RATINGS MEASURED?

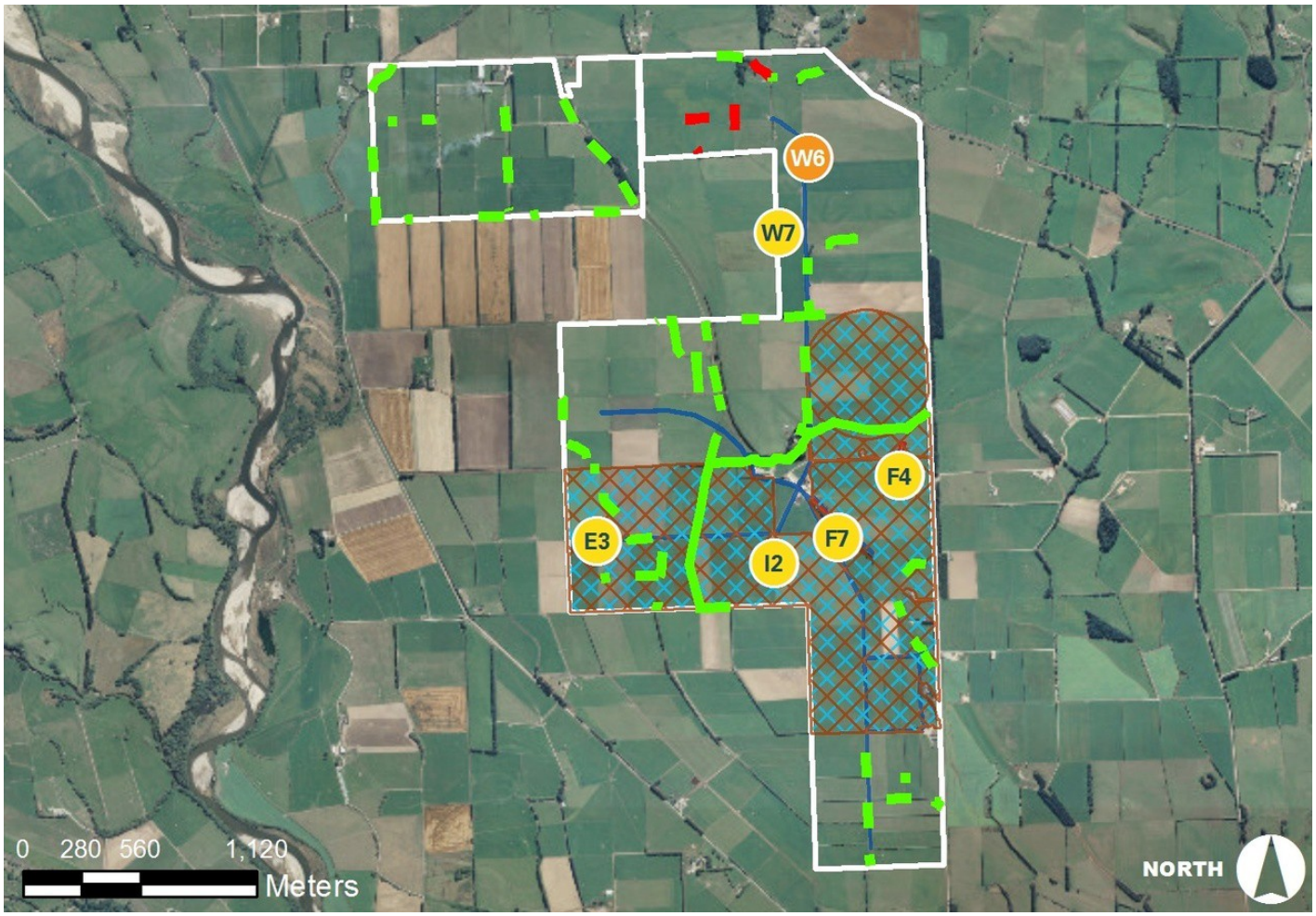
The issues plotted on the chart above have been done so based upon two measures that are assigned to a specific area of your farm where an environmental risk has been identified. 1. Impact of contamination (on the vertical axis, or the first dial) is a measure of the potential scale or significance of contaminants that may be lost from this area of your farm. It's about quantifying how bad could the outcome for the environment be; 2. Likelihood of contamination (on the horizontal axis, or the second dial) is about the chance of the contamination actually occurring from that area of your farm. It takes into account things like how far the area might be from waterways as well as the slope or aspect of the area; When combined together the two measures also give an overall 'risk rating'. The measures and the combined rating are presented for each risk area along with other descriptive information about the risk area on the subsequent pages of this document.

Example:

UNDERSTANDING THE RISKS ON YOUR FARM

The map below shows the location of the risk areas identified on your farm. The Risk Rating presented here is a combined measure of the impact and likelihood of contamination occurring from each risk area.

Low Medium High Critical



- F3 Storage, Infrastructure & Waste Overview
- F4 Silage Storage
- L4 Winter Grazing
- L5 Critical Source Area
- I2 Pivot/Rotorainer Irrigation
- E1 Effluent Overview
- E3 Effluent Irrigation
- W3 Future Riparian Planting
- W4 Unfenced Drains
- W6 Race Management & Maitenance
- W7 Crossing
- N1 Nutrient Management Overview
- N4 Fertiliser applications

MAHI WHAKAHAERE
GENERAL FARM MANAGEMENT

F1 Follow-up Visit 06/08/2021

F2 Farm Overview - Farm Overview

F3 Infrastructure, storage, waste Overview - Storage, Infrastructure & Waste Overview

F4 Silage Storage -

F5 Water Use Overview

F6 Resource Consents - Resource Consents

F7 Calving Pad - Calving Pad

F8 Key Feature - Irrigation & Farm F45/0422

F9 Key Feature - Irrigation Bore F45/0434

F10 Key Feature - Irrigation Bore F45/0426

F11 Key Feature - Offal Pit

F12 Key Feature - Fuel Storage

F13 Key Feature - Dairy Shed & Tanker Track

F14 Key Feature - Fuel Storage

F15 Key Feature - Chemical Storage

F16 Key Feature - Offal Pit

F17 Key Feature - Decommissioned Bore F45/0172

FARM MANAGEMENT

GOOD FARMING PRACTICES

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.	ACHIEVED
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.	ACHIEVED
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	ACHIEVED
Store, transport and distribute feed to minimise wastage, leachate and soil damage	1 ACTION(S)
*Farm waste is minimised and managed properly	1 ACTION(S)
*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	ACHIEVED

*Additional GFP relevant to the dairy industry goals

FARM MANAGEMENT

FOLLOW-UP VISIT 06/08/2021

F1

Original Farm Environment Plan completed March 2019, plan updated to include the following

- Waterways fencing completed on the new block (Runoff 2)
- Some CSA risks reduced
- Effluent Pond Drop Test completed
- Visual sign off of main effluent pond and solids pond completed
- New Laneway Runoff 2
- Updated storage calculation done for consent renewal
- Updated plan to include Essential Freshwater requirements

FARM MANAGEMENT

FARM OVERVIEW

F2

IMPACT OF CONTAMINATION  +  LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

The property is owned and operated by Cashmere Bay Dairy Limited, farm named as Otama Dairy and is located off Jaffray Road at Otama. The property is in the Mataura River/Okapua Stream/Otama Creek catchments and operates under Environment Southlands effluent discharge and water take consented rules.

The total dairy farm area is 353ha (from Fonterra mapping) of which 344ha is effective on flat to gently rolling topography, made up of a regular effluent area of 187.7ha (excludes Environment Southlands water bore buffers, but not waterway setbacks), non-effluent area of 157ha with 8.6ha non-effective from houses and sheds, dairy shed, & effluent infrastructure, lanes and riparian margins along waterways. Irrigation water can be applied to 187.7ha with the use of a center pivot, large Rotorainer and one small Rotorainer.

There are two attached runoff blocks, Runoff - 89.6ha total and 89.6ha effective and Runoff 2 (new block) 80.3ha and is 76.5ha effective.

The farm is consented for 1000 cows and in the 20/21 season 1000 cows were peak milked, the farm is to submit a land use consent to increase consented cow numbers to 1140. Swedes, Chow and Fodder Beet were used in the 2021 winter, MA cows & heifers were wintered on the attached Runoff 2, R1 heifers and R1 bulls on Runoff.

Imported supplements used and feed through the shed are from Barley Grain and PKE.

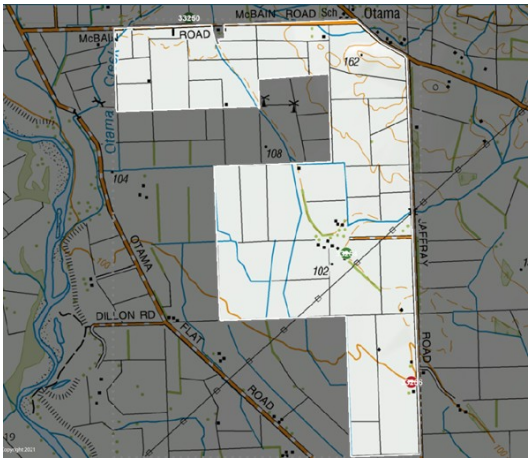
Good records are kept of stock numbers, supplementary feeds, crops, fertiliser use and location/time of spreading, these are required so an accurate environmental report can be produced each season.

This Farm Environment Plan covers the dairy platform and the two attached runoffs, the 20/21 season farm dairy records were used to produce a nitrogen risk score card for the farm. An updated nutrient budget has been completed for the farm as part of the proposed land use consent.

This Farm Environment Plan is designed to.

- Summarise current farming practises and infrastructure
- List industry agreed Good Farming Practises as either achieved (overview sections of this plan) or Good Farming Practises that need to be actioned
- Highlight any risk to water quality issues and how they should be managed.
- Ensure the farm is meeting its discharge and water consent requirements.
- Identify if any, areas of historic connections or significance and natural resources are protected for Mahinga Kai (food gathering place) value
- Identify other actions which could provide additional environmental benefits

FARM MANAGEMENT



FARM MANAGEMENT

STORAGE, INFRASTRUCTURE & WASTE OVERVIEW

F3

IMPACT OF CONTAMINATION  +  LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

The farm dairy is a 50 bale Waikato rotary shed with a 21,500lt & a 14,000lt milk silo, overall presentation is good with a tidy shed and surrounds. PKE and Barley is feed through the shed and stored in a silo's next to the shed. All effluent from the dairy shed is contained on concrete and directed to the farms effluent system.

There is one silage pit area, the location is shown on the overview map, see silage storage feature for recommendations. Baleage is stored on a dry area which is located away from waterways.

Bulk fertiliser can be stored on farm, storage is on concrete, in a covered shed and located away from waterways and drains.

Diesel/petrol storage for the farm meet minimum distance as outside of 20m from the farm dairy, fuel is in above ground tanks away from waterways and drains, chemical storage is in a lockable shed, see overview map for locations.

General farm/household rubbish is removed off farm by a skip at the dairy shed, baleage is stored and removed off farm, this is not currently recycled.

By undertaking a recycling programme through Agrecovery will help to meet one of the Co- operative difference requirements.

Dead stock are also disposed of in two dead holes, one on Runoff 1 and the other on the dairy platform, they both meet Environment Southlands permitted rules of being outside of 50m from a waterway and 100m from the farm boundary/water abstraction point and do not intercept any on-farm subsurface drains.

ACTIONS | RECOMMENDATIONS

Target Date

Recycle Farm Waste – To Achieve GFP — 01 Aug 2022

Farm waste is minimised and managed properly, this can be achieved with

- Look to Reduce, Reuse and Recycle

- General recyclable farm/household waste (such as cans and bottles) should be taken to a local collection station. Use a skip or wheelie bin for regular collection and disposal of solid waste to a transfer station.

- Chemical containers from participating brand owners can be stored and recycled through Agrecovery free of charge, non-branded containers (or containers with no labels) can be recycled through Agrecovery but at a cost,$2.30+ GST per 10L container, $19.50 + GST per drum 61-200L and $80 + GST per IBC 500-1000L.

If registered at Agrecovery containers can be dropped off at the Farm Source

FARM MANAGEMENT

stores, need to be triple rinsed or will not be accepted.

- Ballance fertiliser bags can be returned, need to put pressure on other companies to reuse/take back some of this material i.e. feed and mineral bags.

- Plasback operate a user pays baleage wrap recycling scheme across New Zealand. See www.plasback.co.nz. Costs for recycling is approximately $40 for 150 bale wraps (includes collection bag).

- Ecolab recycle used detergent containers to Agrecovery, check to see if your supplier will do the same

Practices:

Waste is recycled where possible

FARM MANAGEMENT

FARM MANAGEMENT

SILAGE STORAGE

F4

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

The current silage pit is off the tanker track, it is rock based and silage is sufficiently wilted before it goes in the stack to avoid excess leachate. The silage pit is bunded to avoid leachate ponding outside the stack and the covers can go over this bund to prevent stormwater entering the stack, the pit is located away from waterways and tile drains.

Sealed	Compacted metal
Leachate	Contained

ACTIONS | RECOMMENDATIONS

Target Date

Improve Silage Storage – To Achieve GFP

01 Oct 2028

Long term look to have silage stored on a concrete pad with leachate collected and transferred into the farms effluent system or to a sump and applied to land.

A concrete area has been allowed for in the storage calculation done for the farm

FARM MANAGEMENT

WATER USE OVERVIEW

F5

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

Water for dairy shed & stock use is from Environment Southland labelled bore F45/0422, the bore is stock excluded, the bore casing is well above ground level to avoid surface water contamination and the casing head is capped to avoid contamination from birds and rodents, see location on the overview map. Water use for stock & dairy shed is not telemetry with readings having to be taken manually.

Irrigation water is also taken from this bore, water take is telemetry metered with readings sent direct to Environment Southland.

There are two other bores which are used for irrigation water.

F45/0434, located in paddock 15 and is stock excluded, the casing is well above ground level and the cap is secure.

F45/0426, located in paddock 9 and is stock excluded, the casing is well above ground level and the cap is secure.

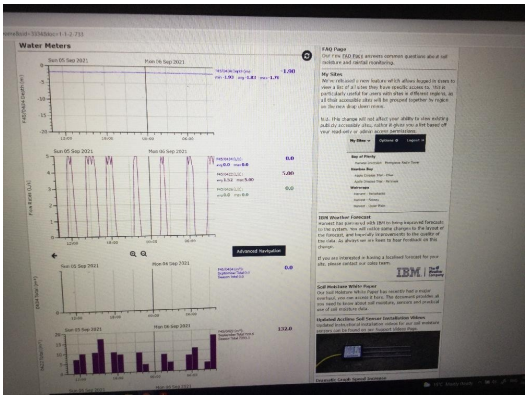
F45/0172 is an historic bore and this is to be decommissioned, see location on the Overview Map

Both these bore also have electromagnetic meters with readings sent direct to Environment Southland. the accuracy of water meters must be verified every 12 months for a mechanical meter and five yearly for an electromagnetic meter or ultrasonic flow meter. Water use from the bores is monitored via Harvest, see attached example picture.

Water use at the dairy is minimised by recycling the cooler water to washdown, water troughs are checked regularly for leaks and leaks are fixed as soon as is possible. Water use through the dairy shed can also be reduced by up to 30% with recycled greenwash used on the backing gate scrapper for washing of the main yard.

The dairy has three 30,000lt water storage tanks.

Water Meter



Electromagnetic Meters

FARM MANAGEMENT

FARM MANAGEMENT

RESOURCE CONSENTS

F6

Cashmere Bay dairy Ltd, currently holds three consents, discharge & water permits from the 19 December 2012 and water permit (irrigation) from the 8 October 2015.

1 - Discharge Permit, AUTH-301811-V2, to discharge dairy shed effluent to land, expires 19 December 2022.

2 - Water Permit, AUTH-301812-V1, to take groundwater for a dairy operation, expires 19 December 2022.

3 - Water Permit, Auth-20158314, to take and use groundwater for the purpose of irrigation, expires 8 October 2025.

A land use consent application is underway to include current support land to be added to the dairy platform, increase cow numbers and to renew the discharge and water consents, this is being done by Landpro. Irrigation take expires in 2025.

The National Policy Statement for Freshwater Management has been released (August 2020) and includes a number of new environmental regulations. On your property the following activities could be impacted in the future by the new regulations:

- Cap on the use of synthetic nitrogen fertiliser
- Winter Grazing
- Stock Holding areas

The regulations permit these activities if certain conditions are met. Where these conditions cannot be met, the farm owner is required to apply for a resource consent from the Regional Council.

The specific requirements and actions are outlined under the relevant sections of this FEP and more general information on the regulations can be found at DairyNZ website link shown below.

ttps:/www.dairynz.co.nz/environment/environmentpolicyandleadership/national-freshwaterregulations/

Irrigation Take	70lt/sec or 6,050m³/day or 480,000m³/year
Consented Cow Numbers	1000
Max Nitrogen Loading Rate	150kg N/ha/yr from effluent
Water abstraction rate	Shall not exceed 120,000 litres/day
Effluent Setbacks	20m of Waterways (minor)/Property Boundaries, 200m of Neighbours Dwelling, 100m Water Abstraction Point

FARM MANAGEMENT

CALVING PAD

F7

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

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, the area is drained underneath to the solids pond, minimal to no effluent is produced from the pad.

It is located well away from any waterways.

Under the 2020 NES freshwater regulations, the calving pad is considered a stockholding area as it are used for holding cattle at a density which pasture, or other vegetative ground cover cannot be maintained (NES definition of stockholding area).

Stockholding areas are required to meet a minimum standard of

- Manage the permeability of the base area so that it is sealed to a minimum permeability standard of 10-9 m/sec (basically concrete)
- Collect, store and dispose of effluent in accordance with regional council regulations or a current discharge permit
- Situate the stock-holding area at least 50 metres away from waterbodies, water abstraction bores, drains and coastal marine areas.

If these standards cannot be met, a resource consent will need to be applied for within 6 months of the 1 July 2021.

ACTIONS | RECOMMENDATIONS

Target Date

☐ **Consent for the Calving pad**

The calving pad does not meet the 2020 NES minimum standards for base sealing and therefore a resource consent will be required within 6 months of 1 July 2021 (required for calving in 2022), this consent will be included in the consent renewals being done for the farm.

WHENUA ME TE ONE
LAND & SOIL MANAGEMENT

LAND & SOIL MANAGEMENT

GOOD FARMING PRACTICES

Manage farming operations to minimise direct and indirect losses of sediment and nutrients to water, and maintain or enhance soil structure, where agronomically appropriate	1 ACTION(S)
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 Compacted soils are subsoil, ripped or cultivated Cover crops (e.g. oats, mustard) are used to reduce losses and increase soil organic matter	ACHIEVED
Retire all LUC 8 land and retire LUC 7e land or ensure that it has soil conservation measures in place	N/A
Use appropriate paddocks for intensive grazing	N/A
Manage grazing to minimise nutrient loss from risk areas	1 ACTION(S)

LAND & SOIL MANAGEMENT

LAND OVERVIEW

L1

The farms topography is flat to rolling underlying mainly well drained Mataura, Oreti, Gore and Pyramid and poorly drained Fleming and Jacobstown soils.

The key risk to water quality is nutrient loss via deep drainage on the well-drained soils and sediment and nutrient loss via the tiles on the poorly drained areas. The tile drains have been mapped to mitigate the risks with winter grazing and applying effluent over drains.

There were numerous Critical Source Area (CSA) identified as part of this Farm Environment Plan visit, they are generally associated with the poor draining soils and springs on the rolling country.

Pugging and compaction of soils on the dairy platform are minimised with.

- All Good Farming Practices associated with winter grazing are undertaken
- A third of the farm is aerated each year
- Wet areas & CSA are reduced with drainage installed and this is to be ongoing
- Lea ground is cultivated and minimum tillage used for second year crops, consider using strip tillage for sowing of crops out of Lea ground.

The use of catch crops (oats) is considered on an annual basis depending on the seasons and paddock conditions, when this is not achievable crop paddocks are resown as soon as is practical to avoid the risk of sediment runoff from bare land and to take up excess nutrients after winter grazing.

Supplements are feed out away from waterways and CSA.

Yearly maintenance is done on laneways to allow good cow flow, prevent the build-up of effluent from occurring and direct runoff to culverts and water. The farm does have some existing shelter belts mainly along waterways which are well maintained

Paddock split in half for a strip-till trial

LAND & SOIL MANAGEMENT

LAND & SOIL MANAGEMENT

SOUTHLAND PHYSIOGRAPHIC ZONE

L2

The Physiographics of Southland were developed to give a greater understanding of the key risks to water quality throughout the Region. The risks to water quality are highly linked to where water comes from and the processes it undergoes as it moves through the soil and drainage networks. Physiographic Zones group areas of Southland that have similar landform types and water quality. The Zones have been identified according to water origin, soil type, geology and topography.

The Physiographic Zones found on the property are listed below:

Oxidising: 332ha - 63%.

Gleyed: 113.94ha - 22%.

Old Mataura: 57.09 ha - 11%.

Bedrock/Hill Country: 20.65 – 4%, will not comment on this zone as under 5%

Riverine: 0.02 ha - 0.00 %, will not comment on this zone as under 5%

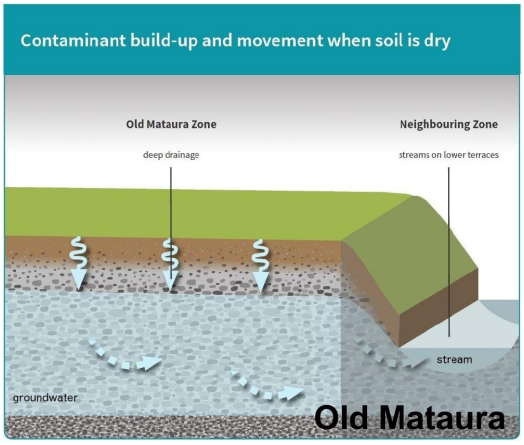
The Oxidising zone is characterised by soil water and groundwater that contains high levels of oxygen, which allows nitrogen to accumulate. Oxidised soils are good at absorbing and storing water and any nitrogen it contains. During drier months, nitrogen is able to accumulate in soil to high levels. During winter when soils are wet, any nitrogen not used by plants leaches down into the underlying aquifer (deep drainage) or into nearby streams on sloping topography or where high concentrations of tile drains occur.

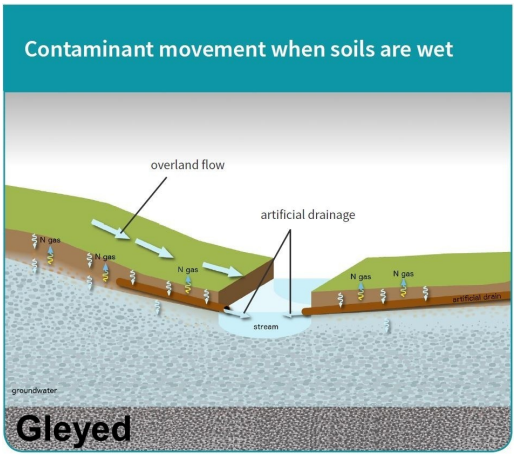
Soils in the Gleyed Zone accumulate and store nitrogen during summer and early autumn when soil moisture levels are low. Some nitrogen will be removed from the soil and aquifers via denitrification (lost as nitrogen gas) so groundwater nitrate concentrations are typically low to moderate. Accumulated 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.

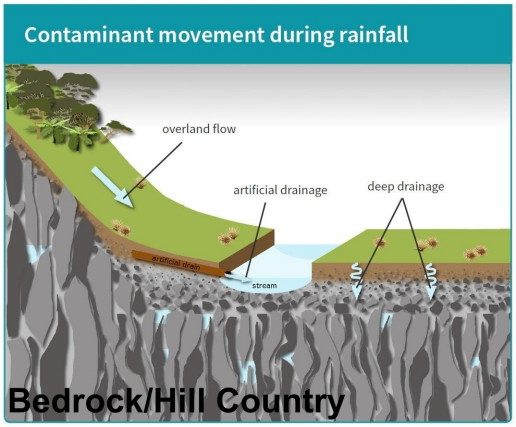
The Old Mataura Zone is located on older, elevated alluvial terraces in the Mataura catchment. Recharge of the underlying aquifer occurs almost exclusively from infiltration of local rainfall through well drained soils. Groundwater flow through the aquifer is generally slow (more time for nitrogen to accumulate) and doesn't get any significant dilution from major rivers. The soils and groundwater found in this Zone have a very limited ability to remove nitrogen resulting in nitrogen building up in groundwater to high levels.

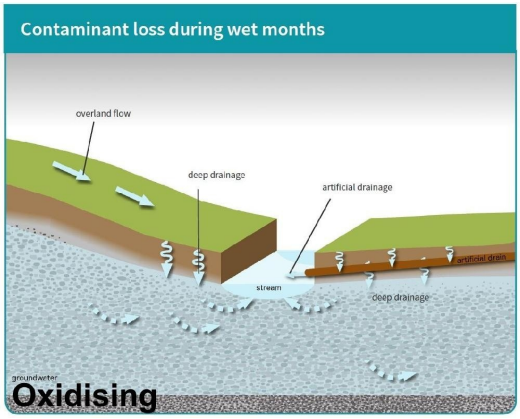
Appendix 1 Physiographic Map

LAND & SOIL MANAGEMENT









LAND & SOIL MANAGEMENT

SOILS

L3

The effective area for the dairy platform and attached runoff's is 497ha and underlays six soil types

Mataura soils make up 219.9ha (44%) of the effective area, they are typically free draining with occasional depressionareas that have imperfect drainage. Textures are typically silt loam to loamy silt with 10 to 20% clay in the topsoil, thisreflects 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 make up 163.4ha (33%) of the effective area, they 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 make up 57.3ha (12%) of the effective area, 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 make up 25.7ha (5%) 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 make up 18.4ha (4%) of the effective area, they 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 make up 12.3ha (2%)), they are 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.

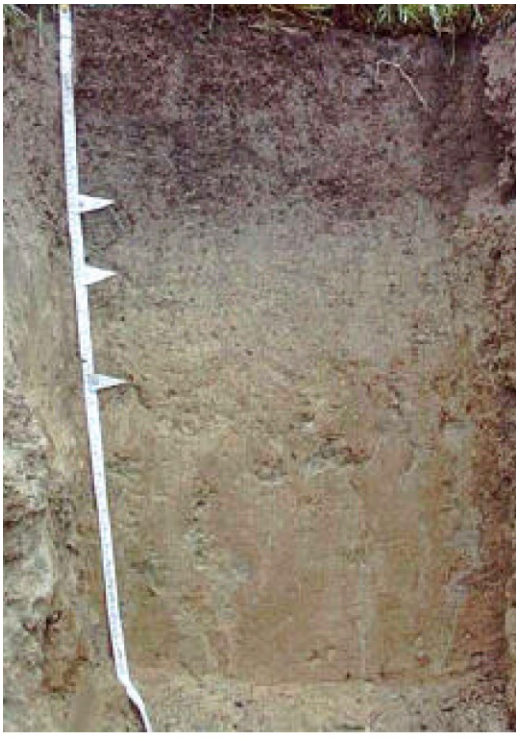
The farm can mitigate the risk of applying effluent when there is a low soil moisture deficit by being able to defer applications with adequate storage and apply effluent with a low-rate Cobra Rain Gun and with effluent applied through the Pivot at low depths.

Appendix 2 Soil Map

LAND & SOIL MANAGEMENT

Oreti profile

Gore profile



Fleming profile

Jacobstown Profile

LAND & SOIL MANAGEMENT

Mataura profile

LAND & SOIL MANAGEMENT

WINTER GRAZING

L4

IMPACT OF CONTAMINATION  +  LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

Winter grazing in Southland/Otago is one of the biggest issues facing dairy farmers at present and any mitigations that can be done within a paddock to prevent sediment and nutrient loss to water, maintain soil structure and prevent cows standing in water should be undertaken.

National regulations which control wintering of cattle on crops (between 1 May and 30 September) will not be applied until 2022 (and are still under consultation/subject to change). There is an expectation from Government that appropriate mitigation actions to benefit freshwater quality and animal welfare are adhered to or further regulations will be put on the industry.

If the proposed regulations come into force in 2022 the farm will have to comply with permitted activity rules and/or have a management plan to mitigate adverse effects from intensive winter grazing (in their certified Freshwater Farm Plan). If the grazing activity does not comply with permitted activity rules and/or have a written plan with clear mitigations then a resource consent will be required.

All stock are wintered across the dairy farm and attached runoff's, the farm is undertaking all the Good Farming Practices for winter grazing, see crop locations on the attached land Overview Map. Attached in Appendix 3 is a Winter Grazing Checklist, check the farm is meeting the guidelines shown.

A winter grazing paddock plan will also be required (a template for this is attached in appendix 4), this will show

• Clear expectations for everyone on the farm on how the wintering on each crop paddock is to be done

• It will also identify areas for improvement

Winter grazing risks are reduced on farm by

- wide waterway buffers in place (5m minimum) when crops are sown and this area grazed last
- crops are strategically grazed
- back fencing and portable water troughs are used
- baleage placed in the paddocks prior to the winter to prevent pugging and mud
- CSA and swales are not cropped, if CSA occur during grazing they are fenced off to prvent stock standing in water.

Soil-and-crop-suitable fertiliser used	Yes
Appendix 3	Winter Grazing Checklist
Silt and Sediment Traps Utilised	N/A
Portable or Permanent Water Troughs	Yes
Paddock soil tested and results utilised	Yes
Baleage placed in paddock before soil is too wet	Yes

LAND & SOIL MANAGEMENT

Appendix 4	Winter Grazing Paddock Plan Template
Stock back fenced off areas already grazed	Yes
Slopes grazed from top to bottom	Yes
Critical Source Areas fenced off and retained	Yes

ACTIONS | RECOMMENDATIONS

Target Date

Provide a Winter Grazing Paddock Plan – To Achieve GFP — 01 May 2022

Provide a grazing plan for each of the crop paddocks, a plan now will save a lot of time over the winter will also show staff have been trained, help to avoid costly compliance issues and bad publicity for the dairy industry & winter grazing.

Evidence:

Winter management plan

LAND & SOIL MANAGEMENT

CRITICAL SOURCE AREA

L5

IMPACT OF CONTAMINATION  +  LIKELIHOOD OF CONTAMINATION = MEDIUM RISK RATING

Critical Source Areas (CSA)/wet areas have a high risk of channelling contaminants (sediment, faecal material and nutrients) to water when conditions are wet and under winter grazing conditions the risk to water quality leaving the farm will further increase if CSA are not managed adequately.

CSA can be low-lying parts of farms such as the area above tile drains, gullies and swales where excess water congregates, transporting nutrients, soil, E. coli and phosphorous to waterways (including drains), when stock have access

The CSA identified on farm are associated with drainage from rolling country and poor draining areas.

- 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, see attached example picture

- P 77 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.

- 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, there is a plan for drainage work to occur through these paddocks

ACTIONS | RECOMMENDATIONS

Target Date

Manage the Critical Source Areas – To Achieve GFP — 01 Aug 2024

In the short term continue to temporary fence off the CSA to exclude stock, when conditions are wet and they have access to these paddocks.

Long term options could include.

- Permanently fence off and plant, could be an option for small area in paddock 76

- Install drainage if there is fall available, this work is currently underway for some of the CSA and is planed for paddocks 31-34

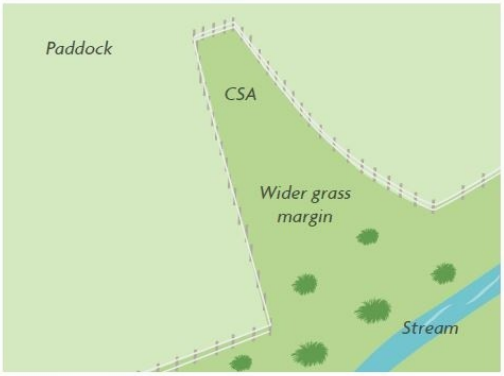
- Extend the riparian margins (as per picture below) where overland flow Critical Source Areas enter waterways. This creates a larger filtering area for run-off.

LAND & SOIL MANAGEMENT

Maintain these areas in rank grass or plant native grass species such as red tussock, flax or Carex-secta.

Practices:

Riparian margins or buffer strips are left beside waterways and other areas where sediment and nutrients may flow such as gullies or swales.



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

Planted Critical Source Area

LAND & SOIL MANAGEMENT

MUDDY AREA 15/16

L6

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

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.

ACTIONS | RECOMMENDATIONS

Target Date

Improve Drainage for Muddy Area — 01 Apr 2019

Re-work the area so drainage installed allows area to dry and grass can be re-sown.

6/08/2021, drain to this area has been unblocked and the area resown.

WHAKAMĀKŪKŪ
IRRIGATION MANAGEMENT

I1 Irrigation Overview - Irrigation Overview

I2 Pivot Irrigator - Pivot/Rotorainer Irrigation

IRRIGATION MANAGEMENT

GOOD FARMING PRACTICES

Irrigation rates and timing match plant requirements

Practices:

Irrigation is done to replace soil moisture deficit only
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

ACHIEVED

Design, calibrate and operate irrigation systems to use water efficiently

1 ACTION(S)

IRRIGATION MANAGEMENT

IRRIGATION OVERVIEW

I1

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

The farm currently utilises Pivot irrigation and Rotorainers to irrigate approximately 187.7ha and irrigation can be subject to restrictions based on minimum flow of 11 cumec/sec on the Mataura River.

