Application for Resource Consent (PART A)

environment SOUTHLAND
Te Taiao Tonga

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

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

PAID
14 JUL 2017
ENVIRONMENT SOUTHLAND

To: Environment Southland
Private Bag 90116
Invercargill 9840

Full name, address and contact details of applicant ***(in whose name consent is to be issued)*** Cheque $1506 mo.

Name: DE & VJ STAFFORD.

Address: 86 CHARLTON SIDING ROAD
RD2 GORE.

Email:

Phone: _____ (*Preferred*) _____ (*Additional*) Fax: _____

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

Contact name/agent: R. DAVIE.

Address: 64 QUINTIN DRIVE
TE ANAU 9600.

Email: inground@vodafone.co.nz
03 249 8826.

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

Land Use

- [ ] Bore/well
- [ ] Convert land to dairying
- [ ] Effluent pond construction
- [ ] Tree planting
- [ ] Gravel extraction
- [ ] Hill country burning
- [ ] Riverbed activity (incl streams/creeks and stopbanks)
- [ ] Bridges and culverts

Discharge

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

Water

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

Coastal

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

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

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

204546.

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

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

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

Discharge of FDE & water Permit for Stock and Stock water.

4 **Location** of proposed activity

Address: 86 Charlton Sidings Road, RD 2 Gore.

Legal Description: Pt lot 39 and lot 40 DP 82, Lot 1 DP 11650 Block XIII Waimumu Hundred

Map Reference (NZTM 2000): _____ E _____ N

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

Name: _____ Phone: _____

Address: _____

_____

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

Checklist: Have you included the following?

- [✓] Payment of the required deposit *(see attached fee schedule)*
- [N/A] Written approval from all potentially affected parties *(forms available from the Environment Southland website)*
- [✓] Site plan/location map/sketch of the proposed activity
- [N/A] 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 must return the application.

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

Signature of applicant

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

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

Name (block capitals) Russell Davie

Signed _____ **Date** 30-3-2017

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

Dairy Green Ltd
Practical Engineering Solutions
Consents, Effluent, Stock water, Irrigation
Design through to Installation
Irrigation NZ Accredited Designer

D E & V J Stafford

Charlton Siding Road
Gore

30 March 2017

V3

Application for:

Discharge Permit Renewal
Water Permit

Contents

A: Background

1. Renewal

D E and V J Stafford own a dairy farm located on the Charlton Siding Road near Gore

The existing consents for this operation – 204546 (Discharge) and 204547 (Groundwater take) –expire on 19 July 2017.

This application therefore seeks to have the dairy farm discharge consent renewed for 500 cows. The groundwater consent does not need to be renewed under the proposed Southland Water and Land plan Rule 54 (a) (i) (1-3) ie 500 cows @ 120L/Cow/day = 60,000L/day.

The farm does not require any upgrade to the FDE collection, storage and irrigation systems. The storage pond has passed an "Appendix P" leakage test.

This application seeks to have the discharge renewed for a further 10 years.

B: Regulatory Considerations

1: Summary

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

Resource Management Act 1991

- The provisions of section 104 of the Resource Management Act1991:
- Part 2 of the Resource Management Act;
- The applicant's assessment of effects on the environment
- The provisions of Sections 104B, 104C, 105 and 107 of the Resource Management Act 1991.

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

- National Policy Statement for Freshwater Management:
- Regional Policy Statement for Southland:
- Regional Effluent Land Application Plan:
- Regional Water Plan
- Southland Water and Land Plan 2016
- Te Tangi a Tauira:

2: Ngai Tahu Values

Regulatory Document	Relevant Sections
National Policy Statement for Freshwater Management:	• Objectives C1, D1 • Policies C1, D1
Regional Policy Statement for Southland:	• Objectives 1.1,1.2,1.3,1.4 • Policy 1.2
Regional Effluent Land Application Plan:	• Objectives 4.1.4, 4.1.5 • Policies 4.2.4, 4.2.7,4.2.8, 4.2.9
Regional Water Plan	
Southland Water and Land Plan 2016	• Objectives 3, 4, 5, 15 • Policies 1, 2, 3
Te Tangi a Tauira:	• Whole Document

Tangata Whenua values have been considered when preparing this application including reference to Te Tangi a Tauira (Iwi Management Plan).

As stated in the Farm Environmental Management Plan the applicant's objective is:

"As good environmental stewards and responsible citizens, manage the farm dairying system so as to take all practical steps to preserve soil structures and avoid contamination of ground and surface water, nutrient leaching, and silting."

This reflects the principals of protection of the mauri of the water and mana of the land while minimising adverse effects on mahinga kai.

No known wahi tapu, ancestral sites, heritage sites or other taonga are associated with the property. Accidental discovery procedures will be issued by Environment Southland alongside the resource consent. These procedures will be followed should taonga be discovered during earth works.

The effects of the activity on mahinga kai and the customary use of water to Ngai Tahu are no more than minor and the effects on physical and natural resources are discussed further in the AEE.

3. Water Quality

Regulatory Document	Relevant Sections
National Policy Statement for Freshwater Management:	• Objectives A1, A2, B1, B2, B3, B4, • Policies A3, A4, B5, B6, B7
Regional Policy Statement for Southland:	• Objectives 5.1,5.2,5.3,5.4 • Policy 5.5, 5.8
Regional Effluent Land Application Plan:	• Objectives 4.1.2 • Policies 4.2.3, • Rule 5.4.5
Regional Water Plan	• Objectives 3,4,8 • Policies 1,4,6,7,13
Southland Water and Land Plan 2016	• Objectives 6, 7, 8, • Policies 13, 14, 15, 16, 17, 18
Te Tangi a Tauira:	• Policies 1, 4, 5, 6, 11, 16, 17, 18

The discharge is to land rather than water and is undertaken in a manner to minimise adverse effects on water quality.