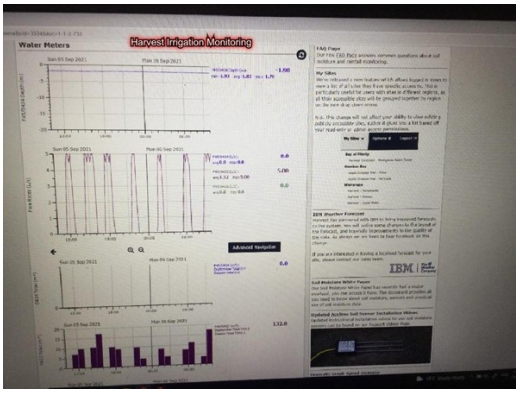
Soil Moisture probes are in place to trigger irrigation events, current farm policy if 10mm of rain occurs then both formsof irrigation are switched off for 2 days

Harvest monitoring system has been installed to monitor water use and record where, when and amounts are applied

.

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



IRRIGATION MANAGEMENT

PIVOT/ROTORAINER IRRIGATION

I2

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

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 159ha, 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.

ACTIONS | RECOMMENDATIONS

Target Date

Calibrate Pivots & Rotorainers – To Achieve GFP

01 Oct 2023

Recommendation from Irrigation NZ that a bucket test on all irrigation systems should be done every 3 years to ensure pumps and systems are meeting their design specifications.

Practices:

* Routine bucket tests are carried out to assess performance

IRRIGATION MANAGEMENT

PARAKAINGAKI
EFFLUENT MANAGEMENT

E1 Effluent Overview - Effluent Overview

E2 Effluent Storage

E3 Effluent Irrigation - Effluent Irrigation

EFFLUENT MANAGEMENT

GOOD FARMING PRACTICES

Effluent system meets code of practice Practices: Effluent is collected from all sources: dairy sheds, yards, feed pads, underpasses The system design is appropriate for the soil type, topography, and climate New systems: accredited designer has been used	ACHIEVED
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	ACHIEVED
Spreading equipment is well maintained and calibrated	1 ACTION(S)
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 Fertiliser applications are adjusted to effluent areas based on soil tests Risk areas for effluent application are identified and recorded on a map Odour impact is considered during application	ACHIEVED
*All effluent systems	1 ACTION(S)

*Additional GFP relevant to the dairy industry goals

EFFLUENT MANAGEMENT

EFFLUENT OVERVIEW

E1

IMPACT OF CONTAMINATION  +  LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

Effluent system for the farm is well designed and set up, effluent can be applied to 187.7ha via a low-rate Cobra Rain Gun and by injection into pivot water or 100% through the pivot with no water.

All effluent from the dairy shed concrete catchment is contained on concrete and gravity feeds through a stone-trap to concrete pond with the dimensions of 12m x 9m x 1.4m deep, effluent from this gravity feeds through to the main effluent pond.

Effluent is applied to land either by the main pivot, straight effluent injected into the water or the low-rate Cobra Rain Gun.

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.

Effluent volumes are reduced by the dairy shed roof diverted all year & the concrete catchment in the winter months, recycled greenwash can be used to the scrapper on the backing gate to reduce washdown volumes if required.

For the consent application in 2022 an updated Massey storage calculation was done by Fonterra to assess if the farm had enough storage in place, the main pond has had a drop test completed in March 2021 to confirm the pond meet the required sealing standard.

Both ponds were emptied for a visual sign off by a suitable qualified person.

Annual maintenance is completed on the effluent system each year but the Cobra has not been bucket tested, it is recommended to have this done each season and Fonterra can help you with this. When the pivot is tested for water irrigation this will also confirm effluent depths applied.

To remove any risk of overloading with nitrogen and potassium the area effluent is applied to should be 80ha for peak cows of 1000 and 92ha for increased cow numbers of 1140. The regular effluent area of 187.7ha meets this requirement.

Soil/weather conditions are visually assessed before effluent is applied and with the use of the soil moisture probes which gives real time information. Proof of placement for effluent applications is achieved via harvest monitoring, see attached picture example.

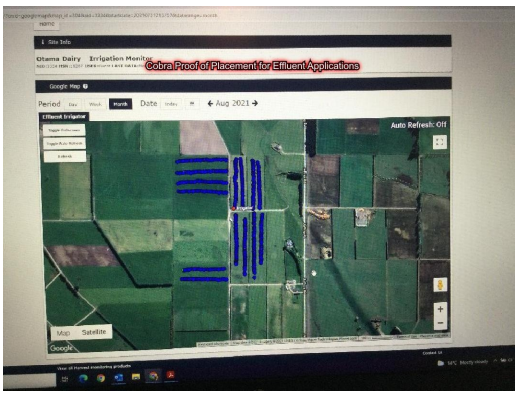
It is Good Farming Practice and will be a consent requirement to have an effluent management plan for staff

ACTIONS | RECOMMENDATIONS	Target Date
Provide an Effluent Management Plan – To Achieve GFP	01 Aug 2023

EFFLUENT MANAGEMENT

An effluent management plan is a practical plan on how your effluent system is operated, what and when maintenance needs to be carried out, what procedures to follow in an emergency and who to contact. The plan should also include areas that are at risk for applications including the location of tile drains.

Fonterra can provide you with a template for this.



EFFLUENT MANAGEMENT

EFFLUENT STORAGE

E2

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

HDPE lined effluent pond with the dimensions of 33.6m x 33.5m x average depth of 3.23m with a 2:1 batter gives a total volume of 2,415.3m³ and an effective volume of 1,942.8m³.

The pond is drained underneath to an inspection chamber to ensure the pond is not leaking, and the area around both ponds are fenced to prevent stock and unauthorised access

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 Pivot and the Cobra Rain Gun.

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 regularly de-sludge the pond.

Dairy effluent storage calculator	Yes, storage report attached in Appendix 5
Solids management	Spread immediately
Stormwater diversion	Yes
Certified (CPENG)	Yes
Pond Lining	HDPE
Pond Sealed (drop test)	Yes

EFFLUENT MANAGEMENT

EFFLUENT IRRIGATION

E3

IMPACT OF CONTAMINATION  +  LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

The area of effluent irrigation on the farm is 187.7ha (this area allows for 100m buffer from the three bores but not 20m setbacks from waterways), 126.9ha on high-risk soils due to the slope and drainage characteristics and 56.3ha low risk.

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 fail-safe. 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 2.5mm depth. If the pivot stops then pump automatically switches off and no siphoning of effluent can occur.

Irrigation method	Through pivot (injected)
Application depth testing	No
Irrigation Method	Low Rate Travelling Irrigator

ACTIONS | RECOMMENDATIONS

Target Date

Calibrate the Cobra Rain Gun – To Achieve GFP

01 Feb 2022

It is recommended to have the irrigator calibrated by doing an application test, this will also validate application depths used in the Massey Dairy Storage Calculation and ensure the effluent pump and irrigator are meeting their design specifications

Practices:

Effluent irrigator/spreading equipment is calibrated

EFFLUENT MANAGEMENT

RARENGA RAUROPI
WATERWAYS & BIODIVERSITY MANAGEMENT

WATERWAYS & BIODIVERSITY MANAGEMENT

GOOD FARMING PRACTICES

Identify areas where runoff may occur and manage to avoid runoff entering waterways	2 ACTION(S)
Tracks, feed areas, gateways and troughs are located away from waterways Practices: Tracks are located away from waterways where practical Supplement is fed 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	ACHIEVED
Stock are excluded from waterways	2 ACTION(S)
*Areas of native plants or significant biodiversity are protected	N/A

*Additional GFP relevant to the dairy industry goals

WATERWAYS & BIODIVERSITY MANAGEMENT

WATERWAY OVERVIEW

W1

IMPACT OF CONTAMINATION  +  LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

The farm is in the Mataura River/Okapua Stream/Otama Creek catchments, there are 12.65km of waterways associated with the farm made up of one main creek that runs through the center of the farm and a one that cuts through the corner of Runoff, there are other numerous waterways that don't flow all year round plus two ponds.

The main waterways, ponds and the majority of the drains are permanently fenced to exclude stock and have grass margins of 1-2m in width, the riparian margins along the fenced waterway are maintained in rank grass to filter sediment or nutrient runoff, see attached example pictures

There are no known sites of cultural or historic significance in the vicinity and no significant areas of native biodiversity on farm.

Mahinga kai is about the value of natural resources, the farm does have permanently flowing waterways to support Kai (food) but the contribution to Mahinga Kai values doesn't have to be only within the farm boundary, as individual actions on farm will have cumulative effects beyond the farm boundary to the wider catchment i.e. sediment traps & wetlands.

There are 30 stock crossing which are culverted, they are generally in good condition with built up ends to prevent direct runoff to water, some minor repairs are required on some.

Gateways are wide to allow good cow flow, they are located in dry areas of the paddocks to reduce pugging. Water troughs are in the middle of paddocks and supplements are feed out away from waterways to prevent pugging and sediment entering waterways.

There are tile drains in place and these have been mapped, see if they can be directed into existing ponds, sediment traps and or wetlands to allow sediment and associated nutrients (phosphate) to be filtered, see tile drain section for further recommendations.

There is no formal riparian plan in place for the farm, if future planting is to be done a formal riparian plan will help to ensure native riparian planting is successful.

WATERWAYS & BIODIVERSITY MANAGEMENT

WATERWAYS & BIODIVERSITY MANAGEMENT

MAHINGA KAI

W2

Mahinga kai is about the value of natural resources – our birds, plants, fish, and other animals and resources that sustain life, including the life of people.

It is critical to manage these resources to allow people to continue gathering kai (food) in the way the ancestors did. Across Aotearoa as guardians of the land we all have a commitment to work towards meeting Mahinga Kai objectives such as protecting wetlands and fish habitats for species such as Galaxia (native freshwater fish), Tuna (eels), Inanga (whitebait) and freshwater Koru (crayfish), mitigating the impact of exotic and pest fish species, and ultimately enabling the continued access to healthy Mahinga kai species that are safe to eat and in quantities to support local communities.

The contribution to Mahinga Kai values doesn't have to be only within the farm boundary, as individual actions on farm will have cumulative effects beyond the farm boundary to the wider catchment.

There are actions done on farm relating to Mahinga Kai and minimising sediment and nutrient loss, these are identified on the farm maps in this report. Specific actions are summarised below

Fish habitat protected	Waterways are fenced off and maintained to support fish habitat. If spawning sites are identified, these are prioritised and protected. If pest fish species are present, actions are in place to remove them, or mitigate their impact and distribution further
Management of sediment	Lanes and culverts are maintained to divert run off of nutrients away from the waterways.
Management of risk areas	Areas of differing soil types that require different management is done on farm as per land management section of this plan.
Waterways protected	All waterways or areas holding water are fenced to exclude stock with a buffer zone to help filter any runoff of nutrients. Any drains are managed to avoid disturbance or damage to Mahinga kai species or habitats.
Management of contaminants	Losses of contaminants from the farm have been mitigated or removed through the actions developed within this farm environment plan. This includes management of nitrogen, phosphorus and faecal matter, which are all detrimental to waterway health and the health of Mahinga kai.
Mahinga Kai access	Access to Mahinga kai is allowed for local communities.

ACTIONS | RECOMMENDATIONS **Target Date**

☐ **Maintain/Enhance Mahinga Kai Values**
Check to see if Cashmere Bay Dairy is meeting the Good Farming Practices associated with Mahinga Kai values including.

WATERWAYS & BIODIVERSITY MANAGEMENT

- Allowing Mahinga Kai access
- Management of sediment, risk areas (CSA) and contaminate loss
- All waterways and fish habitat are protected

Koura (native freshwater crayfish)

Tuna (freshwater eels)

Galaxia (native freshwater fish)

Develop Native Biodiversity

WATERWAYS & BIODIVERSITY MANAGEMENT

FUTURE RIPARIAN PLANTING

W3

IMPACT OF CONTAMINATION  +  LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

The value of native riparian planting contributes to the following.

- Controlling weeds
- Enhancing bird habitat and biodiversity
- Improves aesthetics on farm.
- Providing shelter & shade for stock
- Improving stream bank stability
- Filtering nutrients and sediment from overland flow
- Lowering stream temperature and reducing waterweed growth
- Look aesthetically pleasing and add potential value to the farm

Biodiversity literally means a variety of living things, whether they are animals, plants, insects or microorganisms, for example, birds and spiders feed on pest insects, keeping your pasture healthier. Earthworms cultivate and enrich the soil, helping to produce higher pasture yield. Bees pollinate clover flowers and increase clover coverage.

Options for future riparian planting could be

- the pond in paddock 69, is already permanently fenced off, large area which could be turned into an area of native biodiversity. A small section on the south side would be good to see this incorporated into the pond/wetland area, it is quite wet and of low grazing value.
- section below paddock 63, some plantings have already been done, very large area and native plantings will help tocontrol the weeds.
- main creek that starts in 53 & flows down to the boundary at paddock 13

ACTIONS | RECOMMENDATIONS

Target Date

Develop a Riparian Plan – To Achieve GFP — 01 Jun 2024

If riparian planting is to be done on farm look to get a formal riparian plan done, The Plant Store provide this free of charge, I have seen some of there plans and they are good, there will be other nurseries nearby which offer the same service.

Having a formal riparian plan in place will help progress any future riparian and shelter planting for the property and record the work that has already been carried out, see attached example pictures of native riparian planting.

Practices:

WATERWAYS & BIODIVERSITY MANAGEMENT

A riparian management plan has been developed (include any plantings)


Next to Pond/Wetland Area


Main Creek


Main Creek


Main Creek


Pond/Wetland Paddock 69


Below Paddock 63

WATERWAYS & BIODIVERSITY MANAGEMENT

UNFENCED DRAINS

W4

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

Good farming practice to have all waterways including drains permanently fenced off to exclude stock, fencing will protect freshwater from nutrients, effluent, sediment and help to improve water quality leaving the farm plus will create a habitat for birds and freshwater species.

Good work has been done on farm with 11.9km of all the waterways permanently fenced to exclude stock, including the drains that don't flow all year round. There are 3 small sections where fencing or drainage could be installed to reduce the risk to water quality leaving the farm, these sections are lower as not high use paddocks.

There is an expectation that all waterways/ponds on our dairy farms are permanently fenced including drains, we are highlighting these ephemeral waterways in our farm environment plans to be fenced.

Areas where work it to be done are

- old yard block next to paddock 78 which is only used for some dry cows
- two drains at paddocks 80/82 & 81, these would not normally hold water but issues with neighbours section not being cleaned out.

ACTIONS | RECOMMENDATIONS

Target Date

Permanently Fence/Drain Waterway Sections – To Achieve GFP — 01 Sep 2023

In the short-term temporary fence of these drains that are unfenced when stock have access, long-term look to have these permanently fenced or drainage installed.

Practices:

Any temporary streams are temporarily fenced if grazing while water is flowing

WATERWAYS & BIODIVERSITY MANAGEMENT

WATERWAYS & BIODIVERSITY MANAGEMENT

ARTIFICIAL OR TILE DRAINAGE

W5

Subsurface drain allow water to be quickly transported from the land surface and subsoil to waterways on the 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.

See attached example pictures of sediment traps/wetlands that have been setup on farms in the West Otago district by the Pomahaka Water Care Group and have had water quality testing done by the Otago Regional Council over a year showing remarkable reductions in contaminate levels leaving the farm. These were low cost and relatively easy to setup.

One sediment trap has been established at the pond in paddock 69, the tile drain that starts in paddock 70 drains to the pond.

There are tile drains on farm and these have been mapped, recently more tiles have been added. The tile drain map should be included in the effluent management plan as subsurface drainage is high risk for contaminant loss and therefore all staff on farm should have an understanding of where major drains are, especially for effluent applications.

Outlets marked	Yes
Subsurface Drains Mapped	Yes
Outfall location	Stream

ACTIONS | RECOMMENDATIONS

Target Date

☐ **Investigate Installing Tile Drain Treatment Methods**

Tile drains are a pathway for the transportation of contaminants such as sediment and nutrients to surface waterways.

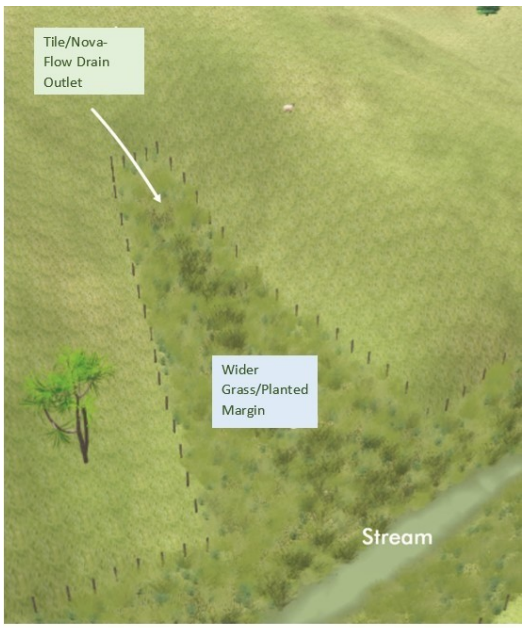
Where practical, consider creating further sediment traps/ponds prior to major tile drains discharging into surface water bodies or diverting tile outlets into existing ponds or wetlands, they do not need to be big, can be low cost to install and reduce nutrient/sediment loss to water markedly.

If the above are not practical or possible for the farm then larger buffer areas could be left at the ends of tile drain outlets to filter drainage, either left in rank grass or planted in low plants such as Carex secta, red tussock, flax and Toe-toe, see attached example

WATERWAYS & BIODIVERSITY MANAGEMENT

Wetland Area

Tile Drain Wetland Area



Tile/Nova-Flow Drain

WATERWAYS & BIODIVERSITY MANAGEMENT

RACE MANAGEMENT & MAITENANCE

W6

IMPACT OF CONTAMINATION  +  LIKELIHOOD OF CONTAMINATION = MEDIUM RISK RATING

Quality lanes allow for good stock flow, which reduces lameness issues and the build-up of effluent on the lane surface and adjacent paddocks and reduces the risk of runoff to water on sloping ground.

Laneways adjacent to a waterway or on sloping ground can be very high risk with the direct runoff of sediment and effluent to water. To mitigate the risk, slope laneways away from the waterways towards the paddock so the grass can filter contaminates, also lane cut-outs can be installed on a slope so water can be directed out into the paddock at regular intervals and not down to a culvert.

The dairy lanes over the farm are wide enough to facilitate good cow flow (4~6m) with a solid base and a incorporating an appropriate crown and camber, on flat to rolling topography with regular maintenance done each year to maintain a good surface and to remove lane edges to allow water to drain off the lanes.

Two sections of lane run next to waterways, one section from paddock 64 to 66, there is a narrow margin in place which has been sprayed, don't spray this grass margin, allow grass to filter runoff or plant to control weeds. Second section by paddock 11 also has a narrow margin in place.

ACTIONS | RECOMMENDATIONS

Target Date

Manage High-risk Laneway Areas – To Achieve GFP — 01 Aug 2023

The farm has already planned to install drainage along the section from paddocks 64-66, this will allow runoff from the laneway to be filtered throughgrazed pasture instead of direct runoff to water.

When laneway maintenance is next done look to see if the section by paddock 11can be sloped away from the creek, also allow rank grass to grow or consider planting carex-secta

Practices:

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

WATERWAYS & BIODIVERSITY MANAGEMENT

Laneway Planting- carex-secta

WATERWAYS & BIODIVERSITY MANAGEMENT

CROSSING

W7

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

There are 30 stock culvert crossings on farm which are generally in good order with built-up ends to prevent direct runoff to water of sediment and effluent, one new culvert recently put in was over length to allow for plantings between the fence and the ends of the culvert.

Some others do require some ongoing repairs.

Type	Culvert
Fish Passage (Culvert)	Yes
Condition	Good

ACTIONS | RECOMMENDATIONS

Target Date

Culvert Repairs – To Achieve GFP

01 Aug 2023

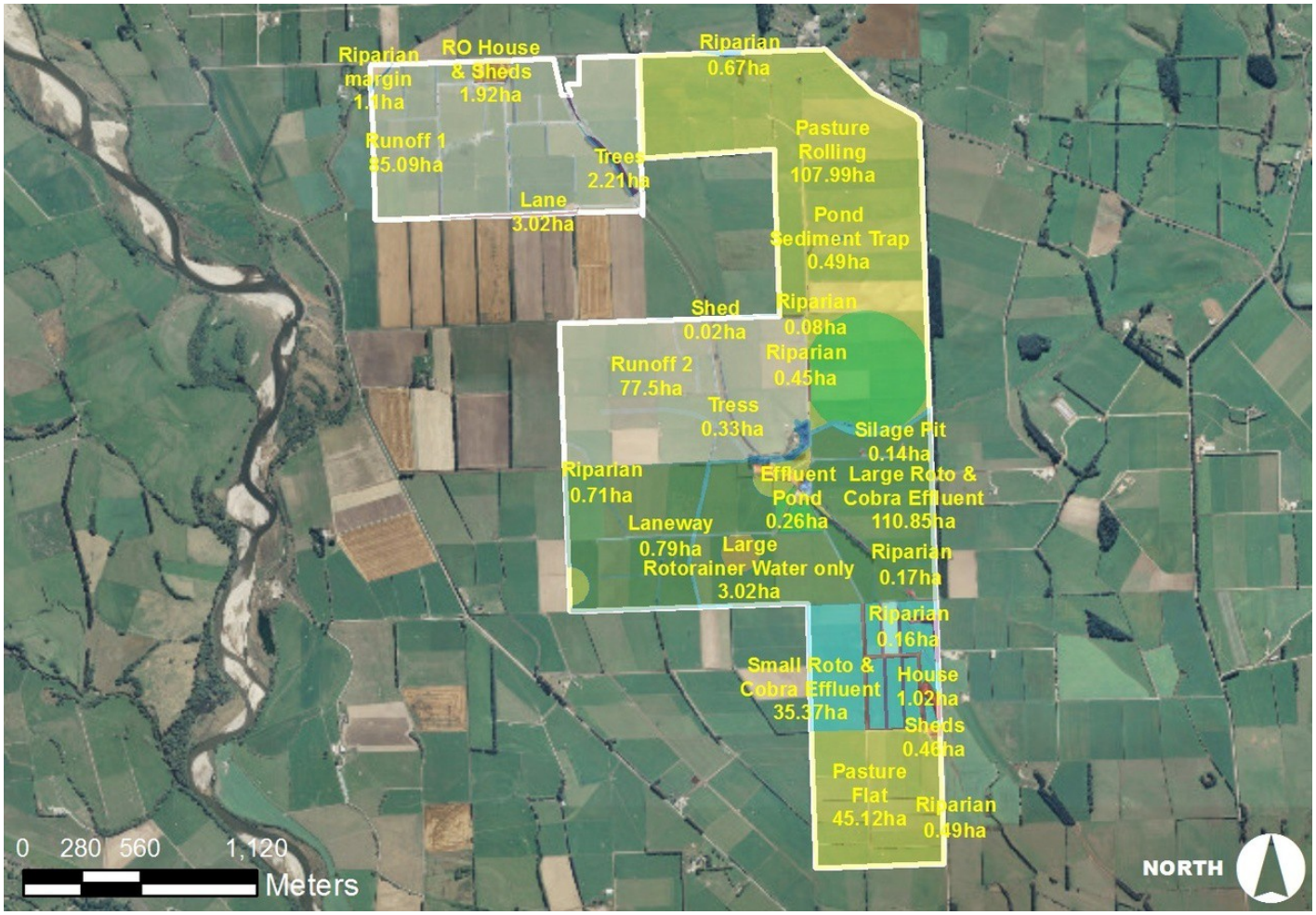
Check all culvert crossings to ensure the ends are not required to be built up so surface water can be directed out into the paddocks and not direct to the water.

Practices:

Bridges and culverts have raised sides or mounds to stop runoff entering waterway

WATERWAYS & BIODIVERSITY MANAGEMENT

TAIORA
NUTRIENT MANAGEMENT



N1 Nutrient Overview - Nutrient Management Overview

N2 End of Season Nitrogen Report

N3 Nitrogen Efficiency Improvements

N4 Fertiliser applications

NUTRIENT MANAGEMENT

GOOD FARMING PRACTICES

Monitor and maintain P levels at the economic optimum Practices: Olsen P trends continue to be monitored over successive years Olsen P is maintained in the optimum range Fertiliser applications are tailored for different management blocks	ACHIEVED
Fertiliser application matches plant requirements and minimises losses	1 ACTION(S)
Spreading equipment is well maintained and calibrated	1 ACTION(S)
*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	ACHIEVED

*Additional GFP relevant to the dairy industry goals

NUTRIENT MANAGEMENT

NUTRIENT MANAGEMENT OVERVIEW

N1

IMPACT OF CONTAMINATION  +  LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

The appropriate use of nutrients on the farm is determined by regular soil testing and advice from the farm's fertiliser representative Ballance, who supply an Agronomy plan each season.

Soil testing is done every year at a block level to assess Olsen P, K, pH and other nutrient level trends over time, with the aim to have Olsen P levels in the range of 25 to 40mg/l.

Latest soil tests done June 2021 show Olsen P levels to be around the optimum range, but some variability across some paddocks. Capital/Maintenance fertiliser recommendations from Ballance are specific to an individual paddock level to ensure the most efficient use of nutrients, product and rates have been adjusted depending on the soil test results.

Generally, Olsen P levels greater than 30 are expensive to maintain when compared to the limited pasture production that is achieved and Olsen P levels over the optimum range invites unnecessary environmental damage.

Farm pasture walks are done weekly to produce a feed budget/identify surpluses and deficits, soil temperature & moisture levels are assessed prior to application, fertiliser is only applied if conditions are suitable.

The farms nitrogen policy is to apply a round of nitrogen in the spring at 30kg N/ha and then to follow the cows applying little and often during the season when pasture is actively growing, at rates not exceeding 35kg of N/ha. Look to assess pasture growth before applying nitrogen especially in the summer months when clover content is at its highest and when combined with favourable soil temperatures/moisture, clover is able to fix significant

amounts of nitrogen for grass growth, resulting in reduced responses to nitrogen fertiliser.

Paddocks that have recently had effluent are missed out of the round for nitrogen fertiliser applications.

Farm information has been supplied to Fonterra in the past for a nutrient budget and/or a nitrogen risk score card to be produced for the farm, a nutrient budget has recently been done to support the land use consent application.

ACTIONS | RECOMMENDATIONS

Target Date

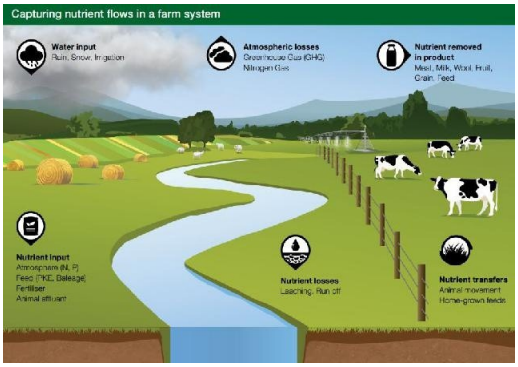
Nitrogen - Assess Requirements before Applying – To Achieve GFP — 01 Oct 2021

Assess pasture and feed requirements before applying nitrogen fertiliser. It is Good Farming Practice (GFP) to only apply nitrogen to meet specific feed demands.

Practices:

Pasture or crop growth and feed requirements are assessed before applying N

NUTRIENT MANAGEMENT



NUTRIENT MANAGEMENT

END OF SEASON NITROGEN REPORT

N2

A Nitrogen Risk Scorecard has been produced based on the information provided to Fonterra in your 20/21 Farm Dairy Records, the final farms environmental report is not available to October. The attached pictures are a summary from the 2021 seasons farm dairy records.

The Nitrogen Risk Scorecard is an alternative method to Overseer for identifying nitrogen loss risks from your farming operation. In some regions an Overseer budget may still be required to meet regulatory requirements and a nutrient budget is recommended for developing your fertiliser programme for the season.

The Nitrogen Scorecard shows that the farm will have a Purchased Nitrogen Surplus of 156kg N/ha, for the 19/20 season this figure was 187kg N/ha. Purchased Nitrogen Surplus reflects the relationship between the amount of nitrogen entering your farming system through fertiliser and feed, versus the amount leaving the farm as product. A low number means you are using purchased nitrogen efficiently and therefore, minimising loses to the environment.

The farms nitrogen surplus is to be bench marked against other farms in Otago/Southland with production above 1350 kgMS/ha, your farm produced 1,485kg MS/ha, the final benchmark figure for 20/21 season is not available till October.

For the 19/20 season your purchased nitrogen surplus was 187kg N/ha and the average benchmark for that season was 155kg N/ha, your farm was just above the average. When the 20/21 seasons benchmark figure is available, I can update the farm environment plan to reflect this.

The farm dairy records for the 20/21 season showed 211kg N/ha (not included was the crop fertiliser used) was applied across the effective dairy platform, the dairy platform is above the Governments Essential Freshwater Rules of 190 kgN/ha cap of N fertiliser applied

I have included a section on Nitrogen Efficiency & N loss mitigations ideas for future consideration on nitrogen fertiliser applications so the farm can reduce its N fertiliser to meet the 190kg N/ha cap.

Inaccurate information supplied in your 2020/21 Farm Dairy Records means the following aspects of the Scorecard are incorrect.

Nitrogen Fertiliser & Crops - there was no crop or fertiliser entered for the beet grazed winter 2021 on the dairy platform.

The following areas in the 20/21 Score Card have been identified as having a very high risk of nitrogen loss and should be investigated further to minimise losses:

Nitrogen Fertiliser - as expected the main driver is the 211kg N/ha being brought onto the farm in fertiliser combined with applying fertiliser in the high-risk months between July & August.

Records kept for nutrient budgeting

NUTRIENT MANAGEMENT

ACTIONS | RECOMMENDATIONS

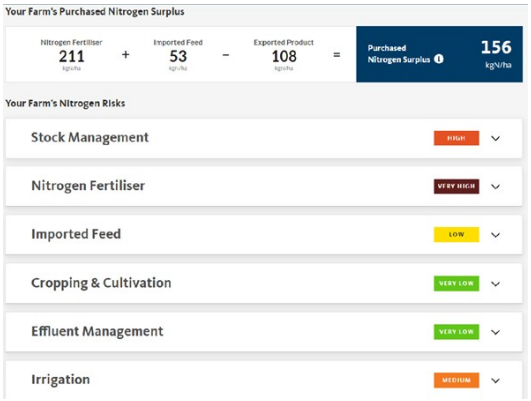
Target Date

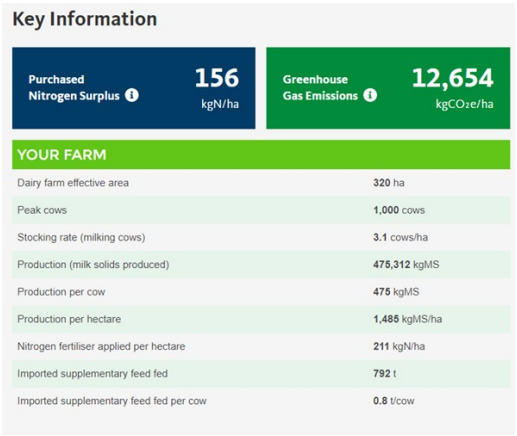
30 Jun 2022

Reduce Nitrogen Fertiliser Use

To meet the new National Environmental Standard (1st July 2021) synthetic nitrogen fertiliser inputs will need to be reduced below 190kg/N/ha/yr (currently 211kg/N/ha/yr in 20/21 season). Reducing N inputs from fertiliser will also reduce the farms purchased nitrogen surplus.

Review the Nitrogen Efficiency Improvements/Loss Reduction feature of this plan





NUTRIENT MANAGEMENT

NITROGEN EFFICIENCY IMPROVEMENTS

N3

Several changes to the way nitrogen fertiliser is used on the farm have been suggested to enable the more efficient use of nitrogen fertiliser and a subsequent reduction in costs. The strategies are focused on a more tactical use of nitrogen to fill feed deficits rather than relying on nitrogen fertiliser all year round. The strategies are all based on maintaining the current milk solids production and stocking rate. It is strongly recommended that the strategies are trialled using a staged approach over the coming seasons.

Initial guidance on the efficiency of nitrogen use was determined by comparing your farms purchased nitrogen surplus against the average nitrogen surplus of farms in your region producing similar milk solids per ha. This indicates there may be opportunities to use nitrogen inputs more efficiently without impacting on milk solids production.

Clover Content

For most of the strategies outlined below paddocks must have a well-managed ryegrass/clover mix with good swards of clover present to promote nitrogen fixation. Care needs to be taken to avoid long-lasting shading of clover runners in spring by prolonged canopy closure (i.e. heavy silage cuts). Shading will reduce clover branching and reduce clover production. This will impact nitrogen fixation later in the year, risking lower summer pasture yields.

Remove a Summer Nitrogen Fertiliser Application	In late autumn to early spring, low temperatures usually restrict clover growth, nitrogen fixation and mineralisation, resulting in less nitrogen being available to grow grass. This results in nitrogen deficiencies being more pronounced in spring, when soil temperature and moisture don't limit grass growth, and a rapid response to nitrogen fertiliser can be expected. During summer, clover content is at its highest, when combined with favourable soil temperatures and soil moisture clover is able to fix significant amounts of nitrogen for grass growth, resulting in reduced responses to nitrogen fertiliser.
Fill Feed Deficits with Low Crude Protein Feed	If additional feed is required to fill a deficit a low crude protein supplement such as cereal silage, barley grain, fodder beet, etc could be used. This will result in less nitrogen being imported into your farming system and less nitrogen being available to leach via cow urine patches.
Skip Individual Paddocks and Optimise Round Length	It takes 20 (spring) and up to 40 (autumn) days after an application of nitrogen fertiliser to get a significant yield response. Ensure your round length is not faster than the number of days needed for a significant yield response (e.g. 20 days in spring) and that pasture is consistently grazed at the 2.5- to three-leaf stage. This may reduce the total number of grazing's per year and automatically reduce the number of nitrogen applications, if routinely following the cows with fertiliser. A longer round length also reduces the nitrogen content in pasture and, therefore, urinary nitrogen excretion from stock. In addition to the above, a feed wedge and weekly pasture walks should be used to identify when pasture growth rates are high and silage making is not required, enabling an application of nitrogen to be skipped from these paddocks.
Reduce Nitrogen Fertiliser on the	Reduce the frequency and/or rate of nitrogen fertiliser applications on the effluent block to account for the nitrogen being supplied from farm

NUTRIENT MANAGEMENT

Effluent Block	dairy effluent. It is recommended this is progressively decreased over the coming seasons to approximately 150kg/N/ha. This could be reduced further if the full effluent area is not utilised.
Remove late autumn applications of Nitrogen Fert	Reduce or do not apply nitrogen fertiliser in late autumn, when average covers are generally sufficient, soil temperatures are falling (lower response to nitrogen) and there is an increased risk of nitrogen loss through soil drainage.
Reduce Nitrogen Application Rates	Reduce nitrogen fertiliser application rates. Using an application of 25-30kg/N/ha is likely to be enough to overcome any spring nitrogen deficiencies. Higher rates (40kg/N/ha max) should be restricted to when conditions for pasture growth are optimal and surplus pasture is going to be harvested for silage. This will avoid high pre-grazing covers and residuals.
Utilise more uniform spreading technology	Consider utilising newer forms of spreading technology, these give a more accurate and uniform application of fertiliser with associated pasture growth benefits and reduced nitrogen fertiliser rates can be obtained for the same pasture growth.
P Loss Mitigations	- Introducing dung beetles (which feed on dung and will bury it), Tunnelling beetles. * increase the level of nutrients in the subsoils * increase aeration and reduce compaction * increase the amount of organic matter in the soil, stimulates microbial activity, and nutrient cycling * provides a food source for soil organisms such as earthworms These provide a flow on effect to improve water infiltration and reduces surface ponding to reduce the level of contaminants entering the waterways - Strip-till involves cultivating narrow planting strips while leaving much of the paddock uncultivated, generally, less than half the soil is cultivated under a strip-till system. Advantages of Strip-Till. * Wind Erosion Prevention * Improved Soil Physical Quality * Reduces adverse effects of cultivation. * Time and Cost Savings * Disease control * Reduced Pugging under Intensive Winter Grazing * Increased Crop Margins

ACTIONS | RECOMMENDATIONS

Target Date

☐ **Review Nitrogen Efficiency Improvements / Loss Reduction Section of this Plan**

It is strongly recommended if these strategies listed above are trialled then use a staged approach over the coming seasons

NUTRIENT MANAGEMENT

Dung Beetles

Paddock split in half for a strip-till trial

One-year-old perennial ryegrass/plantain/clover mix near Dannevirke. The pasture was sprayed, drilled and rolled in March 2017.

NUTRIENT MANAGEMENT

FERTILISER APPLICATIONS

N4

IMPACT OF CONTAMINATION  +  LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

Capital and maintenance fertiliser is to be spread by SVT Transport, they are not listed as being Spreadmark certified, the Spreadmark verification will help to ensures that staff are well trained, equipment is properly calibrated, and fertiliser is being applied in the correct location at the correct rate.

Better Beet apply all nitrogen fertiliser with their advanced technology fertiliser spreader, they have GPS capability and can provide proof of placement via Tremble but Ballance are not as yet set up for this.

The farm is in the process of going to proof of placement for all fertiliser applications and will be recorded in Precision Farming, currently fertiliser use is recorded on farm maps and through Ballance records.

Spreadmark certified/spreader calibrated	No
Fertiliser Programme Planned	Yes
Proof of placement/Fertliser application records	No

ACTIONS | RECOMMENDATIONS

Target Date

Use Spreadmark Accredited Contractors – To Achieve GFP — 01 Aug 2024

When using contractors for fertiliser spreading ensure they are Spreadmark accredited or can provide documentation to show staff are adequately trained, equipment is properly calibrated, and fertiliser is being applied in the correct location at the correct rate.

Both SVT & Better Beet have proof of placement capability and also have a good reputation, if your current contractors have all the above documentation, encourage them to become Spreadmark Accredited.

Practices:

Contractors are Spreadmark accredited

NUTRIENT MANAGEMENT

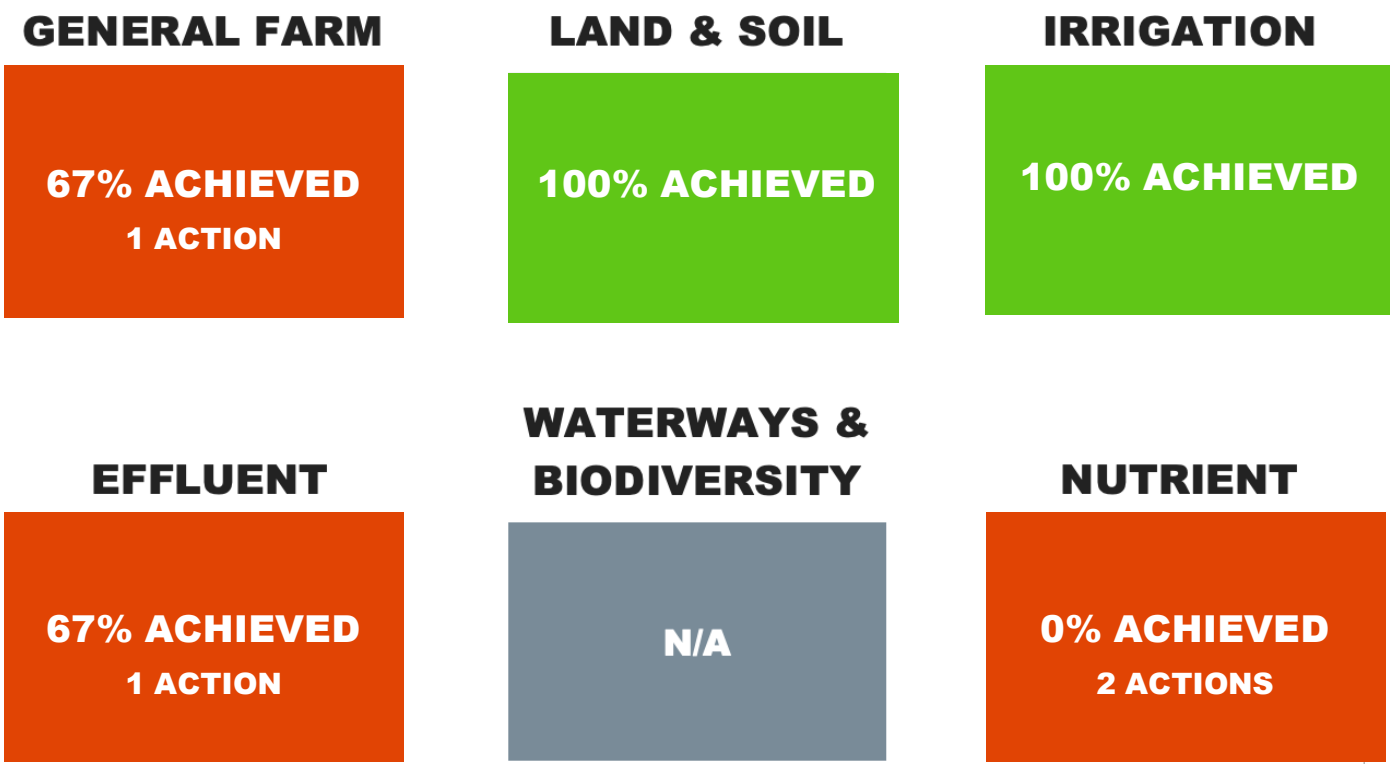
WHAKAPAPA

History of the farm and local area has not been assessed as part of this Tiaki Farm Environment Plan.

APPENDIX

GREENHOUSE GAS EMISSIONS

Climate change affects all New Zealanders, including the primary sector. Reducing greenhouse gas emissions is a priority and action is required across New Zealand and internationally. The New Zealand dairy sector is one of the lowest emissions producers of dairy nutrition in the world due to our efficient year-round pastoral grazing system and healthy cows. Through innovation and continued Kiwi ingenuity, our farmers, scientists, and sector partners can ensure New Zealand dairy continues to stay a world leader, while making meaningful contributions to New Zealand's GHG mitigation targets.This section provides an overview of the current GFPs that could have an impact on reducing emissions on farm.



APPENDIX

GREENHOUSE GAS EMISSIONS

The tables below list the GFPs that have an impact on reducing greenhouse gas emissions on farm.

GENERAL FARM MANAGEMENT

Identify the physical and biophysical characteristics of the farm system, assess the risk factors to water quality associated with the farm system, and manage appropriately	ACHIEVED
Store and load fertiliser with minimal spillage and leaching	ACHIEVED
Store, transport and distribute feed to minimise wastage, leachate and soil damage	1 ACTION(S)

LAND & SOIL MANAGEMENT

Reduce periods of bare soil between crops and pasture to reduce erosion and leaching	ACHIEVED
Retire all LUC 8 land and retire LUC 7e land or ensure that it has soil conservation measures in place	N/A

IRRIGATION MANAGEMENT

Irrigation rates and timing match plant requirements	ACHIEVED

EFFLUENT MANAGEMENT

Effluent system meets code of practice	ACHIEVED
Spreading equipment is well maintained and calibrated	1 ACTION(S)
Effluent applied at correct depth, rate and time	ACHIEVED

WATERWAYS & BIODIVERSITY MANAGEMENT

*Areas of native plants or significant biodiversity are protected	N/A

NUTRIENT MANAGEMENT

Fertiliser application matches plant requirements and minimises losses	1 ACTION(S)
Spreading equipment is well maintained and calibrated	1 ACTION(S)

*Additional GFP relevant to the dairy industry goals

APPENDIX

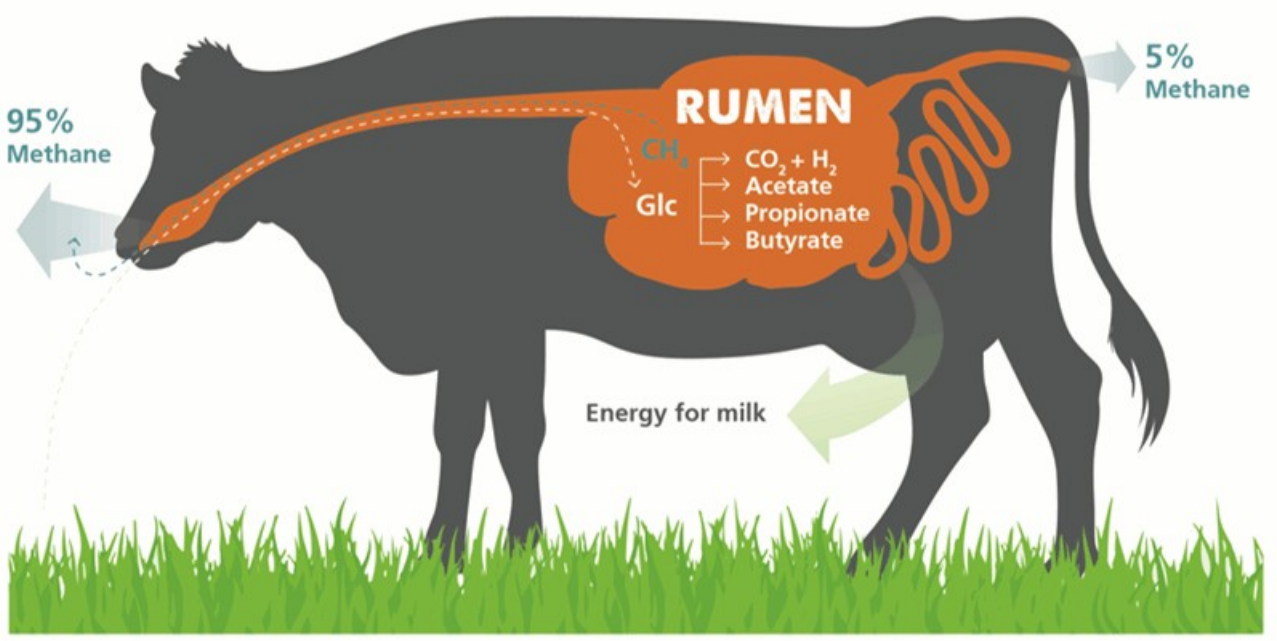
GREENHOUSE GAS EMISSIONS

WHAT ARE GREENHOUSE GAS EMISSIONS?

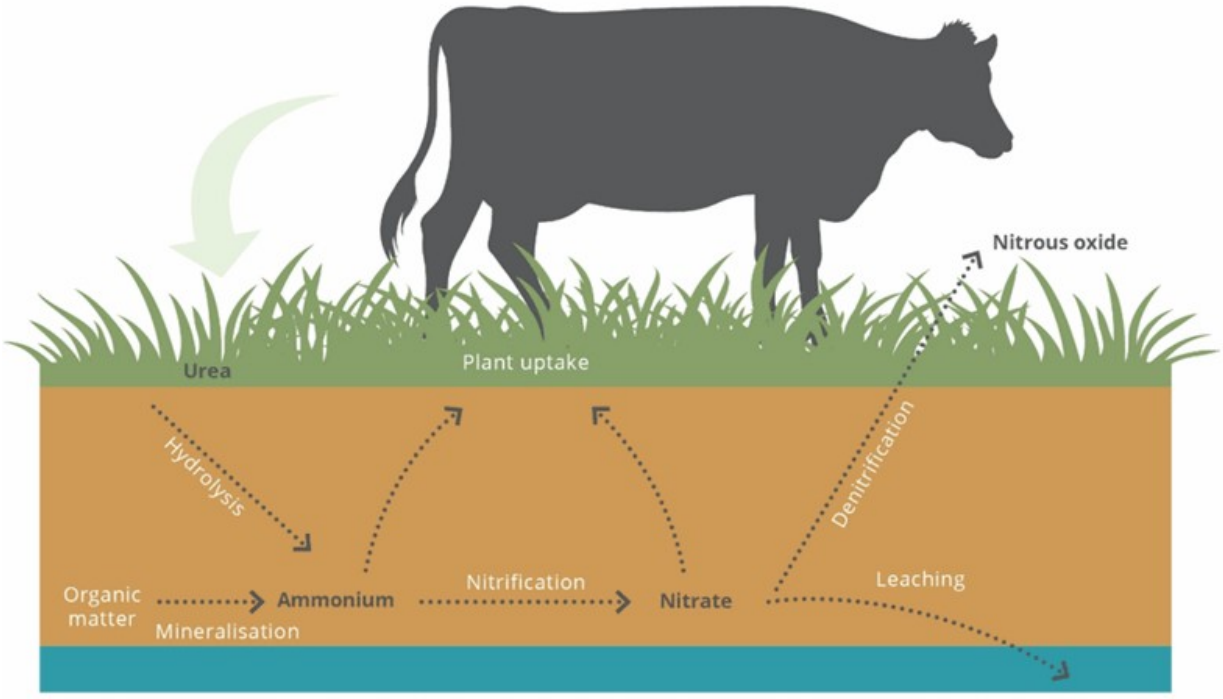
The main agricultural GHGs are methane (CH_4) and nitrous oxide (N_2O). Methane is produced by ruminants (e.g. cows and sheep) by methanogen microbes that are naturally present in the rumen. Most methane is emitted when cattle burp. The amount of methane produced for each farm is directly related to the total feed intake for that farm (including cows, heifers and calves).

Nitrous oxide is emitted from soil when urine, faeces and fertilisers are broken down by microbes in the soil.

How methane (CH_4) is produced



How nitrous oxide (N_2O) is produced



APPENDIX

GREENHOUSE GAS EMISSIONS

ADDITIONAL GREENHOUSE GAS EMISSIONS

Options to reduce and mitigate greenhouse gas emissions on farms fall into three categories: farm management changes, infrastructure investment, and retiring or planting land. The best options for each farm will vary depending on factors such as the farm system and the region. When choosing changes to adopt on your farm, you may find options from all three of these categories work well together.

Farm management changes

The final report of the Biological Emissions Reference Group (BERG), a cumulative effort by the wider agricultural sector, estimated that biological emissions can be reduced by up to 10% for the dairy sector with currently available farm management practices. Most of these mitigations involve good farm practices, such as feed utilisation, choice of feed type and being more selective about how and when to apply fertiliser and effluent to our land. Outlined below are some options to consider. Before you make changes to your farm system or invest in infrastructure, you should seek advice to help determine what will work best for your situation.

OPTIONS TO REDUCE METHANE EMISSIONS

Managing dry matter intake

Current options available to reduce methane emissions are limited, but managing efficient use of dry matter intake (DMI) is the most important. Research shows that for every additional kg of total feed eaten per hectare, total methane emissions increase proportionally. Managing DMI is about reducing the amount of feed eaten per hectare, and increasing per cow performance for every kg of feed that is eaten.

Over time, as cow performance improves it may be possible to adjust stocking rates (but the DMI per cow must remain constant). Increasing reproductive performance of the herd to allow for reduced replacement rates will decrease your emissions as there is less DMI requirement for young stock and less methane emissions.

OPTIONS TO REDUCE NITROGEN LEACHING AND NITROUS OXIDE EMISSIONS

Nitrous oxide emissions occur when bacteria in the soil remove oxygen from nitrate (NO_3-). This mainly happens when the soils are in an anaerobic state (e.g. waterlogged soils). Because nitrogen is supplied to the soil from fertiliser, animal excreta, and effluent irrigation, there are a number of options to manage nitrous oxide emissions and nitrogen leaching.

The mitigations options involve reducing nitrogen loss through:

- better fertiliser application
- planting low-nitrogen forages or crops to reduce nitrogen excretion (eg fodder beet and plantain)
- use of low nitrogen feeds
- improving pasture quality.

APPENDIX

GREENHOUSE GAS EMISSIONS

Reducing nitrogen surplus

Many of the supplementary feeds contain less nitrogen than normal pastures and can help reduce nitrous oxide emissions on farms. You can evaluate supplements used to see if there is potential to change to a lower-emissions feed.

- Evaluate existing cropping activity and the species grown. This can improve nitrogen inputs to the farm and nitrogen surplus through different types of crop and different methods in cultivation/feeding.
- Exploring the use of alternative forages in the pasture sward such as plantain to reduce nitrogen loss to water and atmosphere. These species can retain more nitrogen in the system allowing for less to be lost.

Optimising your fertiliser and effluent use

DairyNZ analysis shows that for every additional 100 kg N/ha applied via fertiliser, total greenhouse gas emissions increase by 2.6 t/ha. As well as using less nitrogen fertiliser per hectare, mitigations strategies include:

- Ensure you are applying the right type of fertiliser in the right places. Test the soil to gauge optimal levels and use precision application to ensure accurate placement.
- Avoid direct leaching and nitrous oxide emissions by not applying in winter or to waterlogged soils.
- Improve effluent management to accurately apply appropriate depths and rates to the soil so that there are less losses.
- Reduce N fertiliser applications on effluent blocks.

Paddock strategies

- Grazing cows off-paddock in the autumn months limits the build-up of nitrate in the soil when the plant growth is reduced. This build-up is then available to be lost to both water and atmosphere of the following winter and spring months. This strategy can reduce nitrogen leaching and nitrous oxide emissions if the associated effluent is well manged.
- Improve irrigation practices so that water is only applied when the soil profile has the capacity to absorb it and the plants need it and that there is no over application. This can be done by using precision water irrigation and scheduling.
- During wintering urine nitrogen leaching and nitrous oxide emissions can be reduced through appropriate paddock selection, grazing time, and grazing regime.
- Using a ‘catch crop’ to minimise the fallow period following a winter crop. This will reduce nitrogen leaching and nitrous oxide emissions during this period.

Planting to offset carbon dioxide

Planting trees can help ‘offset’ emissions from your farm business without impacting on production. As trees grow, they store carbon in trunks, branches, leaves, and roots. Planting will also improve water quality by helping to filter out sediment and nutrients before they enter waterways. Planting could take place in riparian areas, shelter belts, and through retiring land to forestry. Planting also helps to prevent soil erosion and increase the habitat for native wildlife.

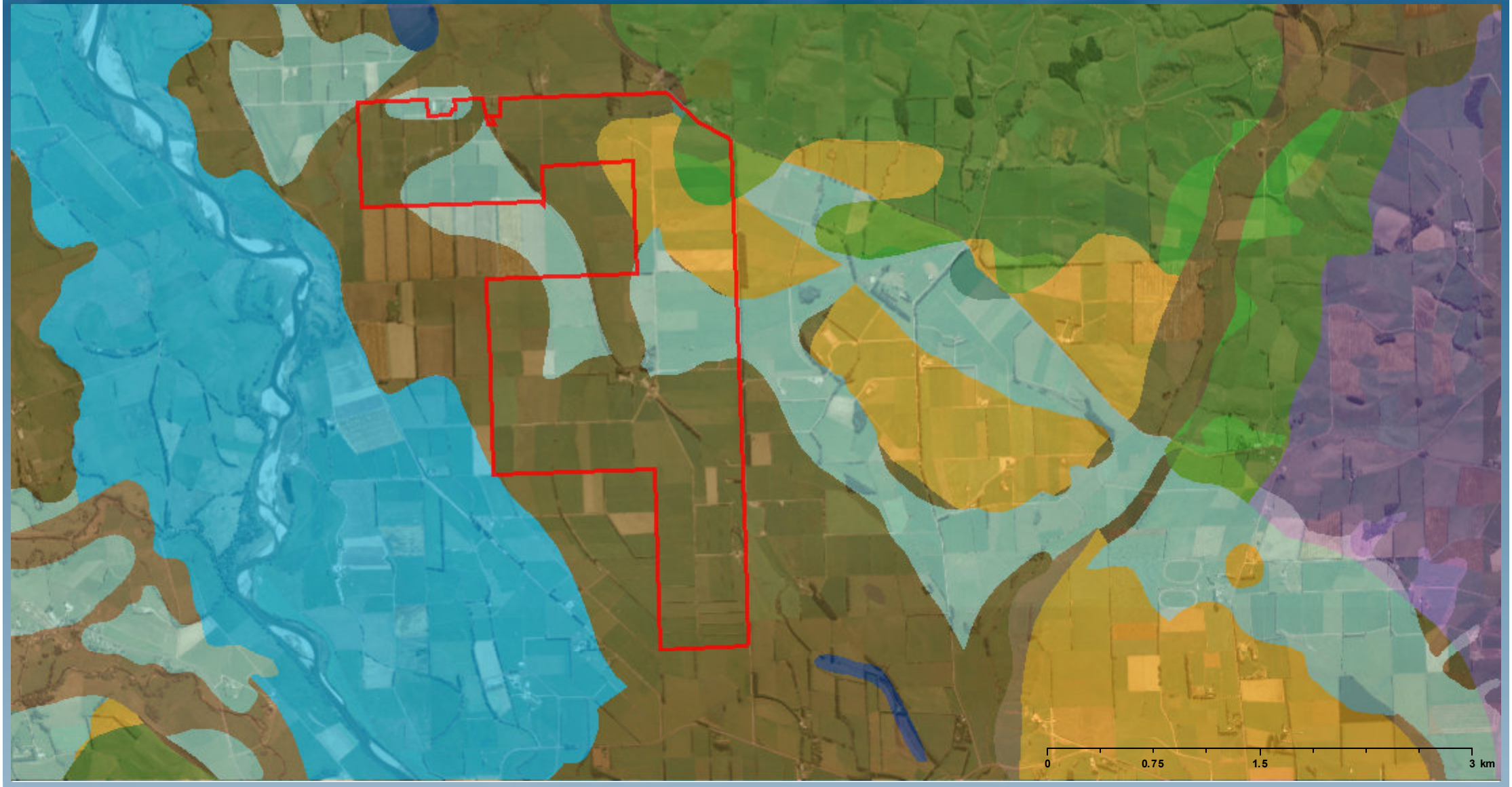
APPENDIX 1

BEACON

Environment Southland Mapping Service

Otama Dairy Ltd

February 25, 2019



polylineLayer

Override 1

Alerts

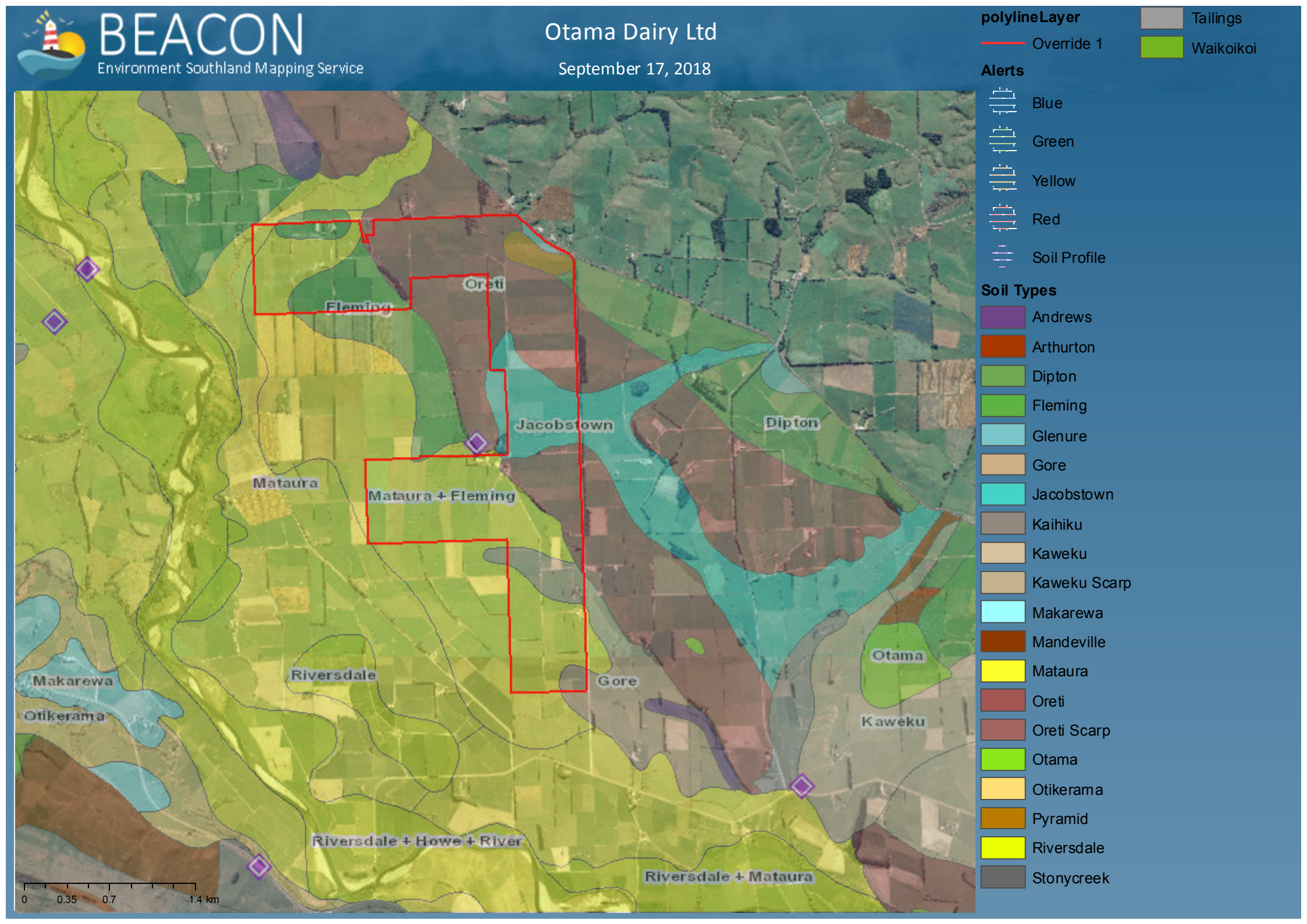
Blue

Green

Yellow

Red

APPENDIX 2


BEACON
Environment Southland Mapping Service
Otama Dairy Ltd
September 17, 2018
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Override 1
Alerts
Blue
Green
Yellow
Red
Soil Profile
Soil Types
Andrews
Arthurton
Dipton
Fleming
Glenure
Gore
Jacobstown
Kaihiku
Kaweku
Kaweku Scarp
Makarewa
Mandeville
Mataura
Oreti
Oreti Scarp
Otama
Otikerama
Pyramid
Riversdale
Stonycreek
Tailings
Waikoikoi
Oreti
Fleming
Jacobstown
Dipton
Mataura
Mataura + Fleming
Riversdale
Gore
Otama
Kaweku
Makarewa
Otikerama
Riversdale + Howe + River
Riversdale + Mataura
0
0.35
0.7
1.4 km

APPENDIX 3

ARE YOU SET FOR WINTER?

Use our winter grazing 2021 checklist to check and improve your winter preparations

What you do this winter matters to all farmers

This year, what we do during winter will be scrutinized more than ever so it is important we all do our bit and get it right. It isn't too late to make improvements for this winter. Animal welfare and environmental protection are both extremely important.

Use our easy checklist

The checklist below will help you assess whether you've covered off the key preparations for grazing.

Note: *your regional council may have more stringent rules which apply in your area. If you're unsure please check with them.*

Wintering Checklist	Green I'm all set to go	Orange This could be improved	Red Not planned, needs more preparation
Stock are excluded from waterways. You have a minimum buffer of 5m (more is required for sloping ground).			
Critical source areas (CSAs) are protected: ideally keep stock off them for the whole winter period. If you have cropped CSAs, fence them off and graze them last during good weather after the rest of the crop has been fed. Leave a good buffer area at the lowest point to filter any sediment run-off.			
Graze paddocks strategically. If adjacent to a waterway, graze towards the waterway. If on a slope graze downwards and in the direction of the water flow, or using a strategic plan suited to your location (such as an extra wide buffer).			
Plan the placement of supplementary feed and portable water troughs away from waterways, critical source areas, and ponding areas.			
Animal welfare requirements are critical: transition carefully, consider shelter, ability to lie down on firm ground, and access to water.			
Measure feed to accurately assess quantity, and plan daily feeding to ensure adequate feed for the whole winter (including extra feed for poor weather).			
Plan and manage mobs to reduce the risk of lambing / calving on crop.			
Develop an adverse weather plan for each winter grazing area to ensure that animal welfare and environmental protection needs will be met in poor weather.			
Make a plan to record evidence (photos, video, your farm diary) showing that good management practices are being implemented; and to use this year's learnings to inform next year's plan.			

Green You're confident you're ready for the coming season, great work!

Orange Check your preparations are in order, and complete any further necessary work. Check out the resources below which can help you.

Red Now's the time to take action and sort out your planning – all farmers will be under scrutiny so you don't want to let the team down. Check out the resources below to help your preparations so you're winter ready.

Resources to help your winter planning and preparations

Beef & Lamb – **beeflambnz.com/wintergrazing**

Dairy NZ – **dairynz.co.nz/wintergrazing**. Dairy farmers can also contact their milk company for information.

Deer NZ – visit **deernz.org** and search for 'wintering feed systems'

MPI – **mpi.govt.nz/protecting-freshwater-health**

Foundation for Arable Research (FAR) – visit **far.org.nz/resources** and search for 'winter grazing'

In some regions, your local catchment group may also have information to assist you.

To check if there are any local rules you need to meet, contact your local regional council. If you're planning to expand your grazing or become more intensive you may need to check with your regional council if you need a consent.

Looking to the future

Going forward, all farmers who graze stock over winter will need to have a documented winter grazing plan. This plan can become part of your Farm Environment Plan.

DairyNZ and Beef + Lamb NZ are supporting farmers with wintering resources, information and events – look out for more information on these.

This information is brought to you and supported by:

APPENDIX 4

Your 2021 Winter Grazing Plan

On the ground action this winter

Farm: _____ Person in charge: _____

Property Address: _____

Farm Size:_____ ha Wintering area:_____ ha No. of paddocks wintered on:_____

Wintering description: _____

_____

How this Winter Grazing Plan can help you

By using this guide, you're taking the right steps to continue lifting on-farm winter grazing standards.

We are strongly encouraging all farmers to make use of this Winter Grazing Plan to demonstrate to the Government that there is a committment amongst farmers to continue lifting wintering standards.

This template is intended to help you develop a simple effective paddock plan for any break fed wintering system this winter.

This template will help you action good management practices at the paddock level to look after the environment, stock and the people working within the system.

Why have a winter grazing plan?

- It creates clear expectations for everyone on the farm on how wintering is to be done
- It identifies areas for improvement
- It provides proof of good practice (to your council, your dairy company and your farm team).

An effective wintering system:

- supports good animal health and welfare
- minimises soil and nutrient loss to the environment
- complies with regional council regulations
- protects valuable topsoil
- complements the overall dairy farm system and the farm team's work
- has a contingency plan for periods of adverse weather.

→ Download a copy of this plan online at **dairynz.co.nz/wintering**

DairyNZ

Planning your winter grazing - wintering tips from farmers on areas to focus on

Critical source areas (CSAs)

These are areas that collect surface water after rain. Nutrients can pool and get into waterways or groundwater from these areas.

Farmer tip

"I fence these off with a semi-permanent fence (waratahs and poly wire) at the start of the winter and graze them last when ground conditions are good. If in doubt about where to fence, I fence off a bigger area."

Direction of grazing

Planning the direction of your grazing can reduce mud levels, creating a better environment for cows and reducing nutrient and sediment loss.

Farmer tips

"Where practical I graze towards Critical Source Areas and waterways. If this is not possible, I leave a large buffer (at least 25m) and graze away. I graze the buffer last."