The Beacon website shows that the property is in a zone where nitrate levels are below drinking water standards.

By following current good management practices in relation to effluent storage and discharge including deferred irrigation and appropriate buffer zones, the effects of the activity on groundwater quality and specific values (bathing, trout/native fish, stock drinking water, Ngai Tahu values and natural character) are expected to be no more than minor.

Good management practices for the management of the effluent system and mitigation measures have been included in the application and in the Farm Management Plan.

The system involves the discharge of effluent onto land at a rate where the soil can assimilate the nutrients in a form that the plants can utilise while avoiding any adverse effects on water quality.

Low rate irrigation, as discussed in the AEE, should reduce the risk of exceeding a soil's infiltration rate, thus preventing ponding and surface runoff of freshly applied FDE.

Where recommended buffer zones from waterways are adhered to when applying effluent and effluent is not discharged over tiles, lines/moles where the soil is at or near field capacity.

4. Water Quantity

Regulatory Document	Relevant Sections
National Policy Statement for Freshwater Management:	• Objectives A1, A2, B1, B2, B3, B4, • Policies A3, A4, B5, B6, B7
Regional Policy Statement for Southland:	• Objectives 4.1, 4.2, 4.3, 4.4, 4.5 • Policies 4.3, 4.4, 4.5, 4
Regional Effluent Land Application Plan:	

Regional Water Plan	• Objectives 5,7,8 and 9 • Policies 21, 22 23, 28, 29, 30, 31, • Rules 16C, 23, 50
Southland Water and Land Plan 2016	• Objectives: 7, 9, 11, 12 • Policies 20, 21, 22, 23, 42 • Rules 54(a)
Te Tangi a Tauira:	• Policies 1, 4, 5, 6, 11, 16, 17, 18

The applicant will be abstracting groundwater in volumes not large enough to require consent.

The water take is a permitted activity under Rule 54(a) of the Southland Water and Land Plan and reflects standard volumes for a dairy farm. As such, it reflects efficient use of water.

The proposed volume of take is consistent with Environment Southland's guidelines of 120 litres per day per milked cow and 50 litres per dry stock unit, which is considered reasonable for the intended end use.

The rate of take does not exceed 2L/sec and should not result in more than minimal stream depletion and interference effects.

The taking of the water should not result in the over allocation of the groundwater zone allowing the resource to continue to be sustainably managed.

5. Soil Health and Effluent Management

Regulatory Document	Relevant Sections
Regional Policy Statement for Southland:	• Objectives 8.1, 8.2, 8.3, 8.4, 8.5 • Policies 8.1, 8.2, 8.4, 8.5
Regional Effluent Land Application Plan:	• Objectives 4.1.1 • Policies 4.2.1, 4.2.2
Regional Water Plan	• Policy 41 • Rule 49
Southland Water and Land Plan 2016	• Objectives 13, 14, 15 • Policies 6, 10 • Rules 21, 32
Te Tangi a Tauira:	• Policies 4, 7, 8, 9, 11, 13, 14, 15

The application seeks to ensure the life supporting capacity of the soil is safeguarded, along with the sustainability of the soil ecosystem by utilising land treatment of effluent without significant adverse effects.

An effluent storage pond has been built which allows for deferred storage until the soil moisture content is suitable for irrigation.

The pond was designed to meet the conditions of Rule 49 of the Regional Water Plan.

The soils are suitable for effluent irrigation and the discharge follows current good management practices.

The land disposal area meets the the best practise recommendation of 8ha per 100 cows. This assists in avoiding an excessive build-up of nutrients in pasture, including potassium concentrations, that can affect stock health.

The renewal application meets the requirements for Rule 21 of the Southland Land and Water Plan as it is for the renewal of a discharge permit for an existing dairy farm with no change in cow numbers. A Farm Management Plan is included as part of the application.

Good management practices are included in the Farm Management Plan. These include practices of a general nature and those specific to the transport pathways for the physiographic zones on the property.

The property is not in the Alpine Physiographic zone.

This system is sustainable in the long term and allows the effluent to be used as a both a fertiliser and a soil conditioner.

The system was designed resilient and flexible and allow the incorporation of new methods and technology as became available and proven.

C: Discharge Permit - Application details

1. Duration of Consent sought

10 years

2. Herd size

The milking herd will be not more than **500** cows.

3. Factory supply Number

Supplier number

4. Volume of effluent

Dairy shed effluent for 500 cows at 50l/cow per day is 25,000 litres per day.

5. Period of discharge

The Cowshed from 1 August to 31 May.

Irrigation to the discharge areas will be done between 1 August and 31 May when ground conditions permit.

6. Milking Frequency

Max of twice per day.

7. Winter Milking

None – and not anticipated.

8. Feedpad/Wintering Pad/Stand-off Pads

N/A

9. Other Sources of Effluent

Hardstands

Rainwater off 830m^2 of hard stands around the dairy shed: 850m^{2}x 0.08 x 3 months = 204m^3.

Underpass

N/A

Feed Pad

N/A

Wintering Shed

N/A

Silage Pad

N/A – use Balage

With rainfall, evaporation and daily irrigation allowances as per the Dairy Effluent Storage Calculator the volume of storage required is: max 1,704 m^3 and 1,508m^3 at the 90% probability storage volume.

The farm's existing pond is 2,013m^3 plus 0.5 m freeboard.

10. Area of land

The farm's total land area is 181.0 ha.

No effluent will be irrigated within:

i. 20 metres of any surface watercourse;
ii. 100 metres of any potable water abstraction point;
iii. 20 metres of any property boundary, (unless the adjoining landowner's consent is obtained to do otherwise);
iv. 100 metres of any residential dwelling other than residential dwellings on the property;

It is not proposed to increase the discharge area to include the new areas.