"We winter our sheep in blocks and shift them every 4 days. We find that the sheep are more content and there is less soil damage with the longer grazing periods provided, the yields are adequate. We check the sheep every two days to ensure feeding levels are adequate."

Bale placement

Well considered bale placement can reduce mud in the paddock, reduce how much time stock spend around waterways and Critical Source Areas, and reduce workload for your team.

Farmer tip

"I keep baleage away from swales and waterways. I also think about how far my team have to carry baleage wrap out of the paddock."

Portable troughs and back fences

A back fence and portable trough will reduce cow movements and therefore limit soil damage through unnecessary stock movement.

Farmer tips

"I put my portable trough and pipes along the side fence. This keeps the pipes away from stock and means that we aren't moving them through muddy paddocks."

"Back fences have been a game changer for us. Although it is another job to do, it means that all the stock are up at the feed face which saves energy, and if we need to get them out of the paddock, the back fence makes this much easier."

"We have found that back fences reduce soil damage. Less soil damage means less groundwork and better new grass."

Planning for the weather

Winter weather can play havoc with paddocks, so having a Plan B, and knowing when to implement it, is critical.

Farmer tips

"We have a few areas planted in crop that are sheltered. We use these areas for any mobs that need more care – lighter, younger or multiples. The shelter dramatically reduces the energy required to stay warm. Since doing this, we have found that ewes finish winter in a much more even state and are well prepared for lambing."

"We winter on fodder beet. It is too difficult and risky to change the diet, so in poor weather we create a straw bale fence using 4 or 5 bales. This gives the stock shelter, and they lie down in the straw warm and comfortable until the weather passes."

Animal welfare

Planning in advance with your team how you will check up on stock, and what to look for helps ensure everyone is on the same page.

Farmer tip

"We check our stock each day to make sure they healthy and well fed. If a team member sees an animal with sunken eyes or poor gut fill, we go back and check it later in the day and take them off crop. We aim to notice that the animal is sick before she notices it herself."

Time efficiency

Forward planning can save time over winter and help protect your stock.

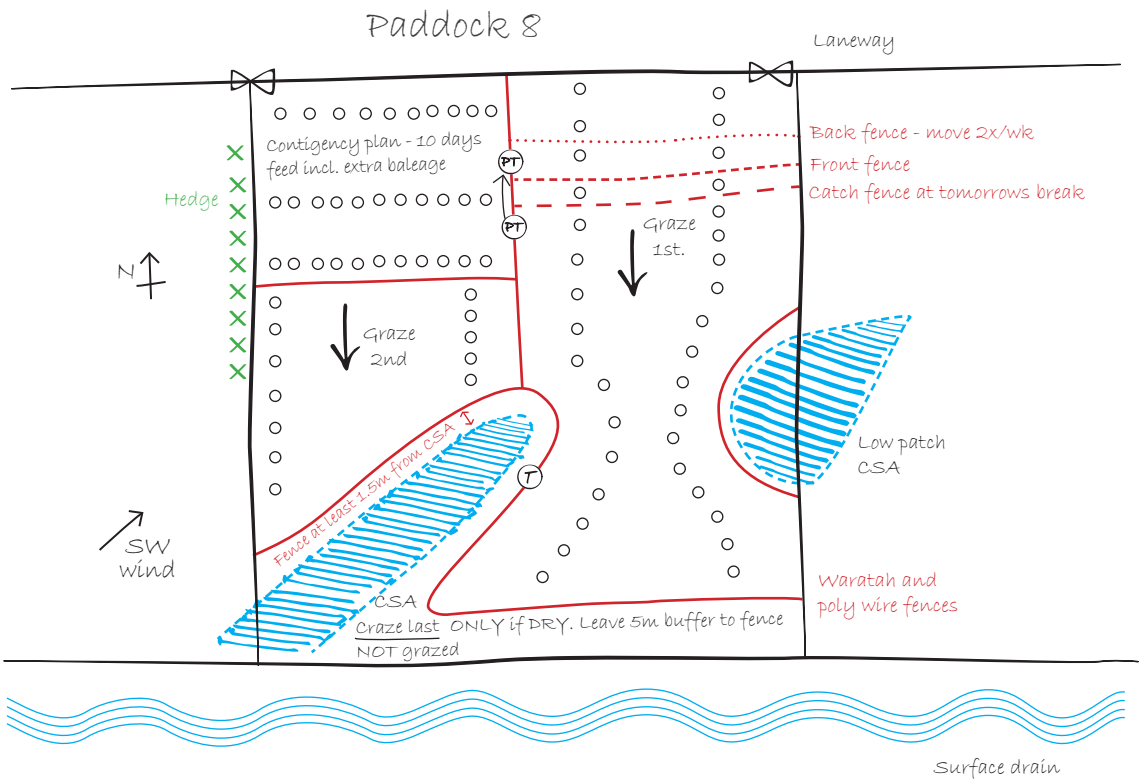
Farmer tip

"We draw our plan on a big farm map as a team initially. As a team, we create the 'master plan' which includes transitioning, animal welfare and our wet weather plan. Any paddocks that are a bit more complex or have a different wet weather plan, I later draw individually to make sure CSAs and waterways are protected."

Paddock wintering plan – Example Paddock

Mob name and size: *100 cows, mid calvers, fat condition*

Diet following transition: *10kg/day kale and 4kg/day baleage (8m crop and 2bales)*



Step 1: Draw an outline of the paddock	Symbol or Complete (tick)
Note map direction (e.g. North arrow)	N
Mark on obvious features (eg hills)	
Direction prevailing wind	SW

Step 2: Identify risk areas/ paddock features	Symbol or Complete (tick)
Critical Source Areas and wet areas	
Areas of slope	
Waterways and wetlands	
Gateways	
Permanent water troughs	T
Shelter	

Step 3: Grazing plan	Symbol or Complete (tick)
Semi-permanent fences for winter	
Direction of grazing	
Buffer zones to critical source areas/ waterways	
Baleage placement	
Portable troughs and hoses	PT
Back fence	
Front grazing fence	
Break out fence	

Step 4: Day to day management	
Cows will be fed	*Daily in the morning and checked each afternoon*
Back fences will be moved	*2x/wk*
Portable troughs will be moved	*2x/wk with the back fence*

Step 5: Executing your paddock plan	
Our transition plan for our stock is…	*Transition over 7 days. There is extra baleage in the first weeks' breaks. 1st day will be 4 bales and 5m crop.* *Cows will be monitored each day for mastitis, lameness, poor gut transition and general poor health. Any animal that does not adapt well will be drafted out and treated if appropriate*
We reduce mud in the paddock by…	*Grazing direction, fencing off wet areas, baleage and water troughs on high areas and small mob sizes*
We monitor animal health and welfare by…	*During the morning shift, we will keep an eye on any cows who are slow to come up to feed or are by themselves in the paddock.* *Monitor the herd during afternoon check – we want to see lying hollows, at least a third of the herd lying down and some feed left in the ring feeders.*
We reduce the risk of calving/lambing on crop by…	*All cows have been date scanned. Mobs split by calving date and BCS. Cows will be transitioned off crop 10-14 days before their due date. We will look every day for signs of animals springing up and any animals identified will immediately be taken off crop.*
We ensure our stock are well fed by…	*A feed budget is done prior to the start of winter. We update the budget in late June to ensure we will have enough crop for the winter. We have ten days contingency feed in the budget for wet/ windy weather. We also spray paint some baleage bales with dates showing the expected grazing dates.* *The herd will be checked each afternoon to ensure that there is 1/3 of each baleage bale left and that the herd are content. If not, or if wet/windy weather is forecast, we give the cows extra feed.*
We ensure everyone understands this plan by…	*Whole team will set up paddock together using this map as a guide. The team will get a refresher on how to identify sick cows, when to implement plans, and the targets of our wintering system.*

Step 6: Our plan for wet weather and poor soil conditions	
Our wet weather plan will be implemented….	*As per paddock 5 plan - If there is a period of cold wet and windy weather forecast.*
Our wet weather and poor soil conditions plan is…	*Cows will be offered more feed during the afternoon check to ensure they are content and that they have access to a drier lying surface at the feed face.*

Step 7: Adverse event plan	
We will implement our adverse plan when…	*There has been, or is going to be a storm event, or, if it is too wet for the cows to lie comfortably (there are no lying hollows).*
Our adverse event plan requires us to…	*We will move the cows to the North West area of the paddock which is easy to access from the laneway. Extra hay and baleage will be fed to the herd and straw can be spread for bedding if needed.*
We will ensure animal welfare requirements continue to be met by…	*Shelter: Hedge along west of paddock* *Lying time: High and dry area of the paddock* *Access to water: Portable trough can be set up quickly* *Feeding: Ad lib feed will be made available (hay and baleage).*

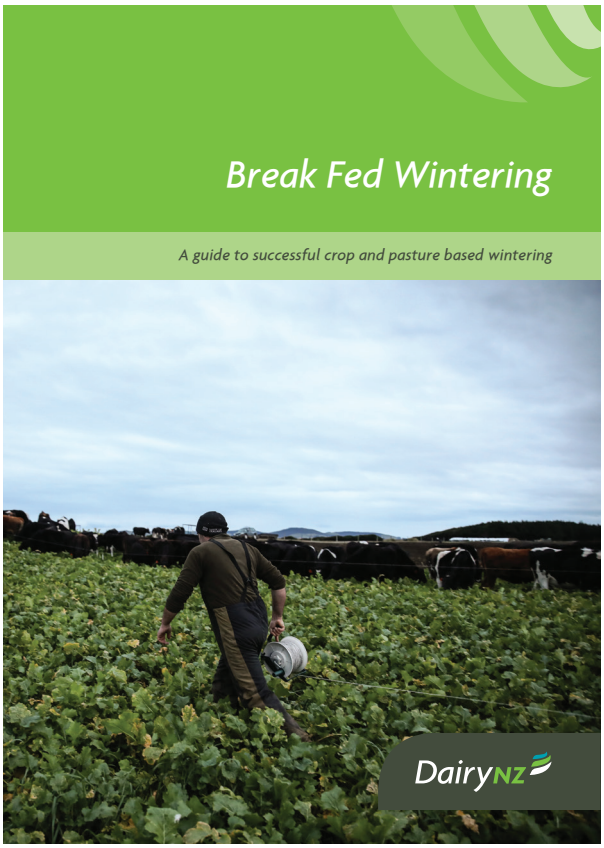
Step 8: Documentation and review	
The evidence we have to show we are following good management practice includes….	*We will take photos periodically – before, during and after grazing the paddock. This will show the use of back fences, good buffers, portable troughs and show healthy content well fed cows.*
Our plan to review this winter's wintering plan is…	*Throughout the winter we will discuss ways to improve our practices. At the end of winter, we will update our paddock plan diagram with all our ideas and use this to help with next winter's planning.*

Resources to help you plan your approach to wintering

For more information on planning your wintering approach see:

- DairyNZ – Break Fed Wintering guide – at **dairynz.co.nz/wintering**
- Beef and Lamb NZ – Winter grazing site **beeflambnz.com/wintergrazing**
- **MPI - Winter Grazing Action Group report on short term animal welfare expectations** – at **mpi.govt.nz** search for 'winter grazing action group animal welfare'
- MPI - Codes of welfare for dairy cattle, sheep and beef cattle and deer – at mpi.govt.nz/welfarecodes
- Your local regional council website for any regionally specific rules and support.

If you would like a second opinion on your planning, ring your local DairyNZ Consulting Officer (on 0800 4 324 7969), your regional council, farm consultant, technical field rep or Catchment Group Coordinator.



Paddock wintering plan for paddock number _____

Mob name and size: _____

Diet following transition: _____

Step 1: Draw an outline of the paddock	Symbol or Complete (tick)
Note map direction (e.g. North arrow)	N
Mark on obvious features (eg hills)	
Direction prevailing wind	SW

Step 2: Identify risk areas/ paddock features	Symbol or Complete (tick)
Critical Source Areas and wet areas	
Areas of slope	
Waterways and wetlands	
Gateways	
Permanent water troughs	T
Shelter	

Step 3: Grazing plan	Symbol or Complete (tick)
Semi-permanent fences for winter	
Direction of grazing	
Buffer zones to critical source areas/ waterways	
Baleage placement	
Portable troughs and hoses	PT
Back fence	
Front grazing fence	
Break out fence	

Step 4: Day to day management	
Cows will be fed	
Back fences will be moved	
Portable troughs will be moved	

Describe below your **master plan** for managing environmental and animal welfare risks.

Step 5: Executing your paddock plan	
Our transition plan for our stock is…	
We reduce mud in the paddock by…	
We monitor animal health and welfare by…	
We reduce the risk of calving/lambing on crop by…	
We ensure our stock are well fed by…	
We ensure everyone understands this plan by…	

Step 6: Our plan for wet weather and poor soil conditions	
Our wet weather plan will be implemented….	
Our wet weather and poor soil conditions plan is…	

Step 7: Adverse event plan	
We will implement our adverse plan when…	
Our adverse event plan requires us to…	
We will ensure animal welfare requirements continue to be met by…	

Step 8: Documentation and review	
The evidence we have to show we are following good management practice includes….	
Our plan to review this winter's wintering plan is…	

Paddock wintering plan for paddock number _____

Mob name and size: _____

Diet following transition: _____

Step 1: Draw an outline of the paddock	Symbol or Complete (tick)
Note map direction (e.g. North arrow)	N
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Step 4: Day to day management	
Cows will be fed	
Back fences will be moved	
Portable troughs will be moved	

How to complete this page:

Note below *any differences* from your **master plan** for managing adverse effects set out for your first paddock in this document. Except where otherwise noted the approach used in your master plan will be adopted.

Step 5: Executing your paddock plan	
Our transition plan for our stock is…	
We reduce mud in the paddock by…	
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We reduce the risk of calving/lambing on crop by…	
We ensure our stock are well fed by…	
We ensure everyone understands this plan by…	

Step 6: Our plan for wet weather and poor soil conditions	
Our wet weather plan will be implemented….	
Our wet weather and poor soil conditions plan is…	

Step 7: Adverse event plan	
We will implement our adverse plan when…	
Our adverse event plan requires us to…	
We will ensure animal welfare requirements continue to be met by…	

Step 8: Documentation and review	
The evidence we have to show we are following good management practice includes….	
Our plan to review this winter's wintering plan is…	

Paddock wintering plan for paddock number _____

Mob name and size: _____

Diet following transition: _____

Step 1: Draw an outline of the paddock	Symbol or Complete (tick)
Note map direction (e.g. North arrow)	N
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We ensure everyone understands this plan by…	

Step 6: Our plan for wet weather and poor soil conditions	
Our wet weather plan will be implemented….	
Our wet weather and poor soil conditions plan is…	

Step 7: Adverse event plan	
We will implement our adverse plan when…	
Our adverse event plan requires us to…	
We will ensure animal welfare requirements continue to be met by…	

Step 8: Documentation and review	
The evidence we have to show we are following good management practice includes….	
Our plan to review this winter's wintering plan is…	

DairyNZ would like to acknowledge the work of Thriving Southland to help develop this plan.

APPENDIX 5

Dairy Effluent Calculator Report

Disclaimer

I/We acknowledge and agree that:

1. the results contained in the report which DairyNZ will provide following my/our use of the Dairy effluent storage calculator ("the calculator") are generated based on the data which I/we have inputted into the calculator; and
2. the reliability of the results and the report is dependent upon a number of variables including, without limitation, the accuracy of the input data, and the validity of the assumptions and algorithms used in the calculator in relation to the input data which may be updated to reflect development in effluent knowledge; and
3. the results contained in the report cannot be relied upon solely to ensure the effluent storage system:
   a. meets the current or future requirements of the district or regional plans of the local territorial authority or regional council or any other authority having jurisdiction.
   b. has the storage capacity to allow practical management of the effluent system.

Accordingly, DairyNZ does not accept liability for any loss, damage, cost or expense suffered or incurred by me/us or any third party to whom this report has been provided (whether by me/us or another person) in connection with the use of, and reliance on, the report and the results contained in it.

DairyNZ's website terms and conditions (which can be found at https://www.dairynz.co.nz/terms-and-conditions) otherwise apply to the use of this service and the provision of the report and the results in it.

Cashmere Bay Dairy Ltd

145 Jaffray Road RD 7 Gore 9777

Supplier Number	33254
Storage max m³	974.54
90th percentile m³	892.89
Total pond useable volume m³	1,942.82
File owned by	Brian Goodger
Created by	Brian Goodger
Created on	09 Aug 2021
Last modified by	Brian Goodger
Last modified on	17 Aug 2021

Storage Pond Disclaimer

Climate for rainfall was taken at the Mandeville site to give a mean annual rainfall of 950 mm.

The farm entered as having a 187.7ha effluent irrigation area, 126.9ha high risk due to drainage on Mataura/Fleming and Jacobstown soils and 56.3ha low risk soils due to slope and drainage on Oreti and Gore soils.

For the purpose of this calculation an estimate of 63 liters/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 the pivot (effluent applied without injecting into the water) applying at 2.5mm depth, pumping 12lt/sec, 720lt/minute or 43,200lt/hour, run for 8 hours putting out 345m³ and 14 hours (one full rotation of the pivot) putting out 604m³. When effluent is not being applied via the pivot the farm uses a low depth/rate Cobra travelling irrigator applying 21,000 lt/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 litres.

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 892.89m³ (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 974.54m³, this DOES NOT include freeboard and sludge allowances (refer to yellow bar on graph indicating 1983 as having the worst conditions for effluent application)

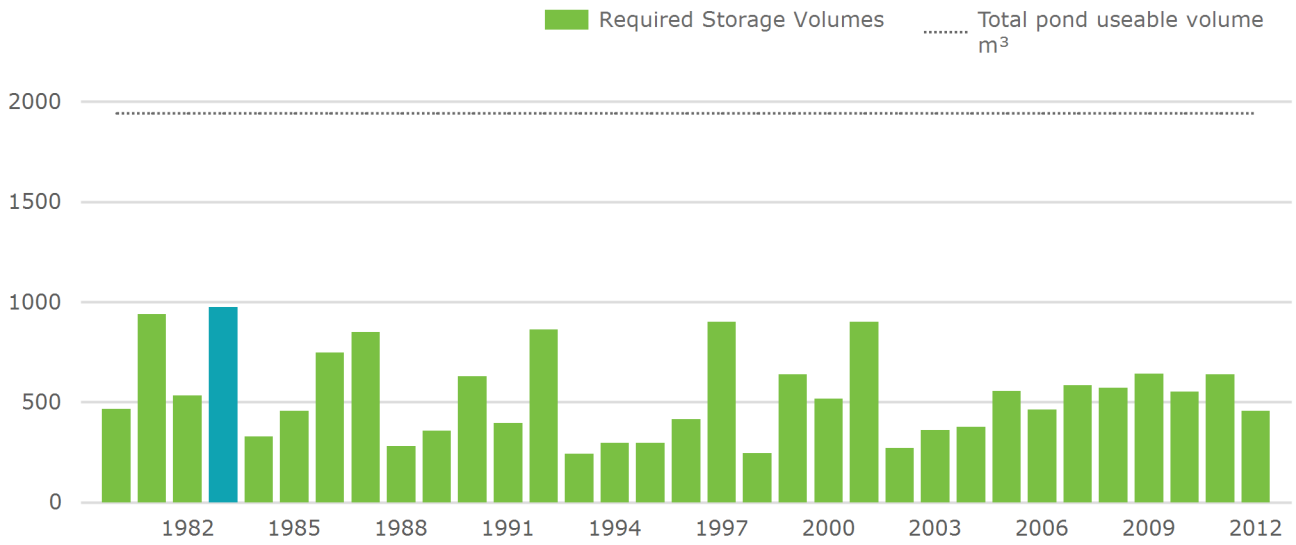
Other assumptions include: 1) 1150 peak cows, monthly numbers adjusted for deaths and culls 2) shed roof water is diverted away from the effluent pond all year 3) all concrete around the dairy is diverted in the winter 4) water use at 63lt /cow/day 5) effluent area is 126.9ha of high-risk soils and 56.3ha of low risk soils. 6) proposed 275sqm concrete lane included under yard catchment, will be diverted. 7) a 700sqm silage concrete pad allowance included under other catchments - no diversion 8) the farm has a calving pad which

is maintained with 500mm of wood bark/chips, it has drainage underneath and drains to the farms effluent system, due to no effluent being produce from the pad it has not been included in this storage calculation.

Cashmere Bay Dairy Ltd storage pond with the dimensions of 33.6m x 33.5m x 3.23m deep with a 2.0:1 batter (dimensions from RES pond drop test done 26/03/2021) was used in this calculation to give an actual size and surface area.
A pond with these dimensions would provide an effective volume of 1,942.8m³ (pumpable volume) and with 500mm of freeboard and sludge allowance a total capacity of 2,415.3m³.
This gives Cashmere Bay Dairy Ltd 1,049.91m³ 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.

Required Storage Volumes



Climate

Site	*Mean Rainfall mm*	*Altitude m*
Mandeville	950	116

Soil

Low Risk Soil ha	*Minimum High Risk Soil ha*	*Surplus high risk soil ha*
56.3	35.7	91.2

Irrigation

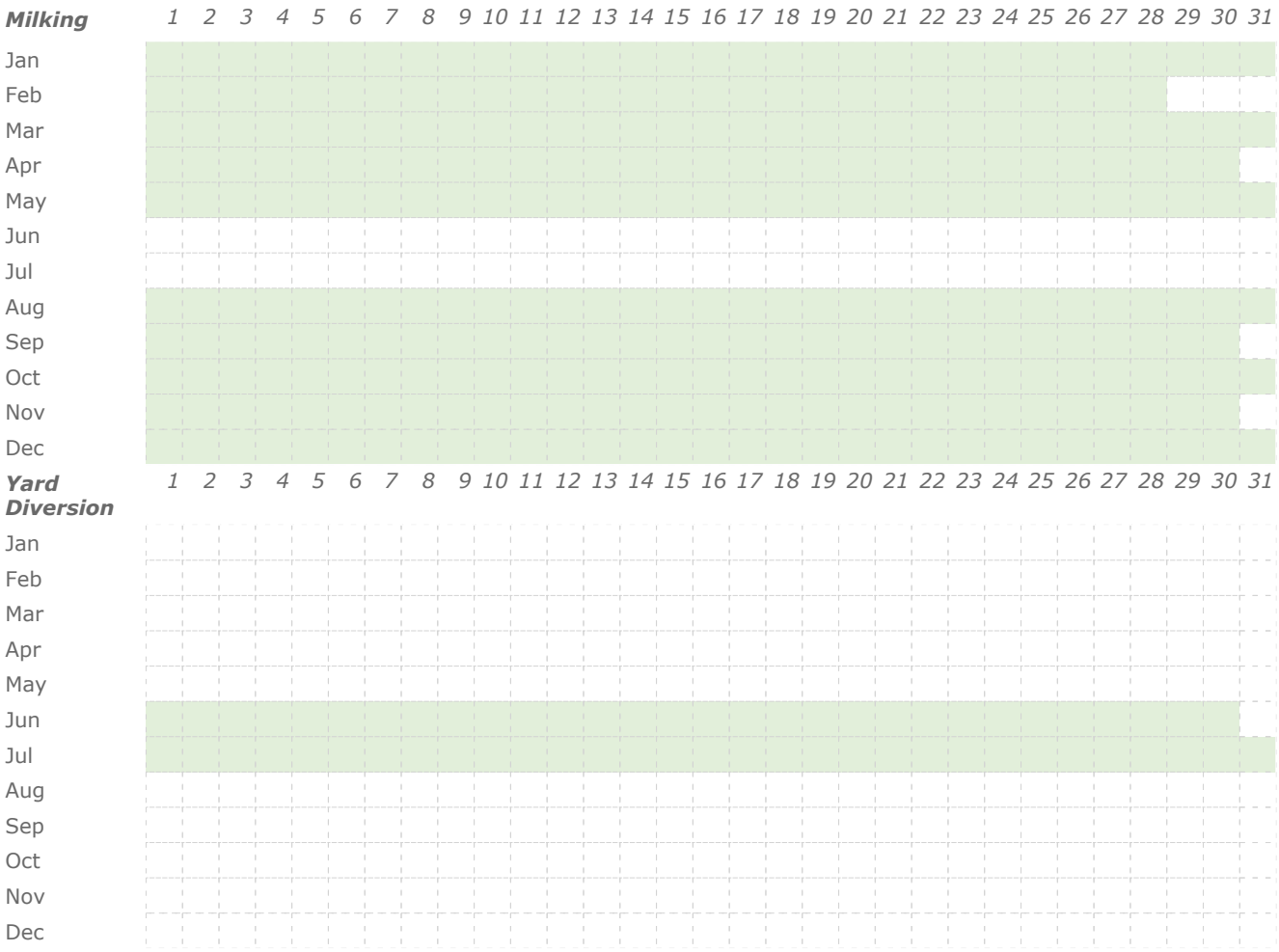
Calculated option	*Application depth mm*	*Pump volume m³*
Option 1: Pump rate 43.2m³/hr and pump time 8hrs	2.5	345.6
Option 1: Pump rate 43.2m³/hr and pump time 14hrs	2.6	604.8
Option 1: Pump rate 21m³/hr and pump time 4hrs	5.6	84

Catchment

Shed		Yard		Feedpad			Animal Shelter			Other
Area m³	Diverted	Area m³	Diverted	Area m³	Covered	Diverted	Area m³	Covered	Diverted	Area m³
336	Yes	1342	Yes	0	No	No	0	No	No	1000

	Yard			
	Cows	Hours	Volume m³	Wash LCD
Jan	1130	6	71.19	0
Feb	1130	6	71.19	0
Mar	1100	6	69.3	0
Apr	1100	6	69.3	0
May	950	6	59.85	0
Jun	0	0	0	0
Jul	0	0	0	0
Aug	700	4	44.1	0
Sep	900	5	56.7	0
Oct	1150	6	72.45	0
Nov	1140	6	71.82	0
Dec	1140	6	71.82	0

Calendar



Report generated on: 17 Aug 2021

Solid Unit

No Data Available

Storage

Emergency Storage Period	0

Storage Name	*Covered*	*Pumped*	*Type*	*Dimension*
Main effluent Pond	No	On	Regular - Rectangular	length 33.6m, width 33.5m, height 3.23m, sludge height 0.1m freeboard height 0.4m and batter 2:1

Appendix

Season	*Required Storage Volumes m³*
1980	467.55
1981	938.18
1982	534.64
1983	974.54
1984	329.95
1985	455.86
1986	746.37
1987	848.85
1988	279.74
1989	356.62
1990	630.82
1991	394.83
1992	861.97
1993	242.02
1994	295.71
1995	296.39
1996	414.11
1997	900.61
1998	245.16
1999	637.85
2000	517.41
2001	901.49
2002	271.44
2003	359.55
2004	375.68
2005	556.61
2006	463.60
2007	584.19
2008	570.84
2009	642.01
2010	553.86
2011	638.18
2012	458.00

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 provided.

Appendix B: OVERSEER Nutrient Budget Modelling Report

Roslin Consultancy Ltd

OverseerFM farm system modelling to support a consent application for expanded dairy

Report prepared for:
Cashmere Bay Dairies Limited

Property Address:
145 Jaffray Road
R D 7
Gore 9777

Overseer File and Report Prepared By:
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Roslin Consultancy Ltd
B.Agr.Sci
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0274 341 140

Overseer Files and Report Reviewed By:
Mo Topham
AgriAce
CNMA

20th August 2021

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This report is designed to be read in its entirety and any excerpts should reference the report for completeness of understanding.

Cashmere Bay Dairies Limited

Contents

1.0 Executive summary:

Cashmere Bay Dairies Limited operate three adjoining blocks:

- Milking platform – 353 ha total (344.4 ha effective)
- Support block 1 – 89.6 ha total (89.6 ha effective)
- Support block 2 – 80.3 ha total (76.5 ha effective)

It is intended to integrate the current milking platform and support block 2. Support block 2 is located very close to the farm dairy and fits in well with the milking platform. Currently support 2 is utilised as dairy support (predominately wintering). Milking on support block 2 would allow wintering to be spread across the entire area (current milking platform and support block 2) to allow a more sustainable crop rotation. The use of support block 1 would not change.

Advice from Environment Southland has been sought as to determine the preferred methodology for modelling the current system. Their advice was to use the 19/20 season as this is the best representation for what was happening on the farm on 2nd Sept 2020.

It is proposed to:

- Increase peak milked cows by 150 cows (from 990 to 1140)
- Remove 120 beef calves / yearlings
- Remove all beef R2s (ranges from 90 to 120)
- Reduce nitrogen fertiliser use
- Target Olsen P at agronomic optimum

To inform the assessment of environmental effects a nutrient budget has been prepared to compare the 19/20 season to the proposed land use.

Nutrient budgeting has been completed using Overseer version 6.4.0 to support a consent application for expanded dairy. These budgets estimate the nitrogen and phosphorus losses from the farm. Five budgets have been completed:

- 19/20
    - The 19/20 milking platform (OverseerFM file “Year Ending 2020”)
    - The 19/20 support block 1 (OverseerFM file “Year End 20 Support 1”)
    - The 19/20 support block 2 (OverseerFM file “Year End 20 Support 2”)

- Proposed
    - The proposed combined milking platform (OverseerFM file “Proposed Milking Platform”)
    - The proposed support block 2 (OverseerFM file “Proposed Support 1”)

1.1 Nutrient loss estimates

The table below compares the estimated nutrient losses from the 19/20 landuse with the estimated losses under the proposed system.

	Milking Platform 19/20	Support 1 19/20	Support 2 19/20	19/20 Total
Total Farm N Loss (kg)	18053	2186	3760	23999
N Loss/ha (kgN/ha/yr)	51	24	47	
Total Farm P Loss (kg)	333	32	40	405
P loss/ha (kgP/ha/yr)	0.9	0.3	0.5	
Pasture Grown (tDM/ha)	17.1	15.1	13.8	

	Proposed Milking Platform	Proposed Support 1	Proposed Total	Difference Between 19/20 and Proposed
Total Farm N Loss (kg)	19563	2344	21907	8.7% decrease
N Loss/ha (kgN/ha/yr)	45	26		
Total Farm P Loss (kg)	357	27	384	5.2% decrease
P loss/ha (kgP/ha/yr)	0.8	0.3		
Pasture Grown (tDM/ha)	16.3	14.4		

1.2 Drivers of changes in nutrient losses

1.2.1 Nitrogen loss estimates

Nitrogen losses from a farm system can have negative impacts on water quality downstream. This in turn can have negative implications on aquatic life and human health.

OverseerFM has estimated a 8.7% decrease in nitrogen losses between the 19/20 and proposed scenarios. This is the cumulative result of many changes to the farm system including:

- Increase in cow numbers
- Reduced nitrogen fertiliser use
- Removal of beef animals

1.2.2 Phosphorus loss estimates

Phosphorus losses from the farm can cause algal growth in surface waterways. OverseerFM has estimated a 5.2% decrease in Phosphorus losses in the proposed system. Key changes include:

- Reducing the farm average Olsen P to 30
- Increase in cow numbers
- Removal of beef animals

OverseerFM is not spatially explicit and a phosphorus mitigation plan should be developed as part of the Farm Environmental Management Plan to reduce phosphorus losses.

2.0 Report purpose

The results of the budgets will be utilised to support a land use consent application for expanded dairying.

This report will emphasise the relevant requirements in the proposed Southland Water and Land Plan, and the National Environmental Standards from a nutrient budgeting perspective. The broader range of requirements should be captured in the Farm Environmental Management Plan (FEMP). This report will inform the FEMP which will be completed separately.

Potential environmental risks on the property have been considered and should be included in the FEMP. These include:

- Contamination of ground water
- Contamination of surface water
- Undesired changes in soil nutrient status
- Nutrient application to non-target land
- Accumulation of non-nutrient impurities in the soil profile
- Excess stocking rate
- Pugging and compaction
- Poor cultivation methods

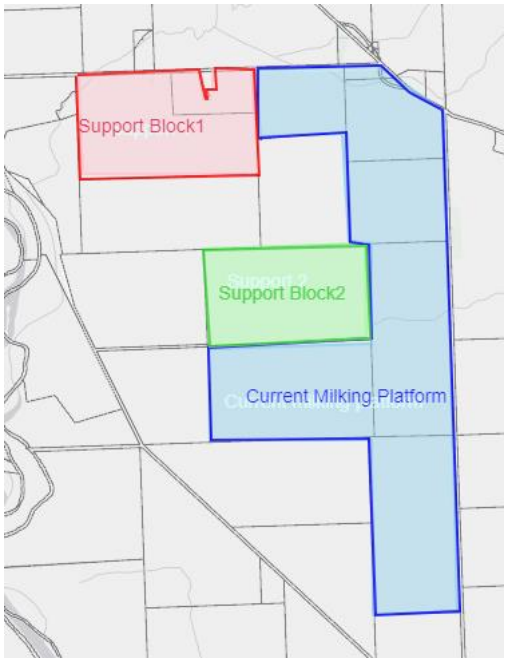
3.0 Farm overview

3.1 Ownership

Cashmere Bay Dairy operate 3 adjoining blocks:

Blocks	Total Area (ha)	Effective Area (ha)
Current milking platform	353.0	344.4
Support block 1	89.6	89.6
Support block 2	80.3	76.5
	522.9	**510.5**

3.2 Location of Blocks



3.3 Farm particulars:

Address	145 Jaffray Road R D 7 Gore
Legal Description	Current milking platform Sec 2 & 5 blk II Otama SD Sec 4 blk I Otama SD Pt sec 9 &10 blk II Otama SD Closed road blk II Otama SD Support block 1 Lot 2 DP 12628 Lot 2 DP 324253 Support block 2 Sec 14 blk II Otama SD
Area	522.9 ha

3.4 Consent Application Modelling Requirements

It is intended to integrate the current milking platform and support block 2. Support block 2 is located very close to the farm dairy and fits in well with the milking platform. Currently support 2 is utilised as dairy support (predominately wintering). This would allow wintering to be spread across the entire area to allow a more sustainable crop rotation. The use of support block 1 would not change.

Cashmere Bay Dairy is required to apply for a consent to expand dairying across the support block 2. The support block 2 has not been previously milked off.

To inform the assessment of effects a nutrient budget has been prepared to compare the current land use to proposed land use.

Advice from Environment Southland has been sought as to the budget to use as the current (baseline). Their advice was to use the 19/20 season as this is the best representation for what was happening on the farm on 2nd Sept 2020.

3.5 Farm system overview

A detailed description of the modelling methodology and Overseer input data is given in the appendices of this report. This section gives an overview of the farm system modelled in each budget.

3.5.1 19/20 Current Milking Platform

A nutrient budget was completed using the following actuals from the 19/20 season:

Stock and production:

- Milking Platform
  - 990 Fr cows were milked at peak producing 466192 kg ms for the season
  - 400 cows were wintered on the property
  - 15 breeding bulls Oct to Jan
  - 310 calves were reared and left the milking platform early October
- Support block 1
  - 310 dairy heifer calves arrive in early October, 100 leave by early November, the remaining 210 remain on farm until they enter the herd as in calf heifers
  - 6 bulls are on farm October to January for heifer mating
  - 120 beef calves from November to March
- Support block 2
  - 600 cows were wintered on the property
  - 10 carryovers remain on the property all year
  - 120 yearling bulls arrived April
  - 120 R1 steers on farm from the start of the season - 30 left in May
  - 90 R2 steers on farm from the start of the season until September

Cashmere Bay Dairies Limited

Feed

- Milking Platform
  - 8 ha of fodder beet for wintering
  - Imported feed
    - Barley grain – 800 t DM fed in shed
    - 47 t DM barley straw (fed on crop)
- Support block 1
  - Crops
    - 6 ha of fodderbeet is grown per annum
  - Exported feed
    - 120 t DM of baleage
- Support block 2
  - Crops
    - 21 ha of fodderbeet was grazed in winter 19
    - 37 ha of swedes was grazed in winter 20
  - Imported feed
    - 67 t DM barley straw (fed on crop)
  - 120 t DM baleage was placed on the crops for grazing in July to September winter 19
  - 62 t DM baleage was harvested and fed on crops winter 20

Fertiliser

- Milking Platform and support block 1 and 2
  - Soil test results from Ravensdown in 2019
  - Fertiliser applications as per Ravensdown and Ballance records
    - Milking Platform - 270 kgN/ha applied in split dressings from August to May
    - Support 1 – 249 kg N / ha applied in split dressing August to May
    - Support 2 - 257 kg N / ha applied in split dressing August to May

Structures

- Milking Platform
  - Farm dairy effluent is spread to 187.7 ha using less than 12 mm application
  - Solids are applied to pastoral areas
  - In shed feeding is used during the lactation
  - A calving pad is utilised in August for part of the herd
- Support block 1 and 2
  - No structures

Irrigation (water)

- Milking Platform
  - 28.7 ha irrigated via centre pivot
  - 122 ha by large rotorainer
  - 37 ha by small rotorainer

3.4.3 Proposed Dairy System

A budget was completed for the proposed integrated dairy system

Stock and production:

- Milking Platform
  - 1140 Fr cows were milked at peak producing 558600 kg ms for the season (note increase in per cow production – with a slightly lower stocking rate and focus on genetic improvement)
  - All cows are wintered on the property
  - 20 breeding bulls are on the property Oct to Jan
  - 265 calves were reared and left the milking platform early December
- Support block 1
  - 265 dairy heifer calves arrive in December and remain on farm until they enter the herd as in calf heifers
  - 9 bulls are on farm October to January for heifer mating

Feed

- Milking Platform
  - 44 ha of swedes for wintering (3 ha irrigated by centre pivot)
  - Imported feed
    - Barley grain – 950 t DM fed in shed
    - Baleage/silage
      - 350 t DM fed on crop
      - 40 t DM fed on pad
      - 275 t DM fed in paddock
- Support block 1
  - Crops
    - 7.5 ha of fodderbeet is grown per annum
  - Exported feed
    - 40 t DM of baleage

Fertiliser

- Milking Platform and support block 1 and 2
  - Soil test results from at agronomic optimum
  - Fertiliser applications at maintenance
    - Milking Platform - 189 kgN/ha applied in split dressings from August to April
    - Support block 1 – 189 kg N / ha applied in split dressing August to April

Structures

- Milking Platform

- Farm dairy effluent is spread to 264.2 ha using less than 12 mm application
- Solids are applied to pastoral areas
- In shed feeding is used during the lactation
- A calving pad is utilised in August for part of the herd

- Support block 1
  - No structures

Irrigation (water)

- Milking Platform
  - 28.7 ha irrigated via centre pivot
  - 122 ha by large rotorainer
  - 37 ha by small rotorainer

Cashmere Bay Dairies Limited

4.0 OverseerFM nutrient loss estimates

4.1 OverseerFM loss estimates

Nutrient budgets have been prepared to support the assessment of effects of the 19/20 and proposed dairy systems. The table below shows the OverseerFM version 6.4.0 estimated nutrient losses from the 19/20 and proposed land use

	Milking Platform 19/20	Support 1 19/20	Support 2 19/20	19/20 Total
Total Farm N Loss (kg)	18053	2186	3760	23999
N Loss/ha (kgN/ha/yr)	51	24	47	
Total Farm P Loss (kg)	333	32	40	405
P loss/ha (kgP/ha/yr)	0.9	0.3	0.5	
Pasture Grown (tDM/ha)	17.1	15.1	13.8	

	Proposed Milking Platform	Proposed Support 1	Proposed Total	Difference Between 19/20 and Proposed
Total Farm N Loss (kg)	19563	2344	21907	8.7% decrease
N Loss/ha (kgN/ha/yr)	45	26		
Total Farm P Loss (kg)	357	27	384	5.2% decrease
P loss/ha (kgP/ha/yr)	0.8	0.3		
Pasture Grown (tDM/ha)	16.3	14.4		

Note:

- There is an increase in biological fixation between the 19/20 and proposed, it is expected with a reduction in nitrogen usage (and an increase in nitrogen fixation by clovers)

5.0 Drivers of changes in nutrient losses

5.1 Nitrogen Loss estimates

Nitrogen losses from a farm system can have negative impacts on water quality downstream. This in turn can have negative implications on aquatic life and human health.

OverseerFM has estimated a 8.7% decrease in nitrogen losses between the 19/20 and proposed scenarios. This is the cumulative result of many changes to the farm system including:

- Increase in cow numbers
- Reduced nitrogen fertiliser use
- Removal of beef animals

5.2 Phosphorus loss estimates

Phosphorus losses from the farm can cause algal growth in surface waterways. OverseerFM has estimated a 5.2% decrease in Phosphorus losses in the proposed system. Key changes include:

- Reducing the farm average Olsen P to 30
- Increase in cow numbers
- Removal of beef animals

OverseerFM is not spatially explicit and a phosphorus mitigation plan should be developed as part of the FEMP to reduce phosphorus losses.

6.0 Recommendations from here

OverseerFM can model a specific range of good management practices. Below is a summary of the potential environmental risks on this property and gives recommendations to mitigate these risks.

Good practice for fertiliser use:

- Regular soil testing is used to inform fertiliser recommendations that target agronomic optimum P, K, S, Mg and Ca levels.
- Develop a fertiliser plan with your fertiliser representative. Recommend you make this OverseerFM modelling available to your fertiliser representative to assist them in developing the fertiliser recommendations.
- Apply using a Spreadmark accredited company for fertiliser application – apply at correct rate and with a buffer to waterways.
- Use of Fertmark registered products.
- Record fertiliser applications (location, date of application and amount applied).

Nitrogen:

- Apply nitrogen strategically to meet plant demand.
- Applications should generally be avoided in May due to rapidly declining growth rates.
- Spring nitrogen applications should not be on soil less than 7 degrees Celsius.

Phosphorus:

- OverseerFM is not spatially explicit and a phosphorus mitigation plan should be developed to reduce phosphorus losses.

Critical source areas:

- These include laneways, gateways, swales in paddocks and wallows.
- Review your Farm Environmental Management Plan to update as required and take action on mitigating risk on any new critical source areas identified.

The Proposed Water and Land Plan is currently in the appeals process and is partially operative. It will be important to stay up to date with developments in Environment Southland policy and rules, including the limit setting process which will develop over the next few years.

A National Environmental Standard (NES) has recently been gazetted. This has implications for the wintering of stock on crop, stock exclusion from waterways, nitrogen fertiliser use, changes in landuse and the use of stockholding areas for cattle.

Both the Proposed Water and Land Plan and the National Environmental Standards require a farm of this size to have a farm environmental management plan. This should be updated to include the recommendations within this report.

Appendices

Appendix 1. Modelling Methodology

Nutrient losses have been estimated using the OverseerFM Version 6.4.0 model. OverseerFM is a software application that models nutrient movements within a farm system. Input data detailing the farm system is entered into the software and interpreted through the use of a series of sub-model that calculate the flow of seven major farm nutrients (Nitrogen, Phosphorus, Sulphur, Calcium, Magnesium and Sodium). Output data is reported for interpretation and to inform farm management practices. It currently requires an expert user to describe the physical and management details of a farm.

OverseerFM assumptions

Within the OverseerFM software, assumptions have been made of the farm management:

- Long term annual average model
  The model uses annual average input and produces annual average outputs.
- Near equilibrium conditions
  Model assumes that 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
  OverseerFM assumes the property is managed at industry agreed good management practice for a specific list of factors including effluent and fertiliser applications. OverseerFM does not assume that all industry agreed good management practices are undertaken on farm.

OverseerFM limitations

Key limitations of the OverseerFM model are:

- OverseerFM does not predict transformations, attenuation or dilution of nutrients between the root zone or farm boundary and the eventual receiving water body. A catchment model is needed to estimate the effects of the nutrient losses from farms on groundwater, river or lake water quality.
- OverseerFM does not calculate outcomes from extreme events (floods and droughts) but provides a typical years result based on a long-term average.
- OverseerFM does not calculate the impacts of a conversion process, rather it predicts the long-term annual average nutrient budgets for changed land use.
- OverseerFM 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 OverseerFM model.
- OverseerFM does not represent all farm systems in New Zealand.
- Components of OverseerFM have not been calibrated against measured data from every combination of farm systems and environment.

Information on OverseerFM can be obtained from the following reports:

- Technical Description of OVERSEER for Regional Councils, September 2015
- Review of the phosphorus loss submodel in OVERSEER®, September 2016
- Using OVERSEER® in Regulation – Technical Resources and Guidance for Regional Councils, August 2016

Data input standards

Nutrient budgets have been constructed using the OverseerFM Version 6.4.0 model.

The nutrient budgets have been developed in accordance with the Overseer data input protocols - "Overseer, Best Practice Data Input Standards, March 2018" and the "OverseerFM User Guide, October 2019." No deviations have been made from these protocols.

Appendix 2. Modelling Inputs

Soil types

Soil type has a large bearing on nutrient loss levels from a property. This is due to different soil types having different water holding capacities, and drainage characteristics. It is therefore important that soil type is inputted correctly.

The table below gives a brief description of the soil types found on the properties.

S-map ref	Group	Soil Order	Drainage class	Description
Selw_50a.1	Recent/YGE/BGE	Recent	Well	deep, well drained, silt
Stew_7a.1	Sedimentary	Brown	Well	shallow, well drained, silt
Eure_23a.1	Sedimentary	Gley	Poor	moderately deep, poorly drained, silt
Clar_33a.1	Recent/YGE/BGE	Pallic	Poor	moderately deep, poorly drained, silt
Balm_21a.1	Sedimentary	Brown	Well	shallow, well drained, silt
Pyr2_2a.1	Recent/YGE/BGE	Pallic	Well	moderately deep, well drained, silt over clay
Eure_20a.1	Sedimentary	Gley	Poor	deep, poorly drained, silt

The table below shows the area and the proportion of the block that the soils identified covered:

Current Properties:

S-map ref	Milking Platform Area (ha)	Support 1 (ha)	Support 2 (ha)	Total (ha)
Selw_50a.1	134.3	20.6	9.0	163.9
Stew_7a.1	99.1	25.1	31.0	155.2
Eure_23a.1	45.6		7.3	52.9
Clar_33a.1	27.7	43.9	29.2	100.8
Balm_21a.1	23.1			23.1
Pyr2_2a.1	10.6			10.6
Eure_20a.1	4.0			4.0

Proposed Properties:

S-map ref	Milking Platform Area (ha)	Support 1 (ha)	Total (ha)
Selw_50a.1	143.3	20.6	163.9
Stew_7a.1	130.1	25.1	155.2
Eure_23a.1	52.9		52.9
Clar_33a.1	56.9	43.9	100.8
Balm_21a.1	23.1		23.1
Pyr2_2a.1	10.6		10.6
Eure_20a.1	4.0		4.0

Climate Data

The following climate information has been used from the OverseerFM climate station tool:

Annual Rainfall (mm)	829 - 859
Mean Annual Temp (°C)	10.0 – 10.2
Annual PET (mm)	750 - 759

Blocks

The farms have been split into the following pastoral, riparian and fodder crop blocks based on soil type, contour, drainage and land use. All contour is flat.

			19/20 dairy platform	19/20 Support Block 1	19/20 Support Block 2		Proposed dairy platform	Proposed Support Block 1
Pasture blocks								
	MP Effluent Centre Pivot		28.7				28.7	
	MP Effluent Large RR		122.0				122.0	
	MP Effluent Small RR		37.0				37.0	
	MP Non Effluent		38.2				38.2	
	MP Effluent						76.5	
	MP Non Effluent (lease)		81.8				81.8	
	MP Non Effluent (lease) rolling		36.7				36.7	
	Pasture			89.6	18.5			89.6
	Fodderbeet Winter 19				5.0			
	Fodderbeet Winter 19				16.0			
	Swedes Winter 20				24.0			
	Swedes Winter 20				13.0			
		Productive Block Area	**344.4**	**89.6**	**76.5**		**420.9**	**89.6**
		Non-effective area	8.6	0	3.8		12.4	0
		Total area	**353.0**	**89.6**	**80.3**		**433.3**	**89.6**
	Fodderbeet		**8.0**	**6.0**				**7.5**
	Swedes						**44.0**	

Farm System Inputs

<table>
<tr><th>Description</th><th>19/20 dairy platform</th><th>19/20 Support Block 1</th><th>19/20 Support Block 2</th><th></th><th>Proposed dairy platform</th><th>Proposed Support Block 1</th></tr>
<tr><td>Area</td><td>Total: 353 ha

Productive farm area: 344.4 ha</td><td>Total: 89.6 ha

Productive farm area: 89.6 ha</td><td>Total: 80.3 ha

Productive farm area: 76.5 ha</td><td></td><td>Total: 433.3 ha

Productive farm area: 420.9 ha</td><td>Total: 89.6 ha

Productive farm area: 89.6 ha</td></tr>
<tr><td>Dairy cows (note: stock numbers refer to those on the last day of the month)</td><td>Production: 466192kgMS (471kgMS/cow at peak)

Mean calving date: 22 Aug
Dry off date: 25 May

<table><tr><th>Month</th><th>Dairy Herd – Fr</th></tr><tr><td>Jul</td><td>400</td></tr><tr><td>Aug</td><td>650</td></tr><tr><td>Sep</td><td>850</td></tr><tr><td>Oct</td><td>990</td></tr><tr><td>Nov</td><td>990</td></tr><tr><td>Dec</td><td>990</td></tr><tr><td>Jan</td><td>980</td></tr><tr><td>Feb</td><td>970</td></tr><tr><td>Mar</td><td>960</td></tr><tr><td>Apr</td><td>960</td></tr><tr><td>May</td><td>890</td></tr><tr><td>Jun</td><td>400</td></tr></table>
15 breeding bulls Oct to Jan</td><td></td><td>Winter and carry over grazing for the dairy farm (all cows are dry while on this block)

<table><tr><th>Month</th><th>Dairy Herd – Fr</th></tr><tr><td>Jul</td><td>600</td></tr><tr><td>Aug</td><td>350</td></tr><tr><td>Sep</td><td>150</td></tr><tr><td>Oct</td><td>10</td></tr><tr><td>Nov</td><td>10</td></tr><tr><td>Dec</td><td>10</td></tr><tr><td>Jan</td><td>10</td></tr><tr><td>Feb</td><td>10</td></tr><tr><td>Mar</td><td>10</td></tr><tr><td>Apr</td><td>10</td></tr><tr><td>May</td><td>80</td></tr><tr><td>Jun</td><td>600</td></tr></table></td><td></td><td>Production: 558600 kgMS (490kgMS/cow at peak)

Mean calving date: 22 Aug
Dry off date: 25 May

<table><tr><th>Month</th><th>Dairy Herd – Fr</th></tr><tr><td>Jul</td><td>1195</td></tr><tr><td>Aug</td><td>1170</td></tr><tr><td>Sep</td><td>1145</td></tr><tr><td>Oct</td><td>1140</td></tr><tr><td>Nov</td><td>1140</td></tr><tr><td>Dec</td><td>1140</td></tr><tr><td>Jan</td><td>1090</td></tr><tr><td>Feb</td><td>1090</td></tr><tr><td>Mar</td><td>1090</td></tr><tr><td>Apr</td><td>1000</td></tr><tr><td>May</td><td>903</td></tr><tr><td>Jun</td><td>1195</td></tr></table>
20 breeding Oct to Jan</td><td></td></tr>
</table>

Description	19/20 dairy platform	19/20 Support Block 1	19/20 Support Block 2		Proposed dairy platform	Proposed Support Block 1
Dairy replacements	310 heifer calves August and September	310 heifer calves arrive Oct, 100 leave 20th Nov (sold), 210 remain until leave farm as in calf heifers 6 bulls for mating Oct to Jan			265 heifer calves August to Nov	265 heifer calves arrive Dec and remain until leave farm as in calf heifers 9 bulls for mating Oct to Jan
Beef	NA	120 beef calves arrive 20th Nov and leave 1st April	120 beef calves arrive 1st April 120 beef steers yearlings on farm, 30 hooked May 90 steers for a second winter and hooked in September		NA	NA
In shed feeding	100% of herd fed inshed Aug – May	N/A	N/A		100% of herd fed inshed Aug – May	N/A
Structures	Uncovered wintering pad Bark surface Management: 10% of cows (65) Aug Lined with effluent treated with the farm dairy system				Uncovered wintering pad Bark surface Management: 15% of cows (176) Aug Lined with effluent treated with the farm dairy system	
Animal distribution	No difference between blocks	No difference between blocks	No difference between blocks		No difference between blocks	No difference between blocks

Description	19/20 dairy platform	19/20 Support Block 1	19/20 Support Block 2		Proposed dairy platform	Proposed Support Block 1
Crop management	Fodderbeet (rotating) 8 ha ex pasture 25TDM/ha yield Planted in Nov – conventional cultivation 250kg/ha CM at sowing KCl, NaCl & kierserite at sowing 150kg/ha N protect applied in Dec and March Grazed in May to August Sown into permanent pasture in Oct	Fodderbeet (rotating) 6 ha ex pasture 25TDM/ha yield Planted in Nov – conventional cultivation 250kg/ha CM at sowing KCl, NaCl & kierserite at sowing 150kg/ha N-protect in Dec and Mar Grazed in May to August Sown into permanent pasture in Oct	Fodderbeet Winter 19 5 ha ex pasture 23TDM/ha yield Planted in Nov – conventional cultivation 250kg/ha CM at sowing KCl & kierserite at sowing 150kg/ha N protect applied in Dec and Feb Grazed in May to Sept Sown into permanent pasture in Oct Fodderbeet Winter 19 16 ha ex pasture 23TDM/ha yield Planted in Nov – conventional cultivation 250kg/ha CM at sowing KCl & kierserite at sowing 150kg/ha N protect applied in Dec and Feb Grazed in May to Sept Sown into permanent pasture in Oct Swedes Winter 20 24 ha ex pasture 16TDM/ha yield Planted in Nov – conventional cultivation 297kg/ha CM at sowing		Swedes (rotating) 44 ha ex pasture 16TDM/ha yield Planted in Nov – conventional cultivation 300kg/ha DAP at sowing 150kg/ha Urea applied in Dec and Feb Grazed in May to August Sown into permanent pasture in Oct	Fodderbeet (rotating) 7.5 ha ex pasture 25TDM/ha yield Planted in Nov – conventional cultivation 250kg/ha CM at sowing KCl, NaCl & kierserite at sowing 150kg/ha urea applied in Dec and March Grazed in May to August Sown into permanent pasture in Oct

Description	19/20 dairy platform	19/20 Support Block 1	19/20 Support Block 2		Proposed dairy platform	Proposed Support Block 1
			161 kg/ha super10 at sowing 54 kg/ha KCl at sowing 541 kg/ha lime at sowing 150kg/ha N protect applied in Dec and March Grazed in May to Sept <u>Swedes Winter 20</u> 13 ha ex pasture 16TDM/ha yield Planted in Nov – conventional cultivation 297kg/ha CM at sowing 161 kg/ha super10 at sowing 54 kg/ha KCl at sowing 541 kg/ha lime at sowing 150kg/ha N protect applied in Dec and March Grazed in May to Sept			
Imported Supplements	Barley grain – 800 t DM fed in shed Barley straw – 47 t DM fed on crop		Baleage – 120TDM Barley straw – 67 tDM		Barley grain – 950 t DM fed in shed Baleage – 350 t DM fed on crop Baleage – 40 t DM fed on pad Silage - 275 t DM fed in paddocks	

Description	19/20 dairy platform	19/20 Support Block 1	19/20 Support Block 2		Proposed dairy platform	Proposed Support Block 1
Exported supplements	33TDM to Storage 26TDM off farm	Baleage 120 t DM	None		None	Baleage – 40 t DM
Soil Fertility	Soil tests were completed in 2019 Olsen P of 32	Soil tests were completed in 2019 Olsen P of 32	Soil tests were completed in 2019 Olsen P of 32		Agronomic optimum Olsen P of 30	Agronomic optimum Olsen P of 30
Fertiliser	Fertiliser applied from actuals (12066 kg P)	Fertiliser applied from actuals (4172 kg P)	Fertiliser applied from actuals (3378 kg P)		Fertiliser applied to maintenance (10729 kg P)	Fertiliser applied to maintenance (2483 kg P)
Pastoral Nitrogen Fertiliser	270kgN/ha was applied to the pasture area in split application between Aug and May	249kgN/ha was applied to the pasture area in split application between Aug and May	257kgN/ha was applied to the pasture area in split application between Aug and May		189kgN/ha was applied to the pasture area in split application between Aug and April	189kgN/ha was applied to the pasture area in split application between Aug and April
Drainage	232.5 ha is 60% drained using mole / tile drainage	None	76.5 ha is 60% drained using mole / tile drainage		309 ha is 60% drained using mole / tile drainage	None
Effluent system	Holding pond Effluent is applied using at less than 12mm Liquid effluent is applied to the "eff" blocks of 187.7 ha Solids are spread on all pastoral areas				Holding pond Effluent is applied using at less than 12mm Liquid effluent is applied to the "eff" blocks of 264.2 ha Solids are spread on all pastoral areas	
Water Irrigation	28.7 ha centre pivot 122 ha large RR (1)				28.7 ha centre pivot 122 ha large RR (1)	

Description	19/20 dairy platform	19/20 Support Block 1	19/20 Support Block 2		Proposed dairy platform	Proposed Support Block 1
	37 ha small RR (2) Soil moisture tapes Depth to target Fixed return Water applied Nov to Feb No irrigation applied to crops (crops were not under centre pivot)				37 ha small RR (2) Soil moisture tapes Depth to target Fixed return Water applied Nov to Feb Crops – irrigation only applied when planted under centre pivot (not practical with RR)	

Appendix C: Dairy Effluent Storage Calculator Assessment

Dairy Effluent Calculator Report

Disclaimer

I/We acknowledge and agree that:

1. the results contained in the report which DairyNZ will provide following my/our use of the Dairy effluent storage calculator ("the calculator") are generated based on the data which I/we have inputted into the calculator; and
2. the reliability of the results and the report is dependent upon a number of variables including, without limitation, the accuracy of the input data, and the validity of the assumptions and algorithms used in the calculator in relation to the input data which may be updated to reflect development in effluent knowledge; and
3. the results contained in the report cannot be relied upon solely to ensure the effluent storage system:
   a. meets the current or future requirements of the district or regional plans of the local territorial authority or regional council or any other authority having jurisdiction.
   b. has the storage capacity to allow practical management of the effluent system.

Accordingly, DairyNZ does not accept liability for any loss, damage, cost or expense suffered or incurred by me/us or any third party to whom this report has been provided (whether by me/us or another person) in connection with the use of, and reliance on, the report and the results contained in it.

DairyNZ's website terms and conditions (which can be found at https://www.dairynz.co.nz/terms-and-conditions) otherwise apply to the use of this service and the provision of the report and the results in it.

Cashmere Bay Dairy Ltd

145 Jaffray Road RD 7 Gore 9777

Supplier Number	33254
Storage max m³	974.54
90th percentile m³	892.89
Total pond useable volume m³	1,942.82
File owned by	Brian Goodger
Created by	Brian Goodger
Created on	09 Aug 2021
Last modified by	Brian Goodger
Last modified on	17 Aug 2021

Storage Pond Disclaimer

Climate for rainfall was taken at the Mandeville site to give a mean annual rainfall of 950 mm.

The farm entered as having a 183.2ha effluent irrigation area,126.9ha high risk due to drainage on Mataura/Fleming and Jacobstown soils and 56.3ha low risk soils due to slope and drainage on Oreti and Gore soils.

For the purpose of this calculation an estimate of 63 liters/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 the pivot (effluent applied without injecting into the water) applying at 2.5mm depth, pumping 12lt/sec, 720lt/minute or 43,200lt/hour, run for 8 hours putting out 345m³ and 14 hours (one full rotation of the pivot) putting out 604m³. When effluent is not being applied via the pivot the farm uses a low depth/rate Cobra travelling irrigator applying 21,000 lt/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 litres.

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 892.89m³ (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 974.54m³, this DOES NOT include freeboard and sludge allowances (refer to yellow bar on graph indicating 1983 as having the worst conditions for effluent application)

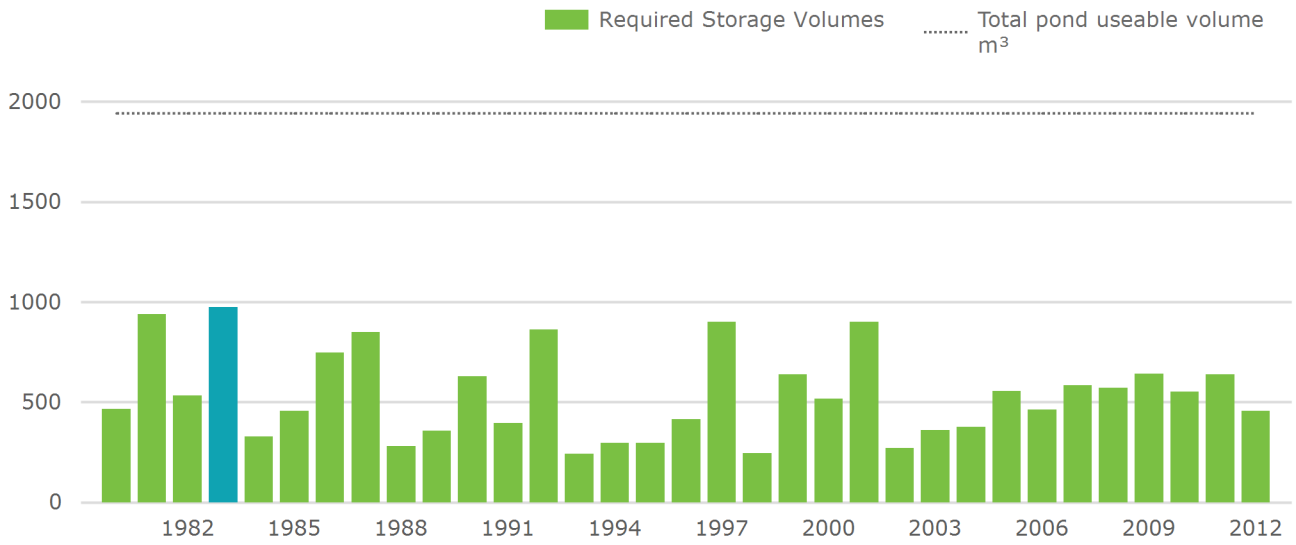
Other assumptions include: 1) 1150 peak cows, monthly numbers adjusted for deaths and culls 2) shed roof water is diverted away from the effluent pond all year 3) all concrete around the dairy is diverted in the winter 4) water use at 63lt /cow/day 5) effluent area is 126.9ha of high-risk soils and 56.3ha of low risk soils. 6) proposed 275sqm concrete lane included under yard catchment, will be diverted. 7) a 700sqm silage concrete pad allowance included under other catchments - no diversion 8) the farm has a calving pad which

is maintained with 500mm of wood bark/chips, it has drainage underneath and drains to the farms effluent system, due to no effluent being produce from the pad it has not been included in this storage calculation.

Cashmere Bay Dairy Ltd storage pond with the dimensions of 33.6m x 33.5m x 3.23m deep with a 2.0:1 batter (dimensions from RES pond drop test done 26/03/2021) was used in this calculation to give an actual size and surface area.
A pond with these dimensions would provide an effective volume of 1,942.8m³ (pumpable volume) and with 500mm of freeboard and sludge allowance a total capacity of 2,415.3m³.
This gives Cashmere Bay Dairy Ltd 1,049.91m³ 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.

Required Storage Volumes



Climate

Site	*Mean Rainfall mm*	*Altitude m*
Mandeville	950	116

Soil

Low Risk Soil ha	*Minimum High Risk Soil ha*	*Surplus high risk soil ha*
56.3	35.7	91.2

Irrigation

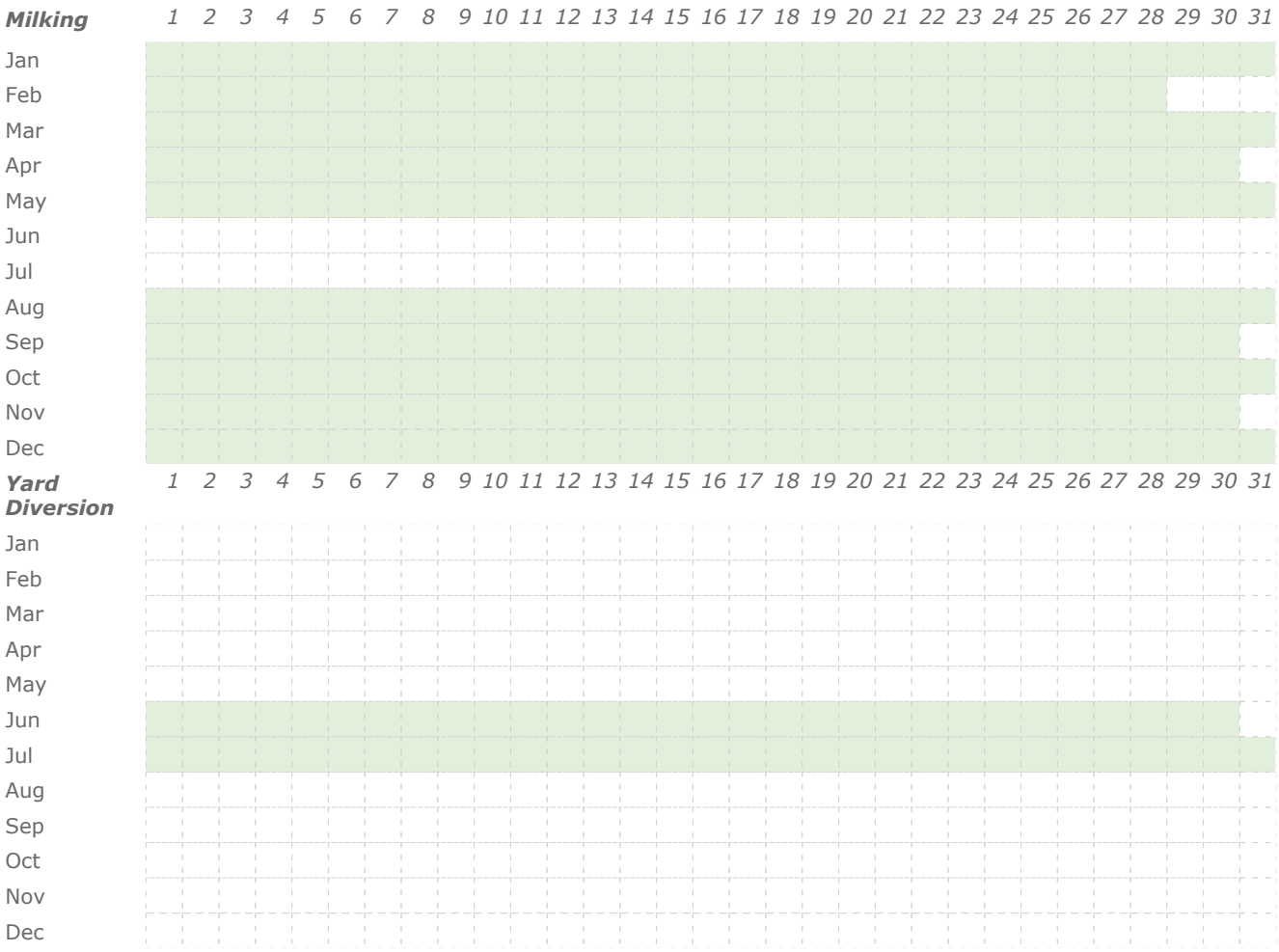
Calculated option	*Application depth mm*	*Pump volume m³*
Option 1: Pump rate 43.2m³/hr and pump time 8hrs	2.5	345.6
Option 1: Pump rate 43.2m³/hr and pump time 14hrs	2.6	604.8
Option 1: Pump rate 21m³/hr and pump time 4hrs	5.6	84

Catchment

Shed		Yard		Feedpad			Animal Shelter			Other
Area m³	Diverted	Area m³	Diverted	Area m³	Covered	Diverted	Area m³	Covered	Diverted	Area m³
336	Yes	1342	Yes	0	No	No	0	No	No	1000

	Yard			
	Cows	Hours	Volume m³	Wash LCD
Jan	1130	6	71.19	0
Feb	1130	6	71.19	0
Mar	1100	6	69.3	0
Apr	1100	6	69.3	0
May	950	6	59.85	0
Jun	0	0	0	0
Jul	0	0	0	0
Aug	700	4	44.1	0
Sep	900	5	56.7	0
Oct	1150	6	72.45	0
Nov	1140	6	71.82	0
Dec	1140	6	71.82	0

Calendar



Report generated on: 17 Aug 2021

Solid Unit

No Data Available

Storage

Emergency Storage Period	0

Storage Name	*Covered*	*Pumped*	*Type*	*Dimension*
Main effluent Pond	No	On	Regular - Rectangular	length 33.6m, width 33.5m, height 3.23m, sludge height 0.1m freeboard height 0.4m and batter 2:1

Appendix

Season	*Required Storage Volumes m³*
1980	467.55
1981	938.18
1982	534.64
1983	974.54
1984	329.95
1985	455.86
1986	746.37
1987	848.85
1988	279.74
1989	356.62
1990	630.82
1991	394.83
1992	861.97
1993	242.02
1994	295.71
1995	296.39
1996	414.11
1997	900.61
1998	245.16
1999	637.85
2000	517.41
2001	901.49
2002	271.44
2003	359.55
2004	375.68
2005	556.61
2006	463.60
2007	584.19
2008	570.84
2009	642.01
2010	553.86
2011	638.18
2012	458.00

Appendix D: Pond drop test results

RURAL ENVIRONMENTAL SOLUTIONS
INDEPENDENT CONSULTANCY

Donna Corbin
Mobile: 027 890 1234
Email: donna@res.kiwi.nz
42 Charlton Road
Gore 9710

Thursday, 1 April 2021

George Raymond
Cashmere Bay Dairy Ltd/Otama Farm
145 Jaffray Road
RD7
Gore 9777

Dairy Supply Number (DSN): 33254
Discharge Permit Number: AUTH-301811-V2
Client Code: CAS20170

Subject: Drop Test Results for CAS20170 Cashmere Bay Dairy Ltd/Otama Farm.