Legal Description
Pt Lot 39 and Pt Lot 40 DP 82, Lot 1 DP 11680 Bk XIII Waimumu Hundred.
Lot 2 DP 404063

11. Total Land area

Total Land area 181 ha

12. Stocking rate

500 cows on 181 ha gives a stocking rate of 2.76 cows per Ha.

13. Effluent collection and storage details

Dairy Shed

I. The effluent from the dairy shed flows by gravity to a stone trap and to a 10m^3 primary pump sump to the north of the dairy shed.
II. From this sump the whole effluent is pumped to the sludge bed further to the north where the solids are removed and the filtered effluent is pumped to the membrane lined 2,013 m^3 storage pond.
III. When field moisture conditions permit the stored effluent is pumped to the discharge area via an underground mainline system to a k/line pod set.

The client advises that in the eight years the storage system has been operating, there have been no issues with a lack of storage even given the two wet springs in the past four years.

Should storage become an issue there is an umbilical system available locally through a contractor. A condition to cover its operation should be included in the consent.

14. Effluent Irrigation method:

Renewal is for a low rate pod sets only plus the standard conditions to allow for the use of an umbilical cord system should that be ever required.

Any 'low rate pod' land disposal system will meet the following conditions:

- a maximum depth of application of 15 mm for each individual application, at a rate not exceeding 10 mm/hour;
- a minimum return period of 28 days between applications;
- a maximum combined depth of application of 25 mm per year to any land area; and
- a minimum land area of 8 hectares/100 cows for the dairy shed effluent.

Any low umbilical cord system will meet the following condition:

- a maximum depth of application of 5 mm for each individual application.

15. Calibration of Discharge Rate

It is submitted that a test of the system is not required as the low rate system lacks the capacity to apply at a rate of more than 5mm per hour.

The irrigation pump is a 7.5kw Alpha closed impellor pump. By using the pump curve the highest application rate can be calculated.

Head to operate K/line podset	23.0m
Static lift	3.0m
100m MDOD90mm, Friction loss	1.5m
100m MDOD63mm Draghose, Friction loss	2.7m
Total Head	30.2m

30m head is 2.94 or near enough to 3 bar.

Using the K/line pod manufacturer (RX Plastics Ltd) data a single k/line pod will deliver 1.030m³/hr for a depth of 2.3mm/hr at 3 bar.

The farm's Kline podset is fitted with the 4.0mm black nozzles.

Pressure and flows of the Naan 5022

Nozzle (mm)	P bar	Q m3 / hr	Application Depth (m)
3.2 Green	2.0	0.570	1.43
	3.0	0.700	1.43
	4.0	0.810	1.43
3.5 Blue	2.0	0.660	1.65
	3.0	0.810	1.65
	4.0	0.930	1.65
4.0 Black	2.0	0.850	2.13
	3.0	1.030	2.13
	4.0	1.180	2.13

Application table from the RX plastic technical manual

The farm's pod-set has 24 pods in the set. Hence in a continuous pumping scenario the volume irrigated will be 24.7m³ an hour. However the depth applied is completely dependent on the setting of the pulsing system with can be set to pulse irrigate depths less than 1mm/hr. eg a single pulse of 15 minutes duration in the hour would be 2.13mm/hr divided by 4 = 0.53mm/hr.

16. Effluent Testing

The nutrient content of the effluent has not been tested to date, however the nutrient content in a 10mm application depth of purely FDE is likely to be around 30 kg N /ha and 3 kg P/ha. A maximum application depth of 25mm per year to the effluent discharge area should result in

loadings of around 75 kg N/ha and 7.5kg P/ha which is well below the recommended restriction of 150 kg N typically placed on discharge permits by Environment Southland.

17. Buffer Zones

The applicant will to comply with all buffer zones as recommended by Environment Southland, i.e.

I. 20 metres from any surface watercourse;
II. 100 metres from any potable water abstraction point;
III. 20 metres from any property boundary, (unless the adjoining landowner's consent is obtained to do otherwise);
IV. 100 metres from any residential dwelling other than residential dwellings on the property;
V. Dairy shed effluent not be discharged onto any land area that has been grazed within the previous 10 days;
VI. Effluent shall not be discharged over tiles, lines/moles where the soil is at or near field capacity.

18. Other Discharges

No other discharges on property

19. Water Zones

Groundwater Zone: Middle Gore Lignite measures (ex Beacon)

Surface Water Catchment: Mid Mataura

20. Groundwater Depth

The groundwater depth will be variable but is in the vicinity of 8.0 m from ground level. (ex bore)

21. Slope of Disposal Area

The disposal area is largely flat but bisected with old meander depressions typical of the river plain.

22. Existing Environment

a. In stream life	No Effect
b. Food gathering from watercourses	No Effect
c. Wetlands/ bird nesting habitats	No Effect
d. Recreational activities	No Effect
e. Areas of aesthetic or scientific value	No Effect
f. Waste discharges	No Effect
g. Other water takes	No Effect

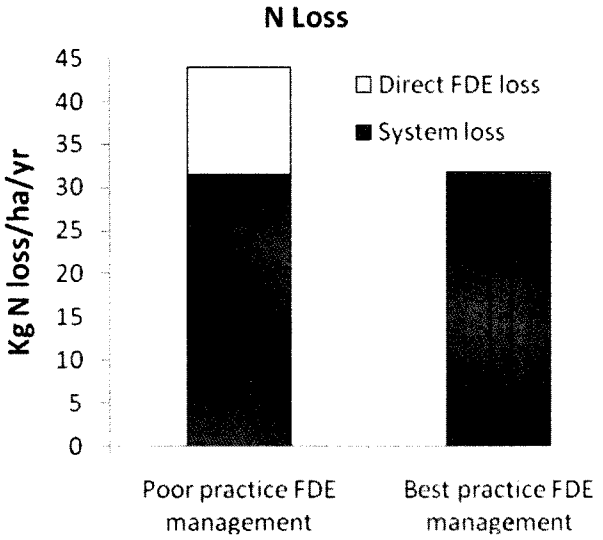
With the discharge to land only occurring when there is a sufficient soil moisture deficit there will be no effect as the nutrient applied will be held in the pasture root zone.