Dear George,

Thank you for the opportunity to undertake a Drop Test on your effluent storage facility on 26/03/2021.

Summary of Results

Full Test – if no exclusions are allowed.

Overall, the results of the Drop Test undertaken (in accordance with Appendix P methodology) show that there was an average unaccounted relative change, of a rise of 0.86 mm per 24-hour period, being a total unaccounted relative change, of a rise of approximately 3.77 mm over the whole test.

The Storage pond, as tested has passed the Appendix P pass/fail criteria.

Excluded data- due to rainfall and wind affecting the pond.

When data is excluded during the test there are long periods of time that the results of the Drop Test undertaken (in accordance with Appendix P methodology) show that there was an average unaccounted relative change, of a rise of 0.43 mm per 24-hour period, being a total unaccounted relative change, of a rise of approximately 1.81 mm over the whole test.

Data was excluded form the test to better show the periods that there was excepted data, outside of the period of rainfall and wind experienced at around 45 hours.

When data was excluded from the test duration, as per the reasoning below (refer to General Comments/Conclusion), the Storage pond, as tested has passed the Appendix P pass/fail criteria, using the test data with excluded periods.

Test Parameters

The Drop Test was performed following the Proposed Southland Water and Land Plan (Decisions Version, 4 April 2018), Appendix P Effluent Pond Drop Test Methodology.

The Drop Test and this report, data and conclusions have been based upon the Appendix P methodology, and information supplied by yourself and farm staff, during discussions on the phone or in person, to either Donna Corbin or her representatives. While reasonable endeavours have been made to ensure the accuracy of the information contained

in this Report, Donna Corbin t/a RES Rural Environmental Solutions does not accept responsibility for any assessments or recommendations made based upon incomplete or incorrect information.

Storage location

Figure 1 Tested Storage Location.

Farm Information

Consented Company Name	Cashmere Bay Dairy Ltd/Otama Farm
Regional Council Consent Number	AUTH-301811-V2
Main Contact	George Raymond
RES Client Code	CAS20170
Dairy Supply Number	33254
Physical Address	263 Jaffray Road, Otamita
Type of Storage	Synthetically lined effluent pond

Storage Information

Freeboard and depths from test, can be overridden by VA.

NZTM 2000 GPS Co-ordinates	1279710 mE, 4899887 mN	
Storage liner type	Synthetically lined effluent pond	
	Leak Detection System – installed?	Yes
	Inspection Chamber Installed?	Yes
	Ground water diversion installed?	No
	Gas venting installed?	Yes
Storage dimensions: rectangular or square storage	Average of side A (North side)	33.6 m
	Average of side B (West side)	33.5 m
	Average internal embankment slope	2.2 to 1
	Average of minimum depth (including free board)	3.23 m
	Minimum liquid level of pond	2.73 m
	Freeboard at start of test	1.12 m
Storage Level	75% full is a maximum available freeboard of:	1.18 m
	Freeboard at time of test:	1.12 m
	The storage was at least 75% full at the time of the test:	Yes
De-sludging	The Consent holder has advised that the storage has been de-sludged in the last 12 months: The pond was desludged in July 2020 at which time a Visual Assessment was undertaken, no sludge build up was noted in the Visual Assessment. The floating material on the top of the pond during the test appeared to the equipment installer, to be a floating foam like material with undigested grass, seeds and other plant matter (see photo below, of the scoop undertaken).	

Effluent Infrastructure

Incoming effluent / liquid / rainfall influences	Incoming effluent is drains from the concrete sump. This was stopped for the duration of the test by placing a bung in the pipe to stop effluent coming into the pond.
	Outgoing effluent is pumped to land via the effluent irrigation system, effluent was not pumped out of the pond for the duration of the test.

Appendix P Summary

Testing is undertaken over a minimum period of 48 hours.	Achieved (the total test, before data is excluded exceeded 48 hours)
Testing recording equipment is to be accurate to 0.8 mm or less.	Achieved Please refer to Appendix 4
Continuous readings are to be taken over the entire test period at not more than 10 second intervals.	Achieved Complete raw data available upon request. Graphed data within this report is based upon averaged data for 0:07:30 minute blocks.
Any change in pond fluid level over the test period needs to be accounted for.	Achieved Please refer to Appendix 3
Ponds must be at or over 75% design depth before a test can be undertaken.	Achieved
The pond has been de-sludged in the 12 months prior to the test being undertaken and there shall be no sludge or crust on the pond surface during the test.	Achieved (Confirmed with the farmer pond was last de-sludged July 2020. No sludge islands noted at the start or the end of the test.)
The pond surface is not frozen during any part of the testing.	Achieved No part of the storage was frozen during the test.
An anemometer shall be installed for the duration of the test and wind speed shall be at 10 metres per second or less for at least 24 hours during the test.	Achieved An anemometer was installed for the duration of the test and approximately 101:06:29 hours of data were collected with a wind speed of less than 10 meters per second.

Test Information

Test Start Time (24-hour format)	2021-03-26 23:23:33
Test Stop Time (24-hour format)	2021-03-31 08:01:45
Total period of raw data	104:38:12 hours
Total period of raw data with less than 10m/s wind speed	104:35:06 hours
Total period of raw data with less than 10m/s wind speed once data is excluded	101:06:29 hours

Total test time (valid averages) with no data excluded	104:35:06 hours
Total test time (valid averages) once data is excluded	101:21:25 hours
Rainfall over the full test duration Rainfall is measured in the independent rain bucket in 0.2mm increments (refer to Appendix 5 for a summary of this device).	+2.40 mm
Rainfall once data is excluded (rainfall during the exclusion period is not allowed for in this figure as the levels are reset from the start of the exclusion period to the end of the exclusion period).	1.40 mm
Control bucket rise for the full test	-5.52 mm
Control bucket rise once data is excluded (the levels are calculated from the start of each non-excluded period to the end of than non-excluded period. Any levels changes during periods of excluded data is not allowed for in this figure).	-5.86 mm
Evaporation in the control bucket for the full test Calculated by subtracting the rainfall during the test period from the total control bucket rise during the test period.	-7.92 mm
Evaporation once data is excluded (Calculated by subtracting the rainfall during the test period from the total control bucket rise during the test period (any excluded periods are not included in the total control bucket rise, nor is any rainfall during any excluded periods).	-7.26 mm

Change in Pond Fluid Level – with no data excluded

Between the start and finish of the whole test, with no data excluded, the following changes where recorded:

The pond had a fall of:	-1.75 mm
The control bucket had a fall of:	-5.52 mm
The unaccounted-for change between pond and control bucket levels over the full test period is a rise of:	3.77 mm
The accounted average relative change per 24 hours, between pond and control bucket levels averaged over 24 hours is a rise of:	0.86 mm

Change in Pond Fluid Level – with data excluded

Between the start and finish of the test data with excluded periods, the following changes where recorded:

Section 1	start time – from start of test: start date and time finish time – from start of test: start date and time Total number of hours	00:00:00 2021-03-26 23:23:20 44:53:27 2021-03-28 20:16:40 44:53:27
Number of hours excluded between sections 1 and 2		03:13:41
Reason for exclusion period 1: the pond appears to rise more compared to the control bucket, this appears to be due to the wider catchment of the pond catching more rainfall compared to the smaller control bucket.		

Section 2	start time – from start of test: start date and time finish time – from start of test: start date and time Total number of hours	48:07:08 2021-03-28 23:30:28 104:35:06 2021-03-31 07:58:19 56:27:58
The pond had a fall over the time with data and time excluded of:		Section 1: -2.67 mm Section 2: -1.37 mm **Total: -4.05 mm**
The control bucket had a fall over the time with data and time excluded of:		Section 1: -3.49 mm Section 2: -2.36 mm **Total: -5.86 mm**
The unaccounted-for relative change between pond and control bucket levels over the test period with data and time excluded is a rise of:		1.81 mm
The unaccounted-for relative change between pond and control bucket levels over the test period with data and time excluded averaged over 24 hours is a rise of:		0.43 mm
Data was excluded for the following reasons: add above and delete this section: • One occasion where the pond appears to rise more compared to the control bucket, this appears to be due to the wider catchment of the pond catching more rainfall compared to the smaller control bucket.		

Pass/Fail Criteria

When tested in accordance with the methodology above, the pond meets the pond drop test criteria if the maximum pond level drop does not exceed the following:

Total Depth of pond: (this is a minimum, range could be + 200 to 300mm)	3.23 m
Minimum freeboard (allowed to meet 75% full):	0.50 m
Depth of the pond excluding freeboard:	2.73 m
Maximum allowable pond level drop per 24 hours for the given pond depth:	2.0 mm

General Comments / Conclusion

- Please refer to Appendix 3 of the Data Graphs.
- From around hour 20 of the test to around hour 45 of the test there appears to be some fluctuation in the relative change, this appears to be due to the pond rising slightly during this period, then decreasing slightly more compared to the control bucket during this period, this is likely to be due to the wind strength, gusts and direction having a greater effect on the larger pond surface than the much smaller control bucket surface, additionally the layer of foam/undigested grass on may result in the wind having a greater on the pond as it may result in the top layer of liquid in the pond being pushed more easily. The probe in the control bucket is mounted directly in the centre of the

control bucket and off to one side in the pond which may also contribute to the pond being affected differently by the wind compared to the control bucket.

- From around hour 45 of the test to around hour 48 of the test there is an exclusion, this period was excluded because, the pond appears to rise more compared to the control bucket, this appears to be due to the wider catchment of the pond catching more rainfall compared to the smaller control bucket and the wind during this time may have also influenced the test during this time period.
- From around hour 58 of the test to around hour 69 of the test there appears to be a slight dip in the relative change, this appears to be due to the pond decreasing slightly more that the control bucket then coming back to normal, this is likely to be due to the wind strength, gusts and direction having a greater effect on the larger pond surface than the much smaller control bucket surface, additionally the layer of foam/undigested grass on may result in the wind having a greater on the pond as it may result in the top layer of liquid in the pond being pushed more easily. The probe in the control bucket is mounted directly in the centre of the control bucket and off to one side in the pond which may also contribute to the pond being affected differently by the wind compared to the control bucket.
- From around hour 69 of the test to around hour 81 of the test the pond appears to be rising slightly, this appears to be due to the wind pushing on the top layer of the pond causing it to rise slightly over this period, this is likely to be due to the wind strength, gusts and direction having a greater effect on the larger pond surface than the much smaller control bucket surface, additionally the layer of foam/undigested grass on may result in the wind having a greater on the pond as it may result in the top layer of liquid in the pond being pushed more easily. The probe in the control bucket is mounted directly in the centre of the control bucket and off to one side in the pond which may also contribute to the pond being affected differently by the wind compared to the control bucket.
- From around hour 81 of the test to around hour 96 of the test there appears to be a slight dip in the relative change, this appears to be due to the pond decreasing slightly more that the control bucket then coming back to normal, this is likely to be due to the wind strength, gusts and direction having a greater effect on the larger pond surface than the much smaller control bucket surface, additionally the layer of foam/undigested grass on may result in the wind having a greater on the pond as it may result in the top layer of liquid in the pond being pushed more easily. The probe in the control bucket is mounted directly in the centre of the control bucket and off to one side in the pond which may also contribute to the pond being affected differently by the wind compared to the control bucket.
- Outside of these periods the pond and control bucket follow similar patterns and trends.

The Drop Test was undertaken following the Appendix P methodology.

This unaccounted-for rise, even with periods of data excluded, may be due to, but not limited to factors mentioned above and other factors such as:

- General factors for all tests (not all of these factors will apply to every test):
    - The difference in volume between the pond and the bucket, affects evaporation rates due to their different thermal mass, i.e. the much smaller control bucket will heat up and evaporate more quickly and at a greater rate than the pond.
        - Due to the control bucket being smaller in size, not in the ground and being shallower it is expected that in warm, bright days that up to 30% additional evaporation may occur. When this occurs the control bucket has more evaporation than the pond and the relative change shows as being a positive change rather than a negative change.
        - However, due to constantly changing temperatures and wind the actual amount of additional evaporation from the control bucket can not be calculated. But the temperatures of the pond and control bucket show high temperatures in both, with the control bucket being typically higher than the pond most of the day.
    - A leaking pond or ground water infiltration would be more likely to manifest as a relatively constant nett rise or fall in effluent level and would be expected to be more obvious at night when temperatures are cooler and evaporation is at a minimum, (and it is not raining). There is no evidence of a consistent and clear

incoming or exiting rise or fall, in the graphs meaning that the difference in the rise/fall is either small or only occurs during specific conditions.

- As an example: A 2mm pond level rise/fall on a 40m x 31m x3m pond (2,000m³) pond, at 75% full (38m x 29m) is approximately 2.2m³ of liquid, a 1mm rise is approximately 1.1m³ of liquid. This is not a great volume. The transfer in or out of the pond over a 24-hour period leakage into or out of the pond is likely to be greater than this and consistent.
- The relative change in level of the control bucket and pond appears to be similar during the night-time when evaporation between the control bucket and pond are likely to be similar.
- The time periods when the pond and control bucket temperatures are closest, are also the times when level fluctuations correlate more closely. Conversely, when the control bucket temperature rapidly increases and is significantly greater than the pond temperature, is when we note the levels diverging, as would be expected if the control bucket is evaporating at a greater rate than the pond.
- Increased solar radiation.
- Leakage through the liner (either into or out of the pond from the surrounding soil/clay etc)
    - All lining materials have a leakage rate, even concrete and synthetic liners, even if liners meet or exceed a leakage rate of 10^{-9}, the pond may have a small to medium drop (depending upon pond dimensions).
    - While this is an obvious explanation it is very relevant as a 2mm rise or fall may only be around 2m³ of effluent transferring between areas, which on the large surface area of the sides and bottom could occur with little soil moisture capacity.
- Wind direction effect. The control bucket is small and round with the level probe towards the centre, this is unlikely to be affected as much from the change in wind direction during a test. However, the pond is rectangle, larger and is likely to be affected by wind direction more than the control bucket. It does not take much of a wind intensity or direction to move the level by 1.15mm (even under 10m/s wind speeds).
- Pond geometry and construction.
    - The sides of the pond allowing rainfall over the opening dimensions, not the actual effluent level dimensions will increase the level at the effluent level greater than the opening size.
    - Sometimes the top embankment of the pond can slope all or some of the top back into the pond. It is usually difficult to determine what proportion of the top embankment slopes into the pond as grass is typically present and it does not take much slope to make rainwater run into the pond. If the data shows that this is a possibility during rainfall events RES will either comment upon this effect (below) or exclude this time period to allow good data to be shown.
    - A large or long pond may funnel wind from different direction differently.
- If environmental factors permit this, a large enough body of water will expand (or contract), more slowly than a small body of water, during daytime hours depending on temperature and other factors. This body of water is then still subject to evaporation during the day. Once it cools down, the water body will contract again, but depending on the level of evaporation occurring during the day, may not contract back to the same level as before.
- During summer months and depending on the temperature and biological activity, it is possible for sludge bulking to occur in ponds which can lead to a rise in pond level as talked about.
- Possible leakage within the acceptable pass/fail criteria.

The standard test, with no excluded data or time has shown a rise less than the 2.0 mm per 24 hour period, however, data has been excluded due to one occasion where the pond appears to rise more compared to the control bucket, this appears to be due to the wider catchment of the pond catching more rainfall compared to the smaller control bucket.

Had there been a leak into or out of the storage during the test it would be expected that this would be a constant rise or drop over the entire test duration and that the periods between the time periods excluded would not have shown steady data and similar level data for the pond and control bucket. This was not the case in this test, the rise only

showed during the periods being excluded and not during the larger, stable periods in between that have not been excluded.

RES believes that with the test data having time and data excluded during the test still meets the Appendix P requirement of:

Testing equipment is accurate to 0.8mm or less.

Continuous readings have been undertaken over the entire test period at not more than 10 second intervals.

Any change in fluid level has been accounted for.

The pond has been de-sludged within the last 12 months.

The pond surface was not frozen during any part of the test.

An anemometer was installed for the full test period.

In line with Appendix P methodology, without data and time excluded, there was greater than 24 hours of low wind (being 101:06:29 hours) and greater than 48 hours of total data (being 101:21:25 hours).

With data and time excluded there was

- a relative change of a rise of 1.81 mm over 101:21:25 hours;
- a change in pond level of a fall of -4.05 mm over 101:21:25 hours;
- a change in control bucket level of a fall of -5.86 mm over 101:21:25 hours.

The test with time and data excluded showed no on-going constant rise or fall during the longer periods of the included data, the test duration with the data excluded was still greater than 24 hours with wind under 10m/s and a total test period of 104:38:12 hours (without any data excluded) and a test period of 101:21:25 hours with data excluded; the relative total change over the total test with data excluded being a total rise of 1.81 mm, being an average rise of 0.43 mm per 24 hours; RES asks Environment Southland to accept this as a passed Drop Test result, in line with the pass/fail criteria of Appendix P.

If you have any questions about the testing process or any information contained in this letter, please do not hesitate to contact me directly on 027 890 1234 or donna@res.kiwi.nz.

Yours Faithfully,

Donna Corbin
Environmental Consultant
RES Rural Environmental Solutions

Appendix 1: Suitability Qualified Person to undertake the Pond Drop Test

Donna Corbin ta RES Rural Environmental Solution (RES) have undertaken the Pond Drop Test in accordance with Appendix P. Donna Corbin ta RES Rural Environmental Solution (RES) consider themselves to be a Suitably Qualified Person for the following reasons:

- *I have been involved in the Diary and compliance industry since 2007.*
- *Prior to this I managed an Aquaculture Farm in Bluff developing all areas of production including plumbing and pumping, consent applications and monitoring.*
- *I have undertaken various contracting roles to Environment Southland, including water sample collection, general consent inspections and application rate testing for irrigation systems. Which involved independent assessment and data recording.*
- *My role as an Environmental Extension Specialist for DairyNZ, Southland and South Island. Providing environmental advice to farmers, providing guidance, advice and input into developing environmental resources and projects such as the Code of Practice, Pond Design and Construction training, Effluent Warrant of Fitness, staff training guides, IPENZ PN21 and 27 and many other DairyNZ resources. During this time I was involved in the development and presentation of many DairyNZ Road Shows, Field Days and Work Shops for Farmers, Councils and Rural Professionals. Including presentation of sections during the Massey University Farm Dairy Effluent System Design and Management, Farm Dairy Effluent Pond Design Training Course and WoF Assessor courses.*
- *My role as an Environmental Consultant for RDAgritech Ltd, providing advice, risk assessments, project management, preparing consent applications and effluent pond/system information gathering and per-design work.*
- *My current role as an Independent Environmental Consultant, trading as RES Rural Environmental Solutions. Providing advice, risk assessments, project management, consent application preparation, education and staff training on dairy farms, Warrant of Fitness (WoF) accredited Assessor, Sustainable Management Plans (SMP), Effluent Management Plans, Environmental Management Plans, Incident Response, Effluent System Assessments.*
- *I have certificates for the successful completion of training courses by Infratrain New Zealand Ltd for Farm Dairy Effluent Pond Construction and Farm Dairy Effluent Pond Design.*
- *I have been involved in the risk assessment and volume calculation of a large number of effluent sumps, stone traps, sludge beds and effluent ponds.*
- *I have been involved in the independent assessment of effluent irrigators, effluent systems, Industry Effluent WoF's, Industry Sustainable Milk Plans and consent applications. During this time I have prided myself in the ability to provide an independent assessment against relevant rules, standards, good practice and practical assessment of effluent storage systems and wider effluent systems components.*
- *RES asks Environment Southland to accept Donna Corbin as a Suitably Qualified Person to undertake a Pond Drop Test in accordance with Appendix P requirements and to provide an independent assessment of the results against this criteria.*

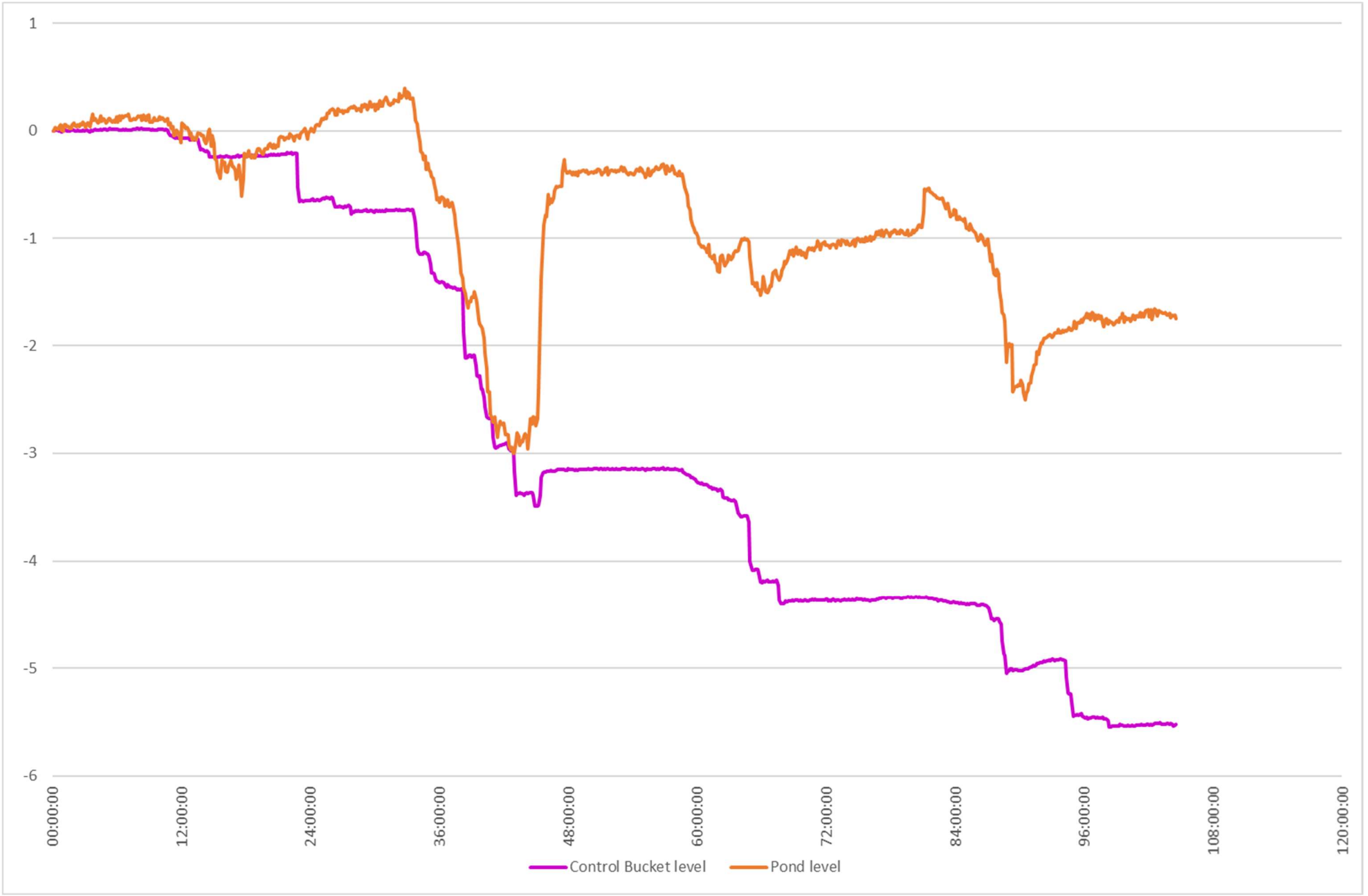
Appendix 2 – Test Photos

Figure 2 Drop Test Equipment Set Up.

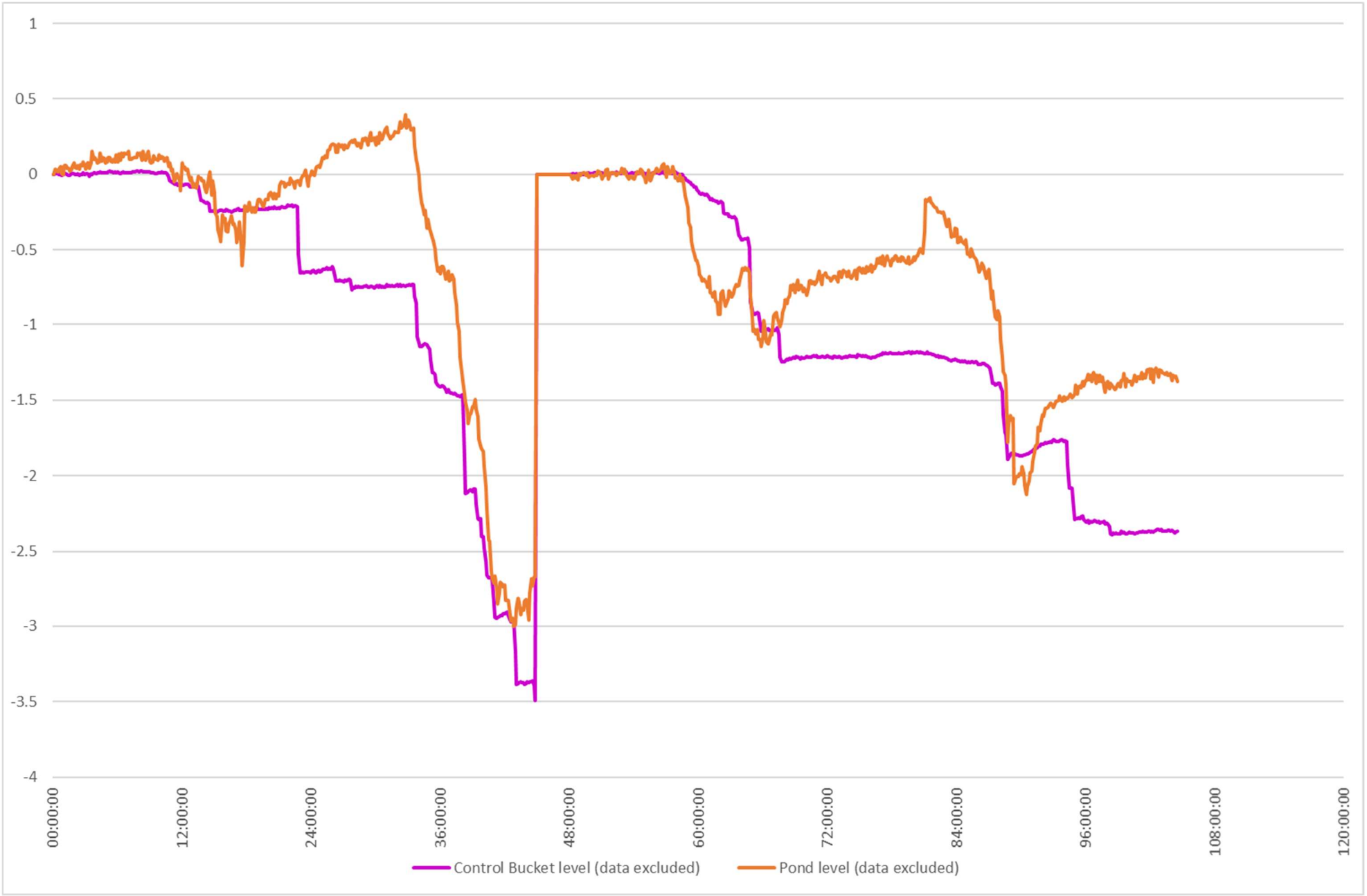
Figure 3 Drop Test Equipment and Pond Level.

Figure 4 Photo of scooped material.