23. Assessment of the risk of Contaminant Transportation

The entire design of the effluent discharge system meets best practice by using buffer storage and low rate/depth effluent application. The use of best practice effluent application should avoid adverse effects on the environment. This principle is well documented in various scientific reports prepared for Environment Southland during the process of setting policies and rules around effluent discharge to land. The 2009 Houlbrooke and Monaghan report

provides context and background to the principle that low depth effluent application should not cause adverse effects on water quality.

The graph below is taken from the 2009 Houlbrooke and Monaghan report to illustrate that nutrient loss from FDE application is minor if undertaken using best practice. In this example, less than 1% of nutrients applied in effluent reached drainage water on tile and mole drained soil. The greatest lost being "system loss" which is a different expression for the grazing effect illustrated earlier in the report.



The applicant intends to apply effluent in accordance with best practice at all times.

Deferred Irrigation

Houlbrooke and Monaghan explain that if effluent is applied to soil when a soil moisture deficit exists then the effluent preferentially remains in the soil's root zone as plant available water. The soluble nutrients in the effluent can then be taken up by the plant and used in nutrient cycling. The applicant plans to use the closest Environment Southland soil moisture monitoring site on the website to determine whether a suitable soil moisture deficit exists. Effluent application will be deferred if soil moisture levels are too high to safely and correctly apply effluent. Effluent will be only applied when there is a ground moisture deficit-nil or little drainage.

The property has effluent storage capacity of 2,013 m^3 which provides for deferred irrigation.

The ability to defer irrigation during marginal times means that effluent is only applied when a soil moisture deficit occurs.

The use of low rate irrigation increases the frequency when it is safe to apply effluent because a lower soil moisture deficit is required prior to irrigation. By deferring irrigation, losses to drainage water should be considerably less than the 1.1% of the total nutrients applied in the effluent experienced in the above trial.

Low rate irrigation

Low rate irrigation is defined as an application rate of less than 10mm/hr. The applicant's effluent system on the dairy farm can apply FDE at a rate of less than 10mm/hr at all times. The application rate can be further lowered when effluent is pulse irrigated.

Houlbrooke explains that the application of effluent in this manner (low rate/ low depth) should reduce the risk of exceeding a soil's infiltration rate, thus preventing ponding and surface runoff of freshly applied FDE. A lower application rate also increases the likelihood of retaining the applied nutrients in

the root zone. A low application rate decreases the likelihood of preferential flow and allows a greater volume of applied FDE to move through smaller soil pores via matrix flow, thus allowing for greater attenuation of effluent contaminants (Houlbrooke et al. 2006, McLeod et al. 1998).

24. Assessment of Environmental Affects

a. Neighbourhood and wider community

As the applicant will adhere to Environment Southlands buffer zones around boundaries, dwellings, bores etc., there will be no more than minor effects on the neighbourhood and wider community.

The farm is already a dairy farm, with a full set of dairying infrastructure in place. No issues have been raised (by neighbours or any other person) with the existing owner during their ownership.

b. Physical effect on the locality including landscape and visual effects

Discharge of effluent has minimal landscape and visual effects as a low rate system with pods is to be used. At times these may be visible from the Charlton Siding Road, however they do not have a large presence on the visual landscape.

With low rate application systems, there is little discoloration of pastures.

c. Plants and animals, habitats and ecosystems

The effluent discharge area covers the area of the property indicated in the existing consent graphic, excluding standard buffers from boundaries, dwellings, bores and waterways. The approximate size is 41 ha. The size of the effluent area is vital to ensure nitrogen, potassium and phosphate loadings are within expected limits to avoid environmental effects and animal health issues. The total area available is at the Council and Industry recommended size of 8 ha/100 cows.

As discussed above, the soluble nutrients in the effluent can then be taken up by the plant and used in nutrient cycling and are beneficial to the soil and pasture.

d. Natural and physical resources having special value

The applicant's property lies within part of the wider Mataura River Catchment. The Mataura River is subject to a Water Conservation Order which restricts the alteration of water quality in the river.

Cumulative effects on the receiving environment are a consideration under Rule 50 of the Regional Water Plan. Long term water quality trends can be used as an indication of cumulative effects on water quality. A long term deterioration trend has been established at the Gore site (the nearest current monitoring site on the river downstream of the applicant's property) in regards to total nitrogen and total oxidised nitrogen.

Given the distance from the subject property and the extent of the other catchments that are monitored at this site, it is submitted that the Gore data is of little relevance in discussing the effects of this operation on the ongoing water quality associated with the property..

Environment Southland testing over the last few years shows how sporadic the results can be when testing N levels in groundwater. There is no obvious trend in N levels in the groundwater under the property. Climatic influences will have the biggest impact on N losses annually.

Low rate irrigation, as discussed above, is utilised to reduce the risk of exceeding a soil's infiltration rate, thus preventing ponding and surface runoff of freshly applied FDE. A lower application rate also increases the likelihood of retaining the applied nutrients in the root zone. A low application rate decreases the likelihood of preferential flow and allows a greater volume of applied FDE to move through smaller soil pores via matrix flow, thus allowing for greater attenuation of effluent contaminants (Houlbrooke et al. 2006, McLeod et al. 1998).

There are no known QEII covenant, historical places or sites of special significance to Maori on the property.

e. Discharge of contaminants into the environment.

Effluent itself may be considered a contaminant, however as discussed above, when applied according to best practice guidelines, it has minimal impact on the environment.

f. Natural hazards, hazardous substances or installations

The property does not suffer from extensive flooding, with even severe rainfall events all surface water is contained within a few meters of the banks of the stream along the northeast boundary. The effluent storage structure is not subject to any flooding with the ponds banks in excess of 2m above flood plain level.

25. Mitigation measures

Maintenance Details

The pump performance and need for maintenance will be monitored via a pressure gauge fitted at the pump. The pump and irrigation lines will be drained for the winter period.

The sludgebed will be cleaned/emptied as and when suitable field conditions permit.

Effluent Treatment Details

The effluent from the dairy shed and yards, gravity's to a larger stone trap before flowing to a pump sump where it is pumped to a sludgebed with the filtered effluent being pumped to the storage pond.

Effluent Storage Details

The liquid effluent storage is 2,013 m^3 in the storage pond.

This provides sufficient storage to enable deferred irrigation.

Effluent Irrigation Mitigation Methods

All buffer zones as recommended by Environment Southland will be adhered to.

Effluent will applied at the appropriate rate as prescribed by consent conditions.

Contingency details

Mechanical Breakdown

The key risk in the effluent collection system is the failure of the transfer pump at the stone trap 10m north of the shed. This risk is well known and the sump and pump is well monitored. Due to the design of the system the effluent will back flood into the dairy shed pit should the pump stop, making detection of any issue evident in real time.

This pump is set up with camlocks etc to allow another pump to be quickly installed into the system if required.

Should the irrigation pump fail there is adequate storage to allow time for the pump replacement.

The aim is to operate the irrigation system to always ensure that there is buffer storage available.

This allows a contingency for wet weather or irrigation pump failure.

Wet Weather

The storage structures contain enough storage for over 70 days of dairy shed effluent even after allowing for the rainwater and effluent runoff from the standoff areas.

The farm has had no storage capacity issues since the storage pond upgrades were completed about seven years ago.

Farm Effluent Management Plan

See attached FEMP Document

26. Alternative Locations or methods

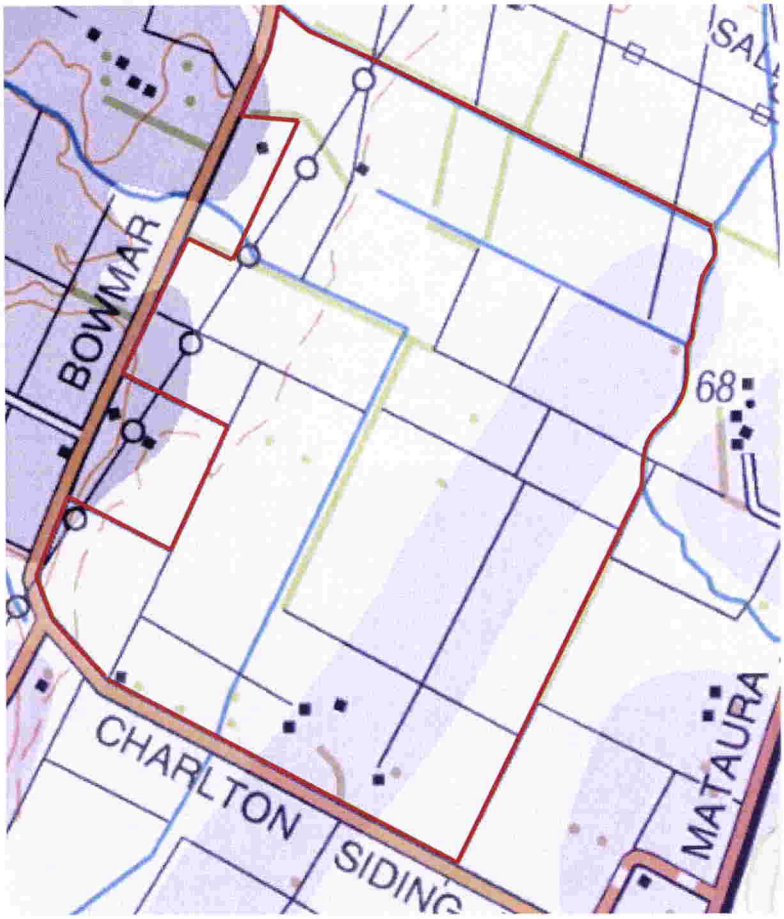
The low rate system has been installed over other possibilities (such as slurry tanker) as there are fewer adverse effects and it is consistent with Council policies.

There are lower operational costs and it has proven reliability.

Should there be issues with the pumping systems there are Umbilical Cord systems and vacuum tankers available in Edendale, Riversdale and Balfour. To permit the use of such system the standard relevant clause should be included in the consent.

27. Physiographic Zones

Physiographic Zone



The whole farm is in the Lignite/Marine Terraces zones

Risks and mitigations

Physiographic Zone	Variant	Key Transport Pathways
Lignite Marine Terraces		Overland Flows Drainage in those soils prone to waterlogging

Good management practices for these zones include:

- nutrient management
- riparian management
- effluent management

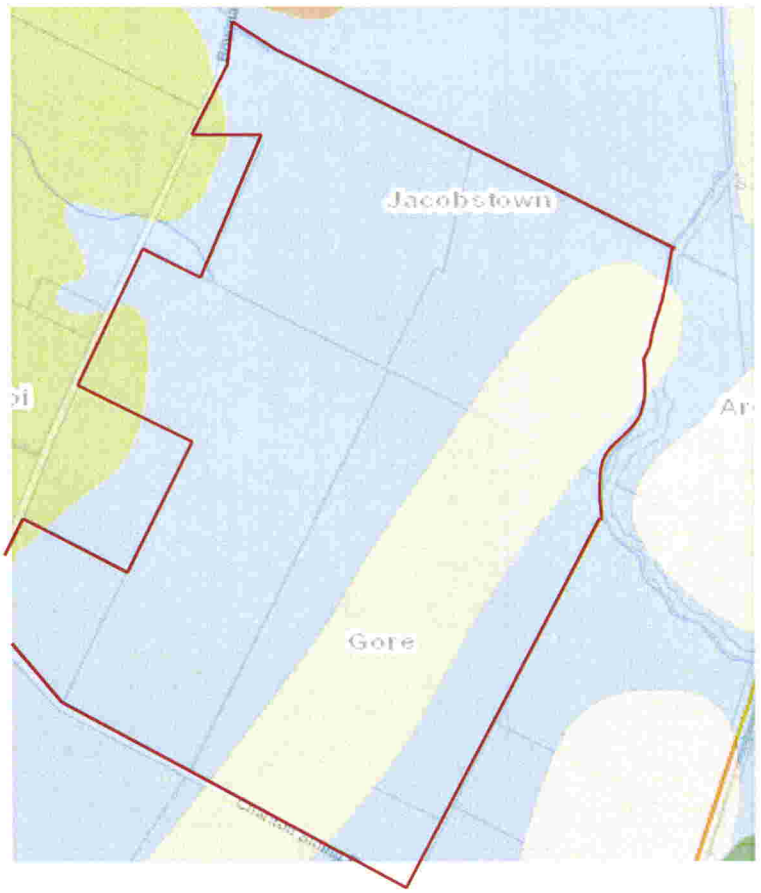
These are discussed in detail in the Farm Management Plan attached.

By adhering to best practice in irrigating effluent as above, the effects of artificial drainage and overland flow are reduced further by:

- protecting soil structure.
- reducing the accumulation of excess nitrogen in the soil during autumn and winter.
- avoiding preferential flow of effluent through drains.
- managing critical source areas.

28. Soil Types

As below farm consists of the Jacobstown and Gore types, although the distinction between the two is somewhat blurred in the field with profiles appearing very similar.



Type	Compaction	Nutrient Leaching	Erodibility	Organic matter loss	Waterlogging
Jacobstown	Severe	Slight	Slight	Slight	Severe
Gore	Moderate	Very Severe	Minimal	Moderate	Nil

29.Farm Maps

See FEMP for further detail

D: Use of Ground Water

Background

The farm has been taking groundwater for the dairy shed and stockwater from a bore as per the existing consent.

Current plan

1. Water Use

   Stock water and dairy shed use.

2. How and Where

Water is pumped from two bores to storage at the dairy shed.

3. Quantities

   The requirements for water are as follows.

1. The groundwater extraction rate will be less 2L/sec concurrent on both bores.

Average rate of take	0.69	litres per second
Maximum rate of take	1.90	litres per second
Maximum daily volume	60	cubic metres per day
Maximum weekly volume	420	cubic metres per week
Maximum monthly volume	1,800	cubic metres per month (30 day month)

4. Abstraction rates

I. Maximum Rate: 1.9 L/sec

III. Operating period

Days/week	Weeks/Month	Months/year
7	4	12

1. Rule 54

Under the proposed plan Rule 54, the existing water consent 204547 does need to be renewed as:

The total ground water and surface water extraction for the landholding will be more than 86,000 l/ per day, i.e. 60,000l/day summer

Summer

Dairy cows	500	Water required	70	litres/head/day
Drystock	50	Water required	40	litres/head/day

Winter (Stock Water only)

(ground water)

Dairy cows	Number	10	Water required	50	litres/head/day
Drystock	Number	10	Water required	40	litres/head/day

2. The groundwater extraction rate will be less 2L/sec.

Average rate of take	0.69	litres per second
Maximum daily volume	1.90	litres per second
Maximum daily volume	60	cubic metres per day
Maximum weekly volume	420	cubic metres per week
Maximum monthly volume	1,800	cubic metres per month (30 day month)

3. The points of extraction are not within 50 m of another bore. (1283308E, 4481561N)

   Effects on bore yields on neighbouring bores are expected to be no more than minor. No known issues have occurred over the term of the existing consent or since the farm was purchased in 2003.

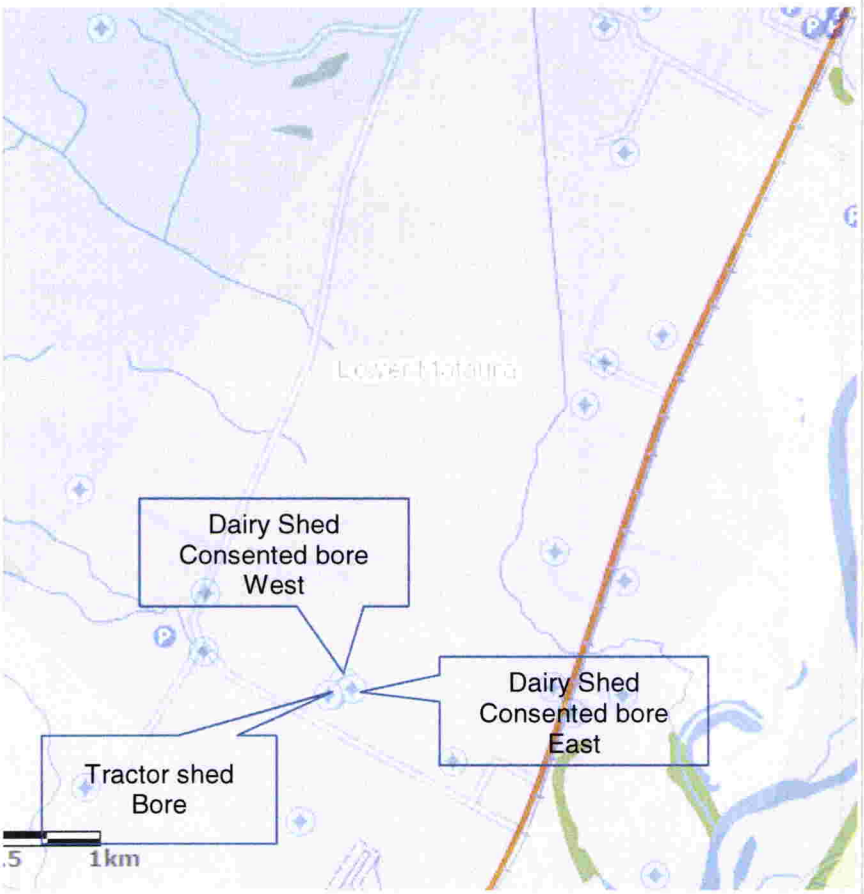
4. No surface water extraction.