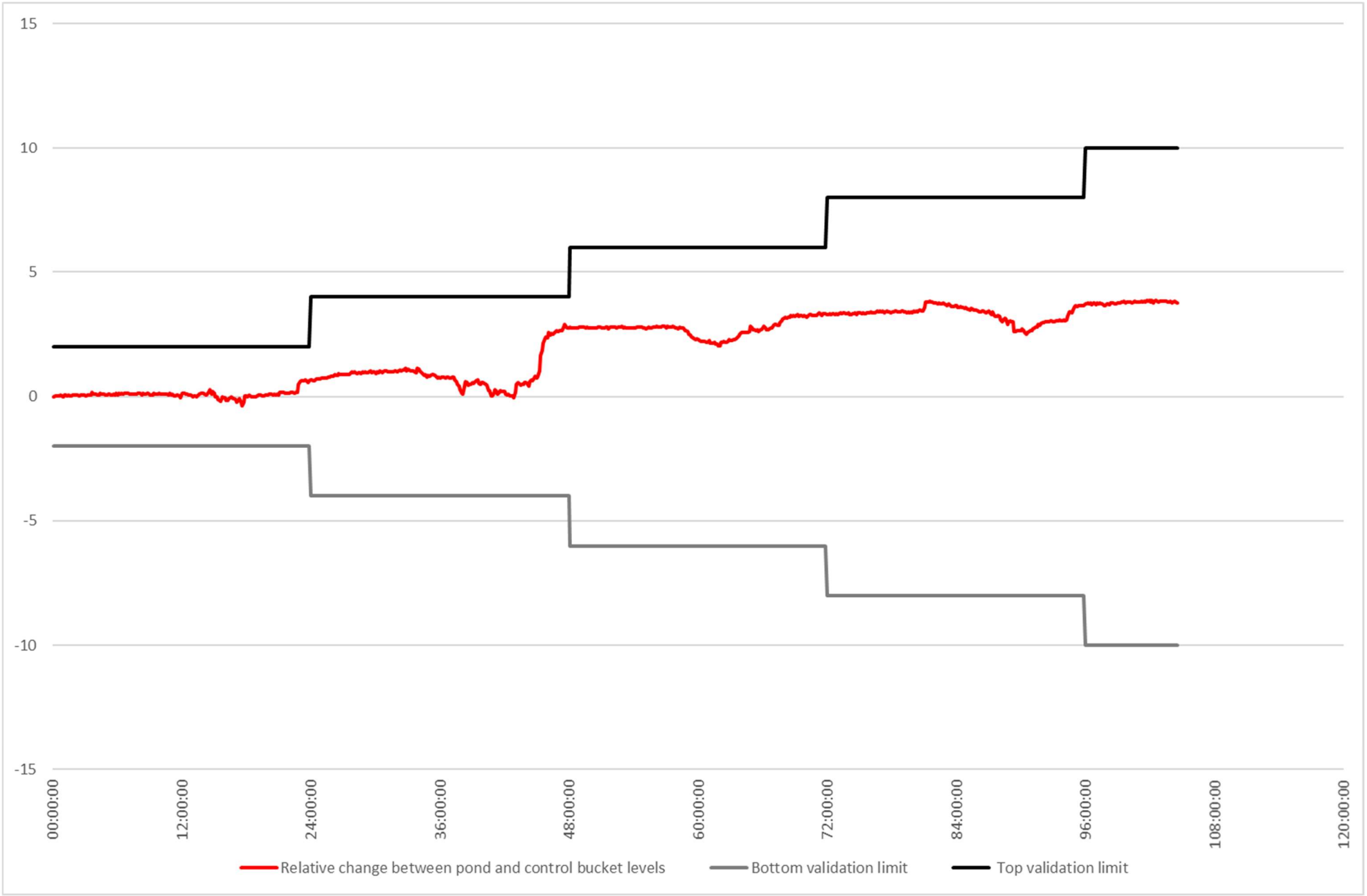
Appendix 3 – Raw Probe Data



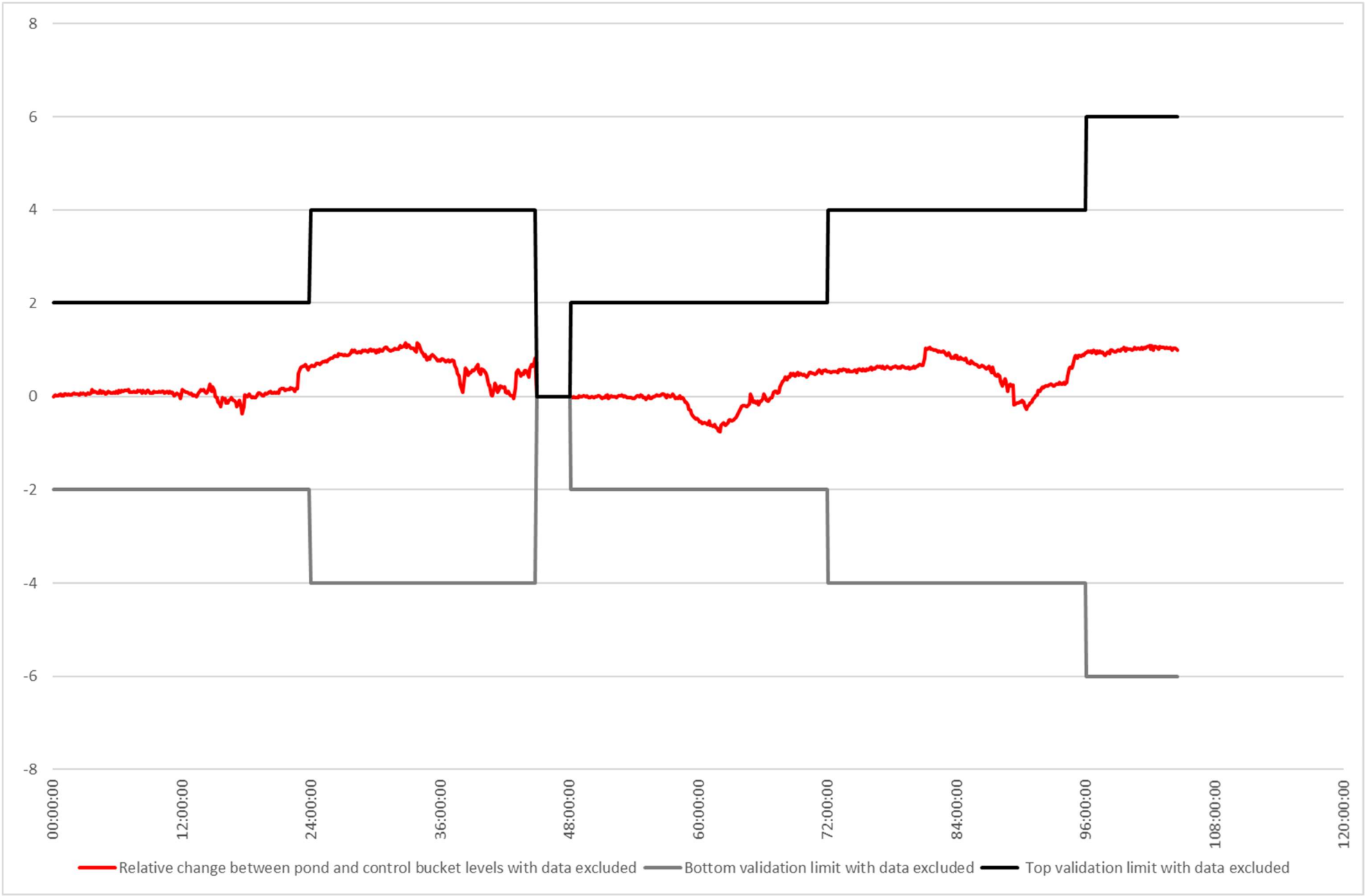
Graph showing pond and control bucket level data.



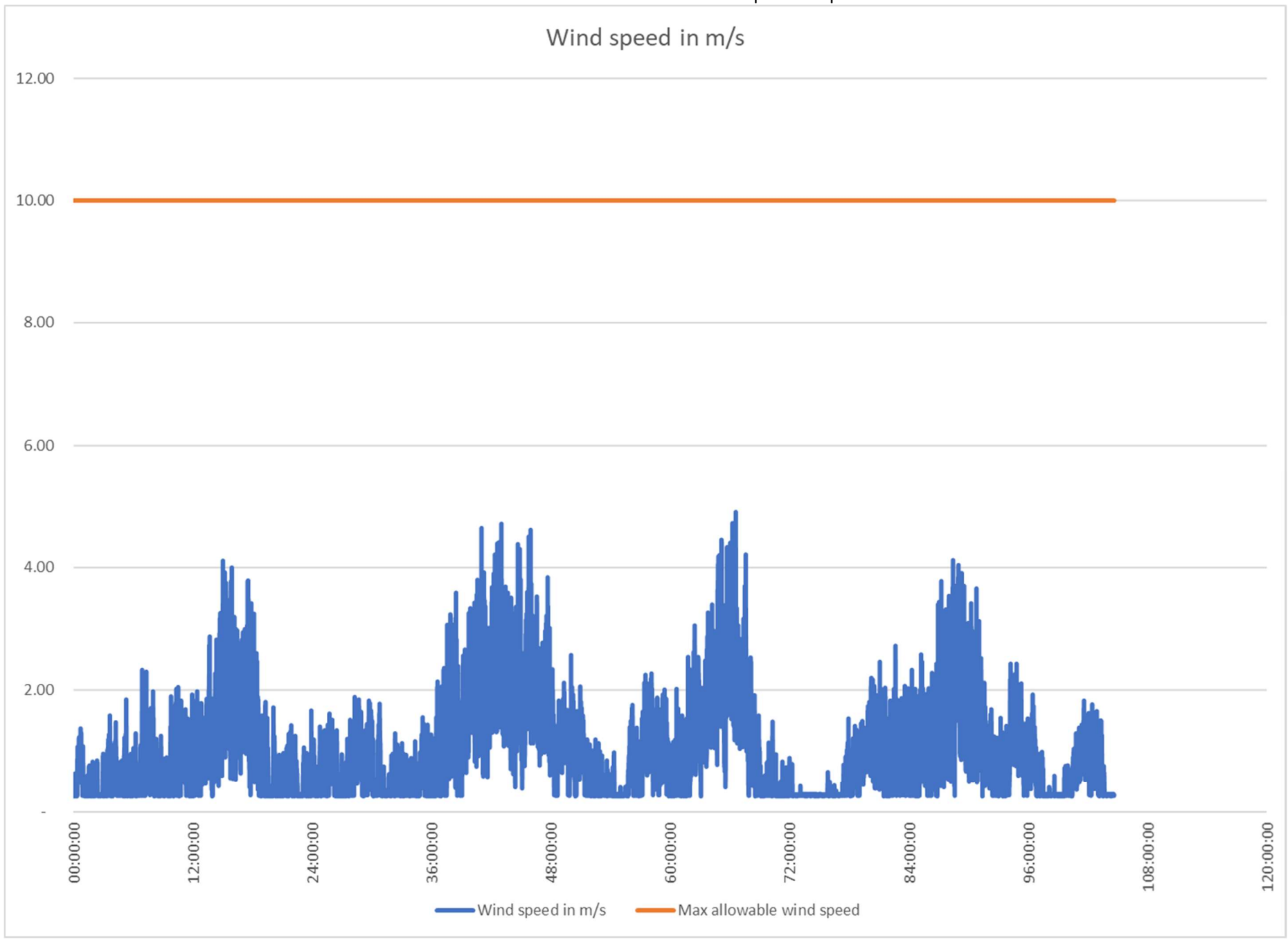
Graph showing pond and control bucket levels with data and time excluded.



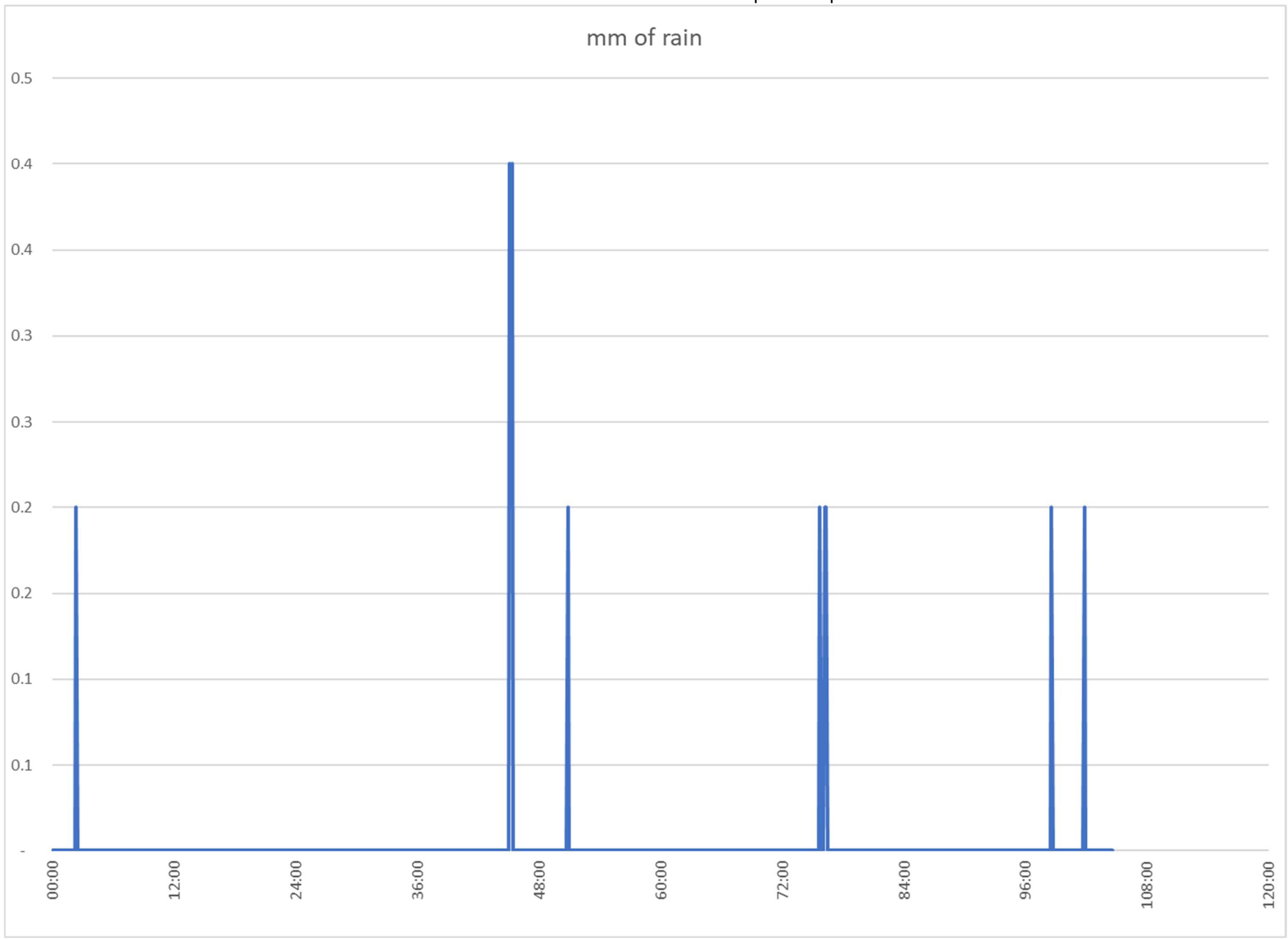
Graph showing relative change between pond and control bucket levels.



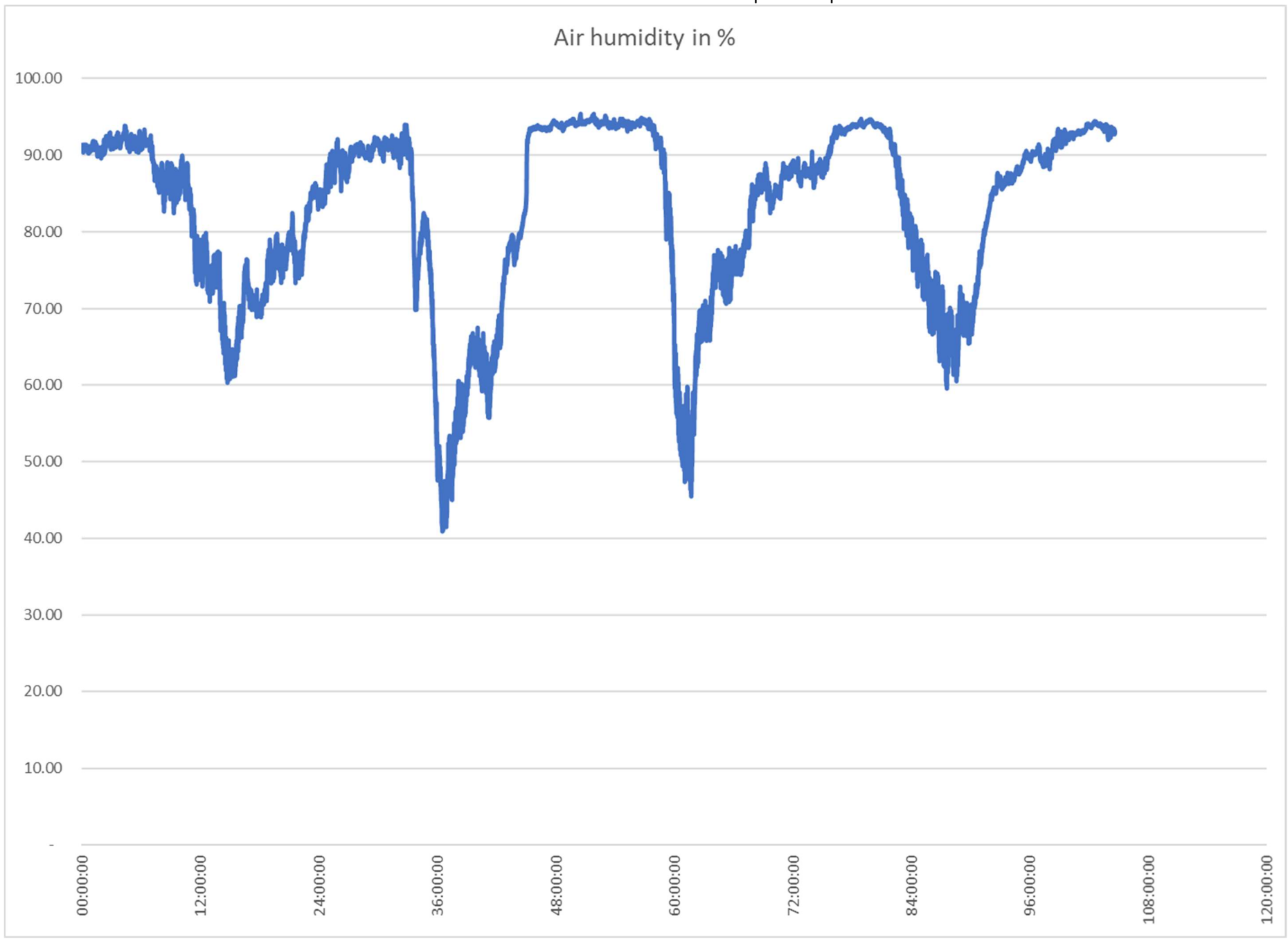
Graph showing relative change between pond and control bucket levels with data and time excluded.



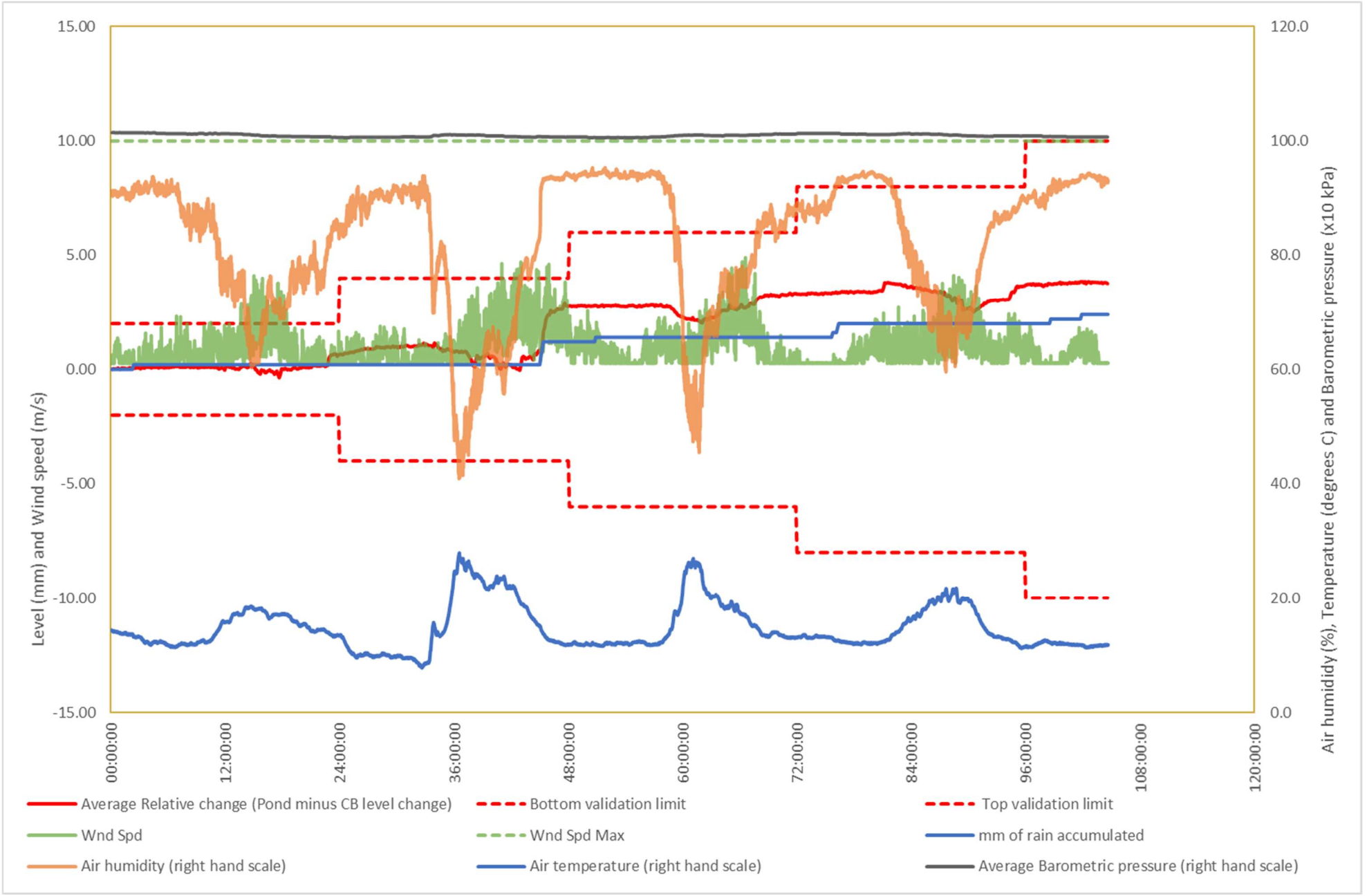
Graph showing wind speed



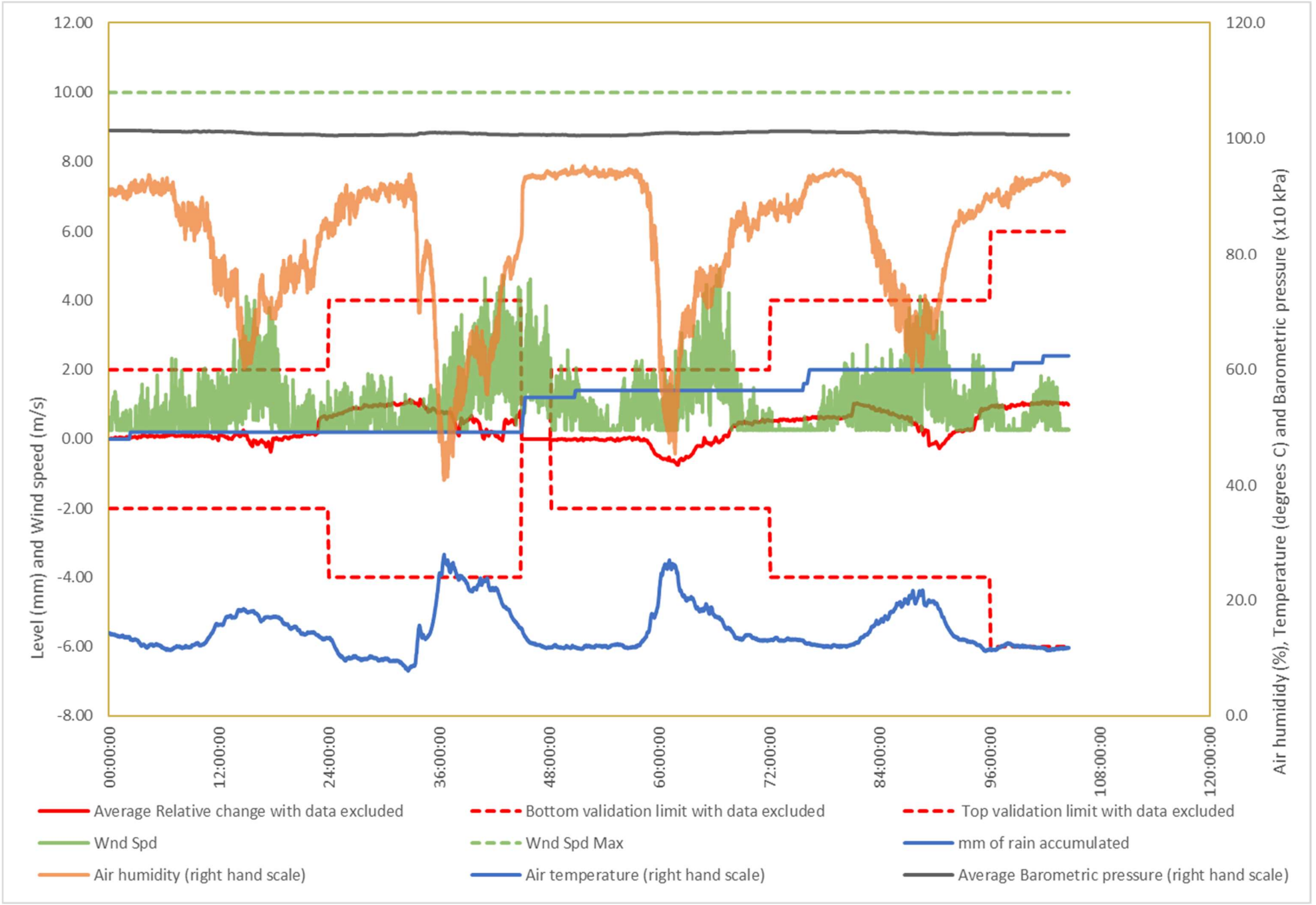
Graph showing rainfall per hour.



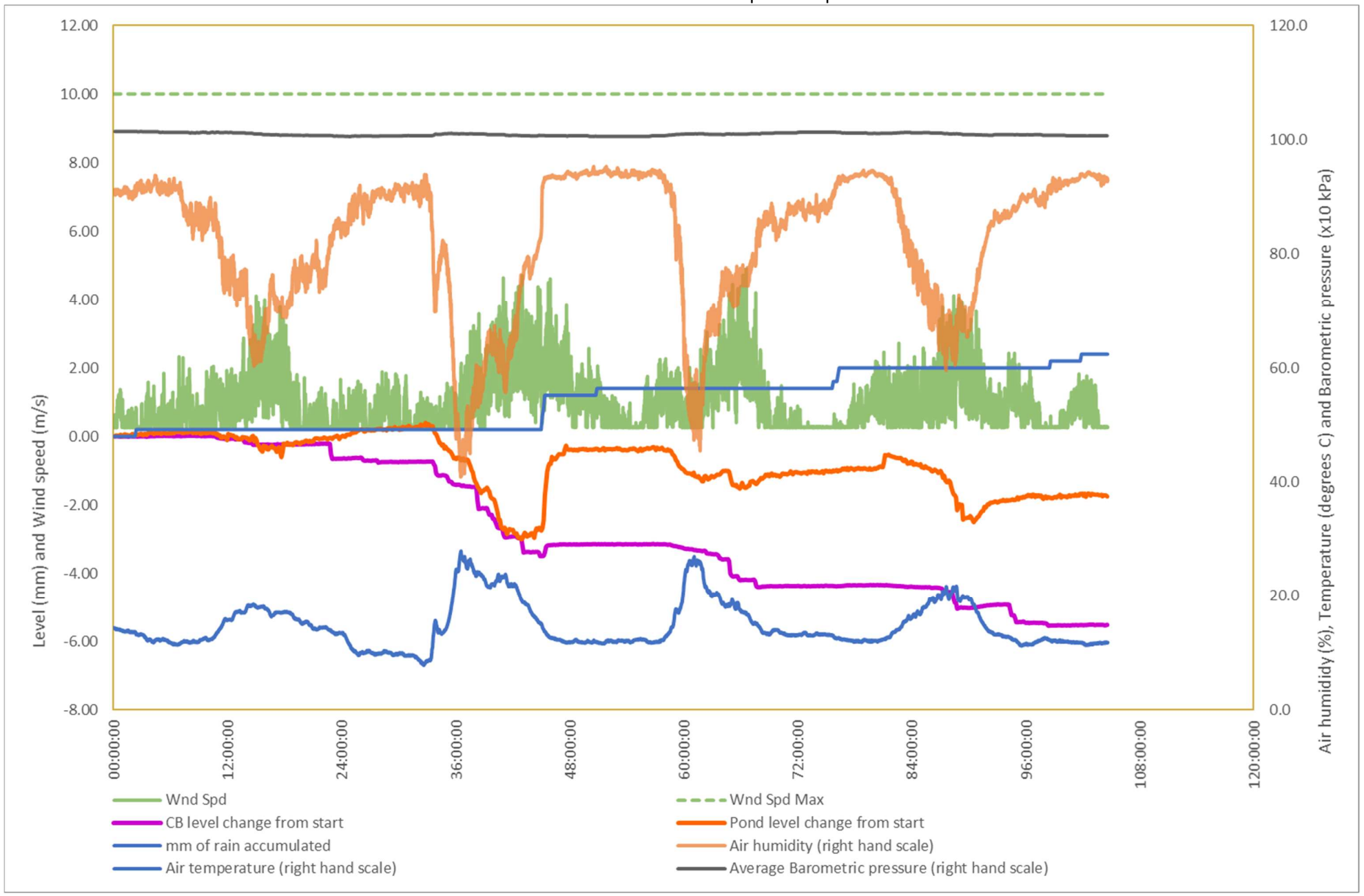
Graph showing relative air humidity



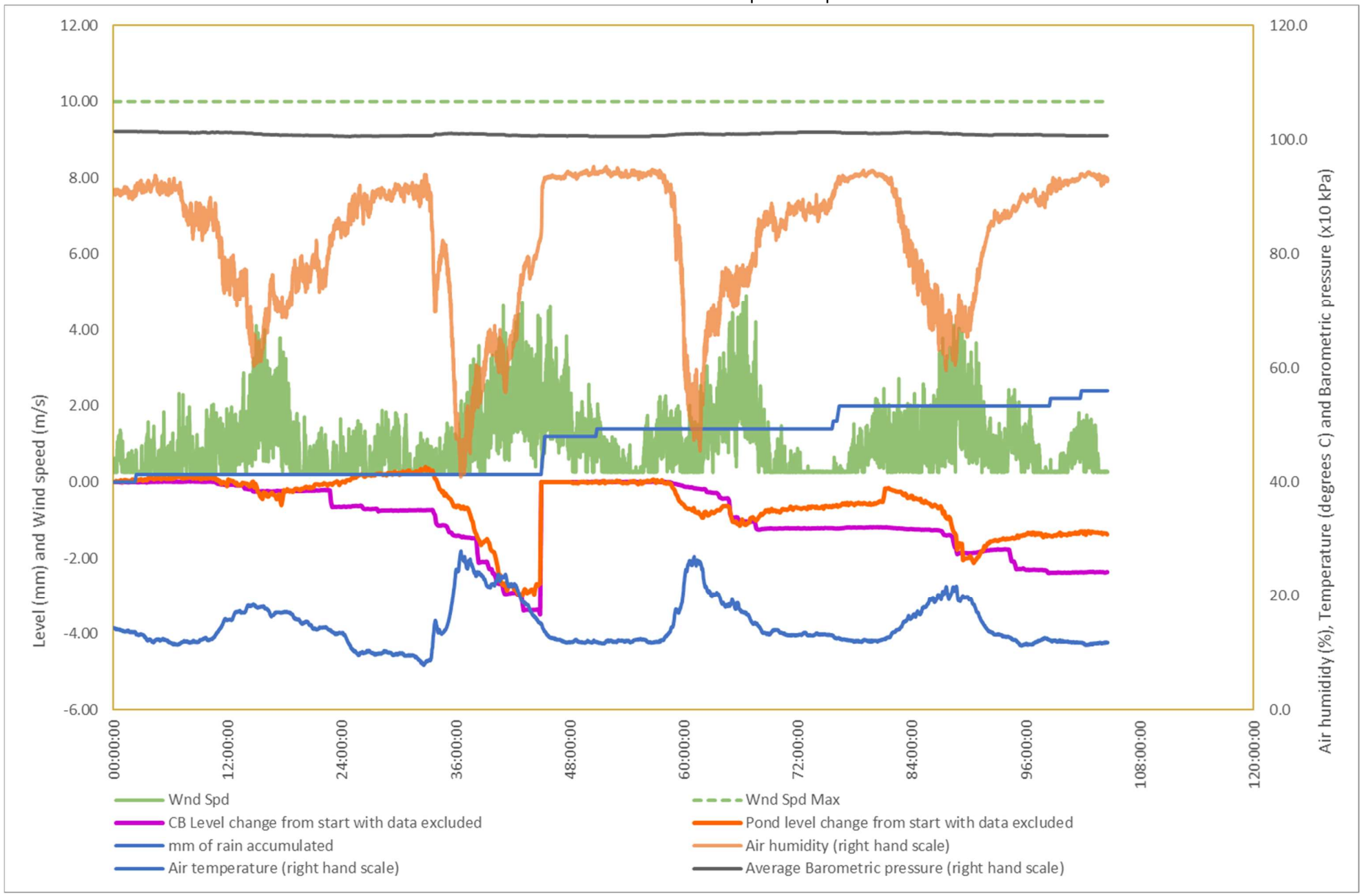
Graph showing relative change, wind speed, mm of rain, humidity, air temperature and barometric pressure.



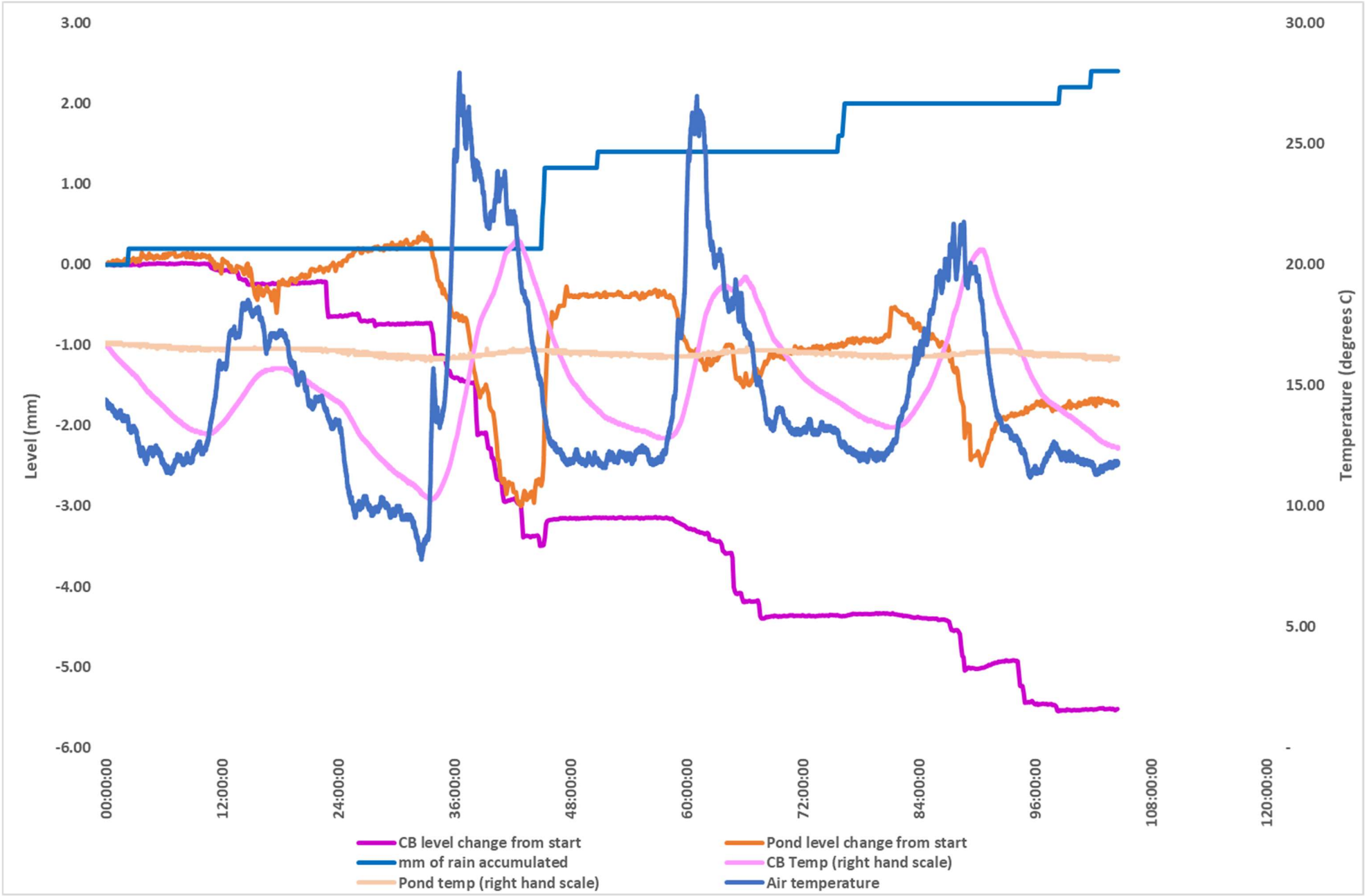
Graph showing relative change, wind speed, mm of rain, humidity, air temperature and barometric pressure with data excluded.