Rule 54 (a) (iii) advice.

1. Farm type — Dairy farm
2. Stocking Rate — 2.76 Dairy cows per ha
3. Points of Extraction — F45/0512 NZTM 2000 1276713 E, 4881591 N
   F45/0465 NZTM 2000 1283269 E, 4881568N

2. Other information

a:. Aquifer Name



b:. Storage of water before use

Water is stored in 2 x 30,000 litre tanks at the dairy shed.

c: . Type of water meter installed

A mechanical meter is currently fitted that allows the cumulative flow to be recorded.

d: Other sources of water available

There is another bore on the farm that supplies the domestic water to the houses and to the calf shed. (Tractor shed bore) but this is low yield and not deemed suitable for supplying the dairy shed and stock drinking water requirements.

Historically it is believed that it was the bore that was used to supply stock water to the farm when it was a sheep and beef farm.

It could be used in an emergency (such as a bore pump failure) for the cowshed by laying piping from the bore to the cowshed.

e: Measures to minimise wastage and maximise efficient use

Procedure in place for checks

- Procedure in place for reporting/repairs
- Check water flowing into troughs when cows come in
- Regular check of troughs when driving past
- Periodic thorough maintenance of troughs
- Watch for leaky pipes/"weak" spots
- Floats in tanks set at a level to avoid waste
- Look out for tank/water cylinder overflows
- Check of water pressure in hand hoses
- Double check taps turned off after milking
- Regular maintenance of pumps, dispensers, etc

f: Associated discharges

See discharge permit (section C above).

g. Surrounding environment

a. In stream life	No Effect
b. Food gathering from watercourses	No Effect
c. Wetlands/ bird nesting habitats	No Effect
d. Recreational activities	No Effect
e. Areas of aesthetic or scientific value	No Effect

h. Effects on water source

a) Aquifer storage volumes

Environment Southland has adopted a staged management approach to groundwater allocation in Southland in order to address the uncertainty regarding sustainable allocation volumes for the region's aquifer systems. This approach maintains an appropriate level of management intervention to ensure adverse environmental effects remain within acceptable limits while allowing progressive development of the groundwater resource. The knowledge

that is gained by the progressive development of the resource will be built into its future management.

The applicant's current water take is already part of the current allocation total mentioned above.

b) River and stream flows, including minimum flows and allocation levels

There have been no known issues over the term of the existing consent related to river and stream flows.

The Charlton stream is 870 meters upgrade of the bore. The Charlton stream bed is perched and it is therefore unlikely that any downgrade extraction would have any immediate effect.

This renewal is not seeking an increase in annual volumes or rate of extraction.

c) Wetland and lake water levels

N/A

d) Groundwater quality

Nitrate is water soluble and can be leached from the soil profile into ground water and surface water environments. This can affect the quality of water for drinking and affect the ecology of surface water by promoting the growth of aquatic plants.

The area has a history of higher nitrate levels in the groundwater, with elevated levels being noted for over 25 years.

The current nutrient budget has calculated the losses of N to water to be 33kg/ha/yr which is about median for dairy farms in Southland.

This application is for no increase in volume of water take.

On farm practises to minimise localised contamination of groundwater include ensuring that any on farm spraying of water ways is always carried out using approved sprays for acquatic environments.

The bore is fitted with a collar to prevent surface water ingress down the bore casing.

The effects on water quality are expected to be no more than minor.

j: Assessment of environmental effects

a) Neighbourhood and wider community

As discussed above the water take is not expected to have adverse effects on neighbouring wells.

There are no actual or potential adverse social effects from the abstraction of the groundwater.

The existing water take has not had an impact on recreational fishing.

The provision of water for the dairy shed is a critical part of the production and economics of the property, which employs three people.

b) physical effects including landscape and visual effects

The water take infrastructure does not create adverse visual effects on the surrounding landscape.

c) ecosystems including plants, animals and habitats

Over the life of the existing permit, there has been no observed recreational fishing in the Charlton Stream waterway. The water take has had no known significant adverse effect on the Mataura River over the term of the existing consent.

There are expected to be no observable effects on animals or their associated habitats.

d) natural and physical resources having special value

The stream running through the property is a tributary of the Mataura River. The Mataura River has cultural, spiritual and historic significance to Ngai Tahu. The river was an important source of mahinga kai (gathering food) and Ngai Tahu tupuna (ancestors) have tikanga (protocol) for sustainable use of its resources.