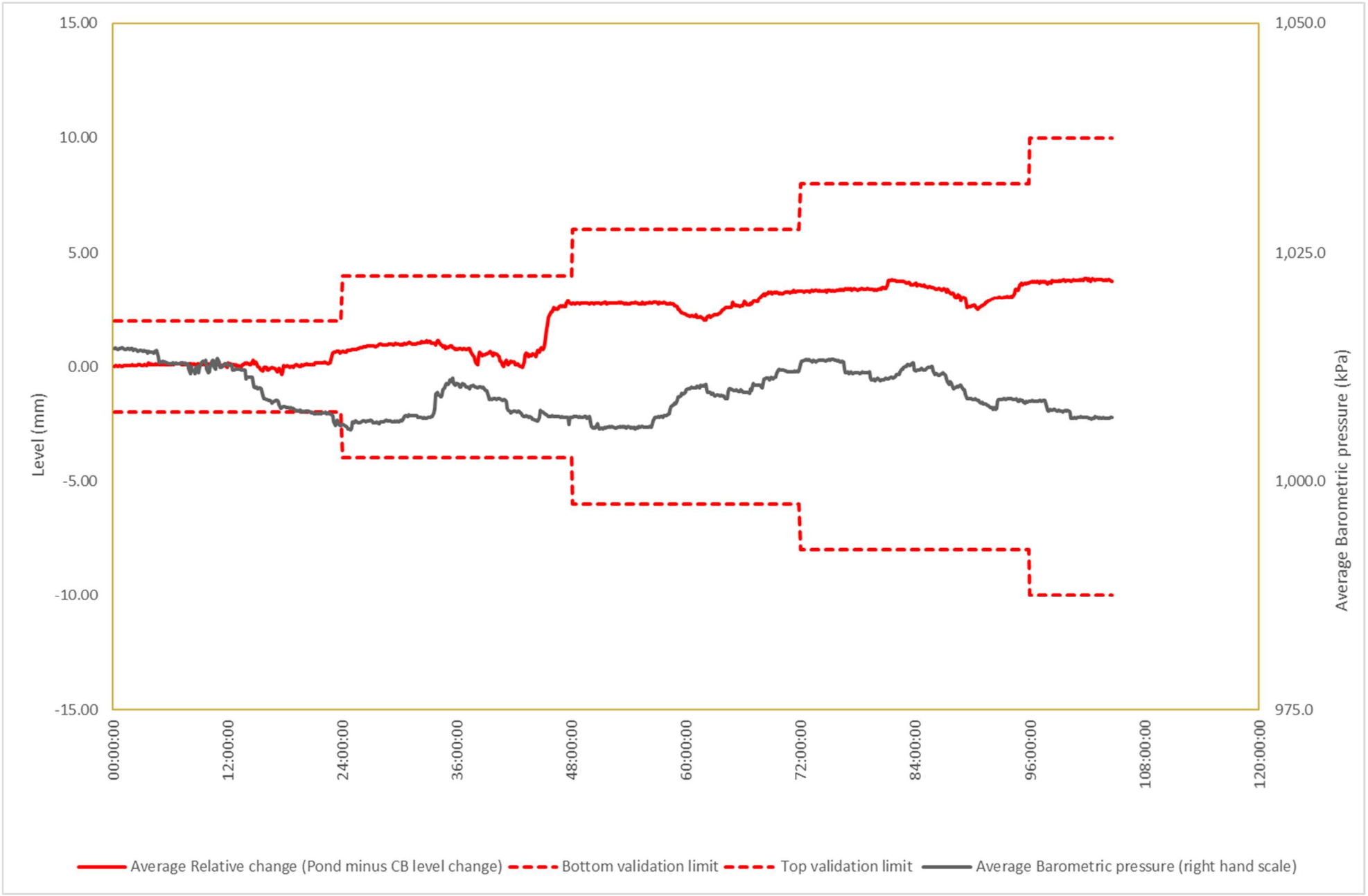
Graph showing control bucket level, pond level, wind speed, mm of rain, humidity, air temperature and barometric pressure.



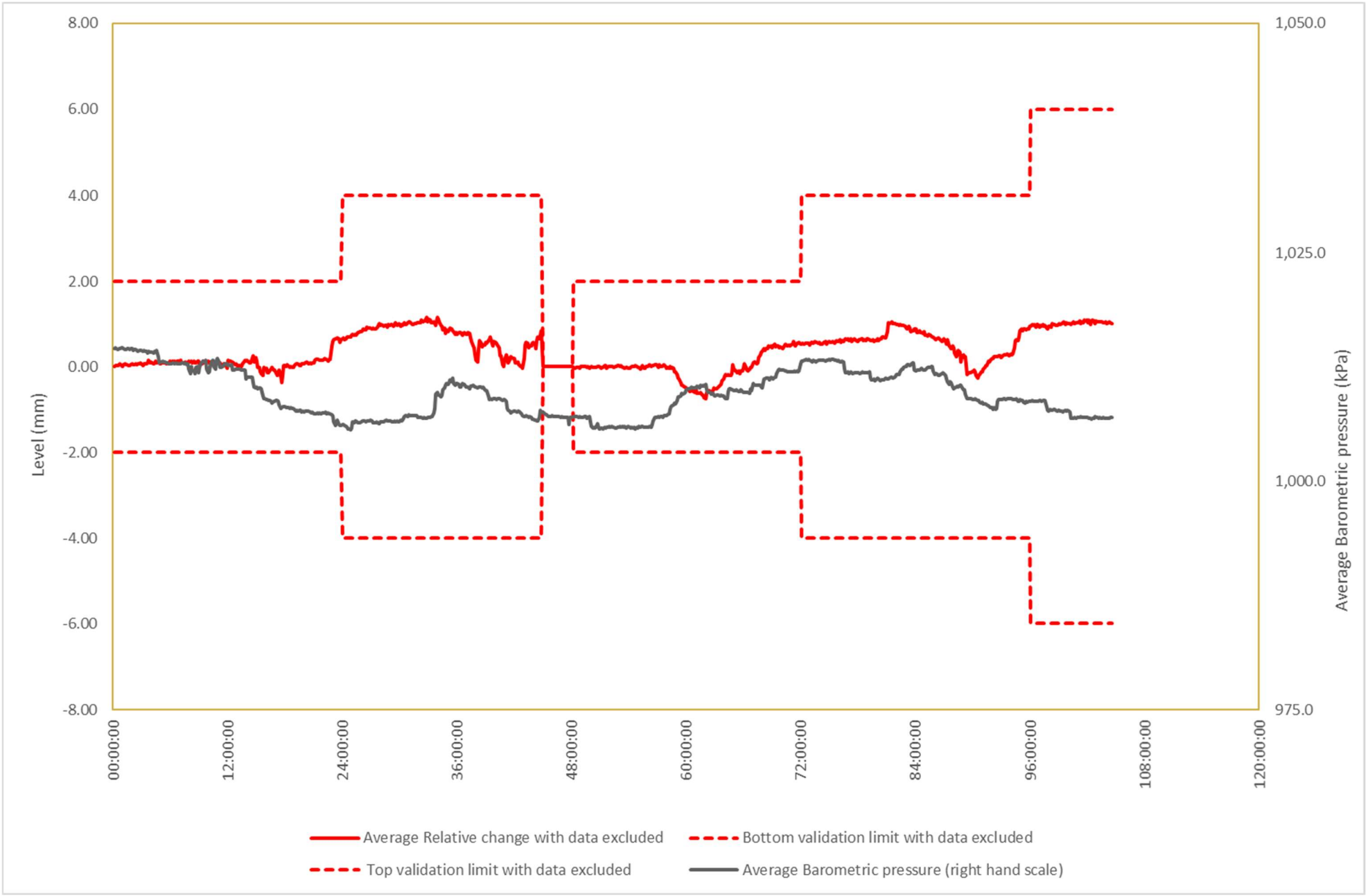
Graph showing control bucket level, pond level, wind speed, mm of rain, humidity, air temperature and barometric pressure with data excluded.



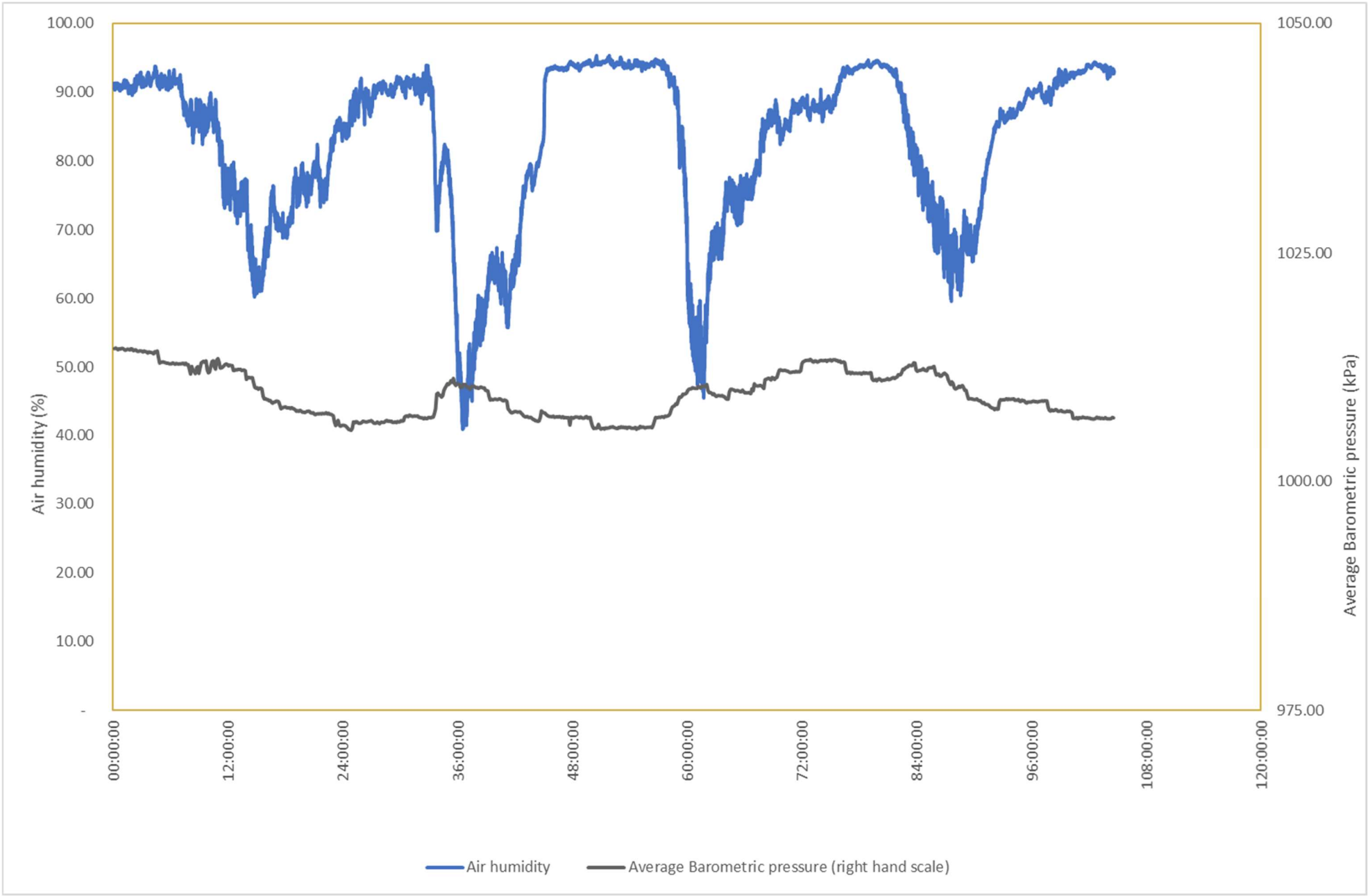
Graph showing pond and control bucket levels and liquid temperatures.



Graph showing relative change and barometric pressure.



Graph showing relative change and barometric pressure with data excluded.



Graph showing relative humidity vs barometric pressure.

Appendix 4 – Level Monitoring Equipment

Magnetic measuring equipment was installed in the storage pond and in the control bucket on the crest of the pond. The magnetic measuring equipment is placed inside a plastic pipe to reduce wind and wave action on the surface of the storage pond.

The control bucket is approximately a 71-litre stainless steel evaporation pan similar in design to a class A evaporation pan used by NIWA and Metservice (except the overall width is smaller to allow for easier portability and transport).

The measuring probe manufacturer's specification sheet has been attached below (some industry sensitive information has been blacked out).

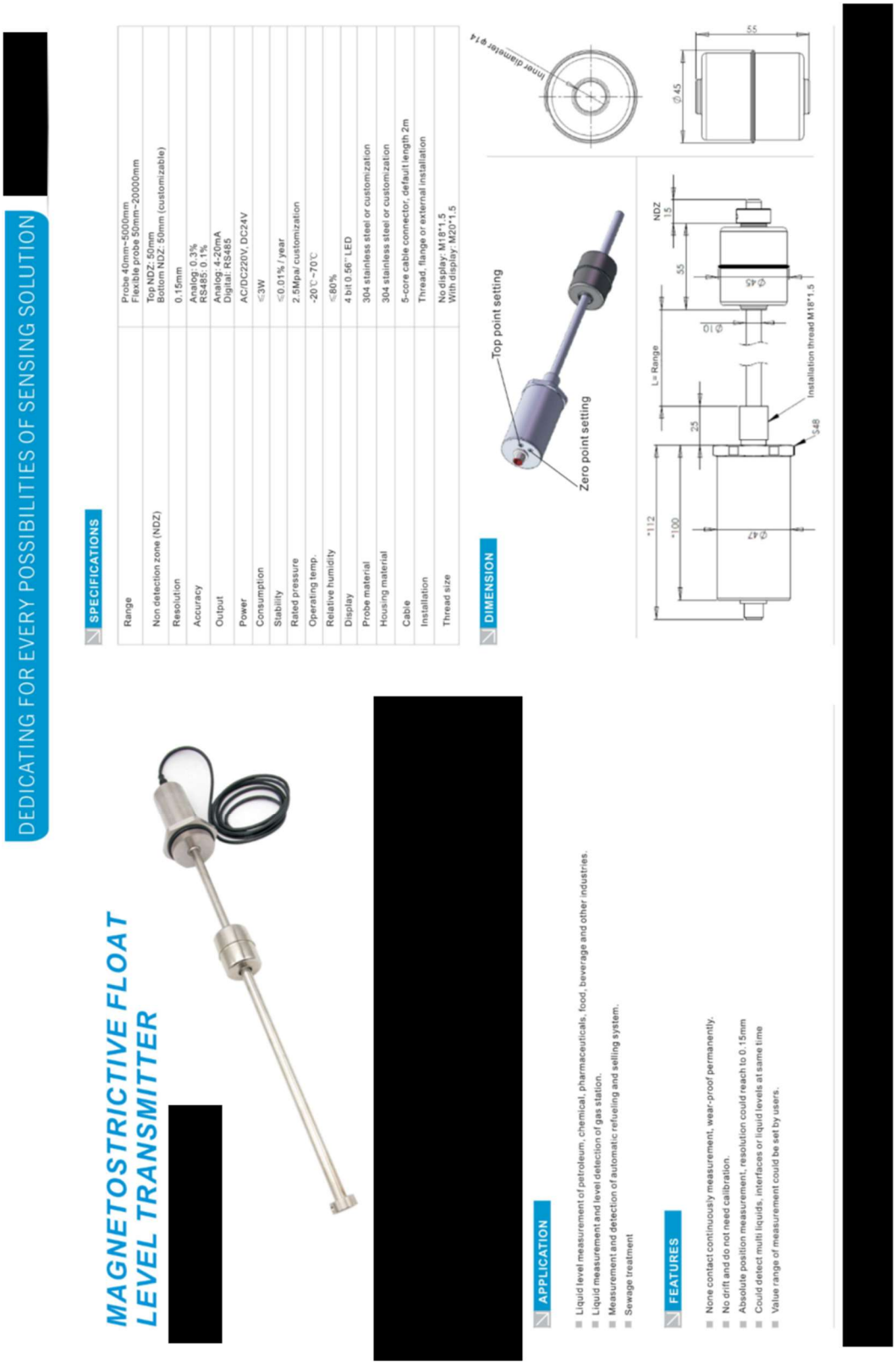


Figure 5 Measuring Probe Data Sheet.

Appendix 5 - Glossary

Average interval of raw data	The raw data readings are averaged every 7.5 minutes. Upon discussion with Colin Young from Environment Southland this period of time appears to be the standard period used by others trying to display the data. As we use Excel to display the data we are limited by the capabilities of Excel graphs, which are unable to handle the large number of raw data points and time periods of some tests. RES do not believe that averaging the data over the standard 7.5 minute intervals will affect the data analysis at all.
Valid Averages	"Valid Averages" is the term that RES use to show that Excel has calculated only the time where the data is valid and is acceptable for use. "Valid Averages" means that all the data used meets Appendix P criteria. If it does not meet Appendix P requirements or other RES internal requirements, then the data is not valid. Checks that occur to ensure that data is valid are thing such as: • Readings occur not more than every 10 seconds. • Data is within the test period and not within the excluded time frames (in tests where data has been excluded). • The Control bucket and pond level readings are within the acceptable ranges. • The Air temperature and pond and control bucket temperatures are within the acceptable ranges. • The wind speed is within the acceptable range. • The adjusted rise/fall is within the allowed tolerances for the pond depth.
Rain Bucket	This test was undertaken using a standalone, Davis 6463 rain bucket. The rain bucket is calibrated in the factory, but RES also calibrate the bucket before the first use and then yearly thereafter. Accuracy: For rain rates up to 4"/hr (100 mm/hr): ±4% of total or ± 1 tip of the bucket (0.01"/0.2 mm), whichever is greater. No corrections have been made to the raw rainfall data collected.
Evaporation	RES has developed an evaporation pan similar to the class A pans developed by the United State National Weather Service and was recommended as standard by the World Meteorological Organisation in 1957. The only difference between the pans used by RES and a standard class A pan is that RES pans are smaller in diameter, otherwise they would not be portable enough to move for each test. RES has run tests beside the class A pan used by 45S Weather Services with very similar results.

Total depth of pond	The total depth of pond measurement in this report is only a minimum measurement, the real depth could be at least an additional 200 to 300mm deeper, there may be multiple reasons for this, including, but not limited to:
	• Inaccuracy of the measuring equipment – this may account for up to 100mm difference
	• Difficulty in measuring the depth when the pond if full due the following potential reasons (these reasons may account for up to an additional 100 to 200mm):
	  ○ Uneven floor of the pond (this is partially negated by taking multiple readings at different locations)
	  ○ Small amounts of sludge (not all sludge may be removed from the bottom even with a good desludging)
	  ○ Can be difficult to measure closer to the middle of the pond if it is a large pond as the measuring probe can only be thrown so far.

	○ Our ability to measure the freeboard above the liquid level during the Drop Test can be further hampered by obstacles around the embankment and using hand held measuring devices. When the Drop Test depth is undertaken using our measuring equipment, the pond is at least 75% full for the purposes of the Appendix P criteria, while we endeavour to do enough measurements to get a good average depth of the pond liquid and the top level above the liquid level, this is typically a minimum only and the original design depth (where available) should be used for any pond calculations.
Internal embankment slope	While every endeavour has been made to accurately measure the internal embankment slope, with the pond being at least 75% full during the drop test it can be difficult to accurately measure the internal embankment slope as when the pond is full there is less embankment that can be measured and as a result the internal embankment slope measurements may not be as accurate when taken during the drop test.

Appendix E: Visual assessment

PASS

Principal	|	Heiko FRANZ	***Principal***	|	Gary SUMMERS
Cell	|	021 196 0508	***Cell***	|	021 873 883
Email	|	heiko@tsdnz.co.nz	***Email***	|	g.summers@groundsource.co.nz

VISUAL ASSESSMENT

29 March 2021

Inspection Date : 26 March 2021

CLIENT DETAILS –

George Raymond
Cashmere Bay Dairy Ltd/Otama Farm
145 Jaffray Road
RD7
Gore 9777

Client Name: Cashmere Bay Dairy Ltd/Otama Farm
Supply Number: 33254
Authority Number: AUTH-301811-V2
Client Code: CAS20170

- **Facility** – Synthetically Lined Sump
- **Shape** - Rectangular
- **Measurements** (approximately) -
  - *metres* 12 metres x 9 metres
  - *batter* 1:1
  - *depth* 1.4 metres (1.1 metre to effluent outlet)
- **Venting** - There is no gas venting visible.
- **GPS Co-ordinates** - 45°58'46.40"S | 168°51'54.83"E
- **NZTM2000 Co-ordinates -** 1279727 mE | 4899907 mN
- **Sump Ground Level** - The sump is constructed in-ground.

Desludging

- The sump has been desludged as far as possible using the slurry tanker.
- Some sands, small gravel and sludge remain in some areas.

Leak Detection

- There is no leak detection system visible.

Embankments & Vegetation

- There was no evidence of additional lush growth that stood out in comparison to the rest of the embankment.
- The surrounding was cleared, sprayed and well maintained.
- There is netting fence surrounding the sump and effluent pond area.

Ground Water Drainage / Ring Main

- There is no ground water drainage/ring main system installed.

Equipment & Associated Structures

- There is no effluent pump permanently installed in the sump.
- There is no stirrer installed.
- Effluent drains by gravity from the sump to the effluent pond.
- Due to the concrete construction, additional protection to prevent liner wear from inflowing effluent is not required.

Liner

- The inspection of the liner showed it to be in good condition with no evidence of defects.
- I was able to walk around the base of the sump. No defects, holes or damage was felt.
- In areas where sand and effluent remained built up, a number of random locations were manually scraped to reveal the liner.

There are no visible cracks, holes or defects that would allow effluent to leak from the facility.

Gary SUMMERS
Principal
GROUND SOURCE

CHARTERED PROFESSIONAL ENGINEER'S CONCLUSION

I have reviewed the information and photos provided by the visual inspection of the synthetically lined sump for Cashmere Bay Dairy Ltd.

There are, based on the available information, no visible faults in this installation that would allow for the effluent to be leaking from this facility.

Based upon my review of the photos, the report supplied by Ground Source and the conditions stated in Rule 32D (a)(ii)(2)(a), I believe that this has sump has passed inspection.

With nearly 20 years of experience in the water and wastewater industry where I started working as a draughtsman to process engineer and project manager for projects from small to large scale, including wastewater treatment sumps, and being a chartered professional engineer, I believe I am qualified to peer review this visual assessment.

Heiko FRANZ, CPEng
Principal
TREATMENT SOLUTIONS AND DESIGN

==========

DISCLAIMER

- All assessments are visual inspection only.
- Visual assessments are carried out in accordance with the proposed Southland Water and Land Plan Rule 32D (a)(ii)(2)(a).
- No guarantee is given or implied for the item(s) under assessment.
- No composition or suitability testing is performed.
- No conclusion or opinion is made as to the suitability of material(s) or if fit for purpose.
- No compaction test or any form of structural testing is performed.
- No visual assessment as to structural integrity or suitability is performed or implied.
- No inspection is undertaken of ancillary equipment such as pumps, pipework, valves etc. The visual inspection of the facility is of the liner or seals that could potentially allow effluent to escape from the facility.
- All items will be visually inspected for cracks, holes, tears, defects, scouring, etc that maybe leaking.
- All conclusions and comments are based on information provided by the consent holder, managers or staff. Should this information be found to be inaccurate it may invalidate the conclusion drawn.
- Any decisions made, alterations or changes based on this report that require consent variation or alteration are the responsibility of the consent holder.

Figure 1 : Facility ex-Google Maps

Figure 2 : Sump overview

Figure 3 : Slurry tanker suction - showing depth of remaining effluent

Figure 4 : South and west sump embankments

Figure 5 : Area of effluent scraped to reveal the concrete liner

Figure 6 : Effluent outlet pipe

Figure 7 : Scrape mark on embankment

DEFINITIONS

PONDS : Synthetically Lined OR Clay-Like Material

- **Desludging** - There is no formal definition. Our definition is: "desludging is the act of emptying the pond, preferably while stirring, to within 300mm-500mm of the lowest point. This can be undertaken using the farm system (if capable of moving any sludge build-up) or a contractor using a slurry tanker or umbilical cord system (if allowed for on the discharge permit)".

Defect(s) –

- An imperfection or abnormality that impairs quality, function, or utility.
- In relation to a clay liner; something that could not reasonably be considered part of the original design and function.
- Any damage or issues arising from erosion, physical damage, subsidence or scouring.
- For example -
  - scouring under inlet pipes by water flow;
  - erosion due to wave and wind action;
  - damage by excavator, stirrer or other equipment.

SLUDGE BEDS and WEEPING WALLS

- **Desludging** - There is no formal definition. Our definition is:
  "All solids and liquid are to be removed as far as practical without damaging the facility, but to a standard that allows for a visual assessment of all surfaces to a standard that a drop test is not required."

  We must be able to inspect as much of the base and embankments as is reasonably possible.

- **Defect(s)** –
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  - For example -
    - scouring under inlet pipes by water flow;
    - erosion due to wave and wind action;
    - damage by excavator, stirrer or other equipment.

QUALIFICATIONS and BACKGROUNDS OF PERSONNEL

Principal | Heiko FRANZ
Cell | 021 196 0508
Email | heiko@tsdnz.co.nz

I am a suitably qualified person to undertake Drop Test, Visual Assessments and Effluent Pond Design as outlined below.

- I have been involved in the design, building and project management in the domestic, commercial, industrial and municipal water and wastewater industry for 20 years and have gained very in-depth knowledge and experience in these areas.
- I have a Bachelor of Environmental Engineering degree, specialising in the design of the treatment systems.
- Part of this degree was an extensive geological and geotechnical module.
- I have gained the recognition of a Chartered Professional Engineer and am also on the International Professional Register.
- I have undertaken the design and project management of a multitude of dairy related wastewater treatment plants, treating up to 4,000 m^3 of effluent per day.
- I have designed and project managed effluent ponds for dairy treatment, landfills and meat works to name a few.
- I have designed and built dairy irrigation schemes including storage ponds.
- I have experience in the design and project management of municipal water treatment plants producing up to 20,000 m^3 of drinking water per day.
- I have very solid experience in the operation, maintenance and servicing of treatment plants including ponds.

Principal | Gary SUMMERS
Cell | 021 873 883
Email | g.summers@groundsource.co.nz

I have had in excess of 20 years' experience in many aspects of the dairy industry.

- Site assessment and construction monitoring of new dairy ponds, sumps, stone traps and weeping walls for Green Being and RD Agritech (now RDA Consulting), including compaction testing of structural aspects of the above.
- Attendance at Dairy NZ's course for Effluent System Design.
- 20+ years of assessment of soil types, composition and water table levels, excavation and compaction of soils for Ground Source Limited.
- 2 Years construction of dairy sheds, yards, stone traps, sumps, weeping walls and lanes, including excavation and foundations for Graham White Building.
- Piping design and specification and installation of pumps and complete systems for Ground Source Limited.
- Drop testing of dairy effluent ponds.
- Effluent application rate testing.
- Effluent fail-safe systems installation, testing and maintenance for Smart Farms, now Farm Trenz, Regen and Harvest.
- Repair and maintenance of Buddy Controller and other effluent systems.
- Experience also includes dairy electrical, pipework, pumping and effluent system design, installation and maintenance, electronic control and PLC system design, programming, installation and maintenance for dairy and other industries.

In most instances, the visual site inspection will be undertaken by Gary Summers and reviewed by Heiko Franz.

In all other instances, Heiko Franz will undertake the inspection.
Invoices for Visual Assessments and reports will be issued by Ground Source Ltd.

PASS

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Principal	|	Gary SUMMERS
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Email	|	g.summers@groundsource.co.nz

VISUAL ASSESSMENT

31 July 2020

Inspection Date 17 July 2020

CLIENT DETAILS –

George Raymond
Cashmere Bay Dairy Ltd/Otama Farm
145 Jaffray Road
RD7
Gore 9777

Client Name: Cashmere Bay Dairy Ltd/Otama Farm
Supply Number: 33254
Authority Number: AUTH-301811-V2
Client Code: CAS20170

- **Facility** – Synthetically Lined Pond
- **Shape** - Square
- **Measurements** (approximately) **-**
  - *metres* 33.5 metres x 33.0 metres
  - *batter* 2.1:1
  - *depth* 3.0 metres + fall on floor of pond
  - *depth of remaining effluent* 50 mm-450mm
- **Venting** - There is gas venting installed.
- **GPS Co-ordinates** - 45°58'47.78"S | 1279723 mE
  168°51'54.56"E | 4899864 mN
- **Pond Ground Level** - The pond is constructed three-quarters in-ground.

Desludging

- The pond has been desludged to a depth of 50-450 mm. This was measured by manual depth probing.
- The pond was desludged by a contractor using a slurry tanker, leaving an island of soft sludge I the centre of the pond.

Leak Detection

- There is a leak detection system installed under the liner which drains into an inspection sump.
- The sump was full of water above the height of the pipe for the leak detection system. It appears that water, dirt and ground contamination had washed into the inspection sump at some time in the past.
- On investigation, George Raymond advised that there was a small spill/leak from the contractor's equipment during the pond desludging process and contaminant entered the inspection sump. The contractor rectified the issue and sump was pumped out at the time.

Embankments & Vegetation

- The top of the embankments was cleared, sprayed and well maintained.
- The external grass-covered embankments were in good condition with no appreciable stock or other damage visible and no areas of excessive lush growth comparative to surrounding areas were found.
- The fence surrounding the pond is located at the top of the embankments.

Ground Water Drainage / Ring Main

- There is no ground water drainage/ring main system installed.

Equipment & Associated Structures

- There are 2 effluent pumps installed at the pond: 1 floating suction; 1 submerged suction attached to the stirrer foot.
- There is a permanent stirrer installed.
- The liner is protected by a second layer of liner beneath the inlet pipe protecting the base liner from wear due to incoming effluent flow.
- Both suction inlets were able to be inspected. The floating suction does not have protection due to the floating function of its operation. The second suction was fixed to the stirrer foot frame and sits on a concrete pad.
- There appears to be a concrete base installed on which the stirrer foot is sitting. The concrete could be felt underfoot).

Liner

- The inspection of the liner showed all visible seams and joins to be in good condition with no evidence of separation or defects.
- There is a rip in the liner located on the corner closest to the pump shed, on the liner bend where it enters the anchor trench. This is a defect however due to its location it will not affect the effluent pond ability to contain effluent.
- It is recommended that this rip/tear be repaired.

Even though there is a defect on the synthetic liner, there are no visible cracks, holes or defects that would allow effluent to leak from the facility.

Gary SUMMERS
Principal
GROUND SOURCE

CHARTERED PROFESSIONAL ENGINEER'S CONCLUSION

I have reviewed the information and photos provided by the visual inspection of the synthetically lined pond for Cashmere Bay Dairy Ltd/Otama Farm.

The pond appears to be in good shape with no evidence of leakage to be seen. There is some damage to the very outskirts of the liner which will not facilitate leakage of the effluent into the soil.

Based upon my review of the photos, the report supplied by Ground Source and the conditions stated in Rule 32D (a)(ii)(2)(a), I believe that this has pond has passed inspection.

With nearly 20 years of experience in the water and wastewater industry where I started working as a draughtsman to process engineer and project manager for projects from small to large scale, including wastewater treatment ponds, and being a chartered professional engineer, I believe I am qualified to peer review this visual assessment.

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Figure 1 : Facility ex-Google Earth

Figure 2 : Pond Overview

Figure 3 : Stirrer in North Corner

Figure 4 : Example of Effluent Depth

Figure 5 : West Embankment, Pump and Stirrer

Figure 6 : Liner Seam Example

Figure 7 : Inspection Sump 1

Figure 8 : Inspection Sump 2

Figure 9 : Inlet Pipe with Additional Liner Protection

Figure 10 : Liner Rip/Tear Located on Anchor Trench

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In most instances, the visual site inspection will be undertaken by Gary Summers and reviewed by Heiko Franz.

In all other instances, Heiko Franz will undertake the inspection.
Invoices for Visual Assessments and reports will be issued by Ground Source Ltd.