The existing water take has not hindered this custom or had an impact on recreational fishing and the effects of the renewal should also be no more than minor.

e) discharge of contaminants

Associated effluent discharge – see section C above including AEE for the discharge.

f) natural hazards or hazardous substances/installations

According to Environment Southland's Beacon website, there are no areas of natural hazards in the vicinity of the applicant's property (including significant flood zones). The observations of the last 13 years by the current owners, is that flood event are largely contained within the steam banks.

i: Monitoring or mitigation measures

Water metering monitors the volume and rate of the water take. The bores are fitted with paddle type water meters currently. This will be upgraded with a data logger.

Water efficiency is a key focus on farm. Simple tasks such as keeping water reticulation systems and dairy shed plumbing in a good state of repair will prevent water leaks and reduce water wastage.

j: Alternative locations or methods

The bores have sufficient capacity and all infrastructure is already in place.

E: Effluent Pond

1. Location of the pond

2. Liner

   Synthetic membrane

   As the pond is sited in gravels no underfloor leak detection system has been installed. The pond leak test is attached.

3. Construction Details

   Name of Designer: Dairy Green Ltd

   Name of Builder: Croyden Contracting Ltd

   Built

4. Construction Standards

   The pond was designed and installed to the Environment Southland Code of Practice for Design and Construction of Agricultural Effluent Ponds. (Rule 49)

5. Pond Capacity

   The pond has a capacity of 2,013m^3.

Dairy Green Ltd

Practical Engineering Solutions
Consents, Effluent, Stock water, Irrigation
Design through to Installation
Irrigation NZ Accredited Designer

DE & VJ STAFFORD

October 2016

FARM MANAGEMENT PLAN

VER 1.0

A: PROPERTY DETAILS

Entity Name:	D E and V J Stafford
Contact Person:	David Stafford
Address:	Charlton Siding Road
Legal Description	Pt Lot 39 and Pt Lot 40 DP 82, Lot 1 DP 11680 Bk XIII Waimumu Hundred. Lot 2 DP 404063
Land Area	181 Ha (total)

Resource Consents: Discharge only

Discharge Consent: Renewal # TBA

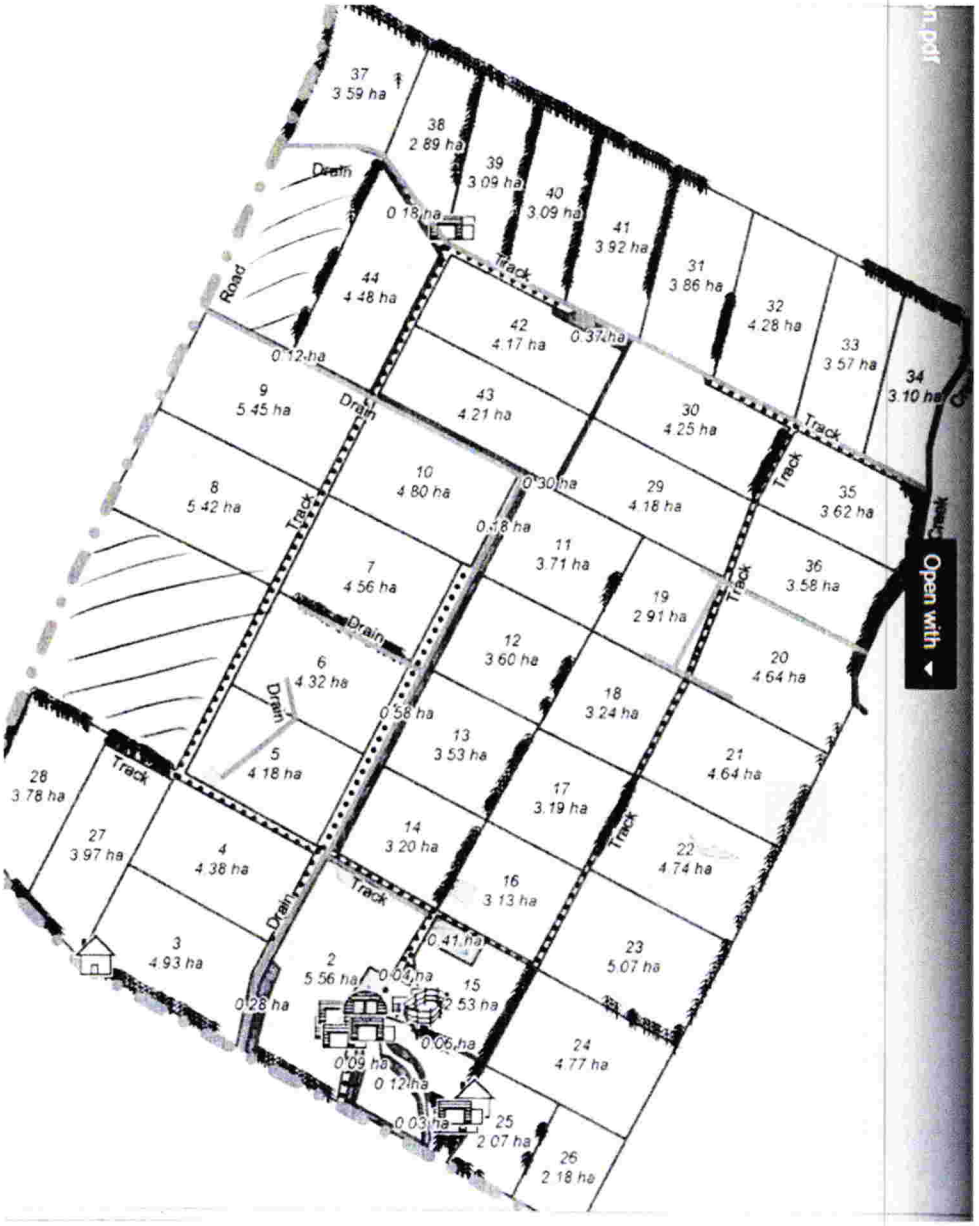
This document is designed to be a living document.

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

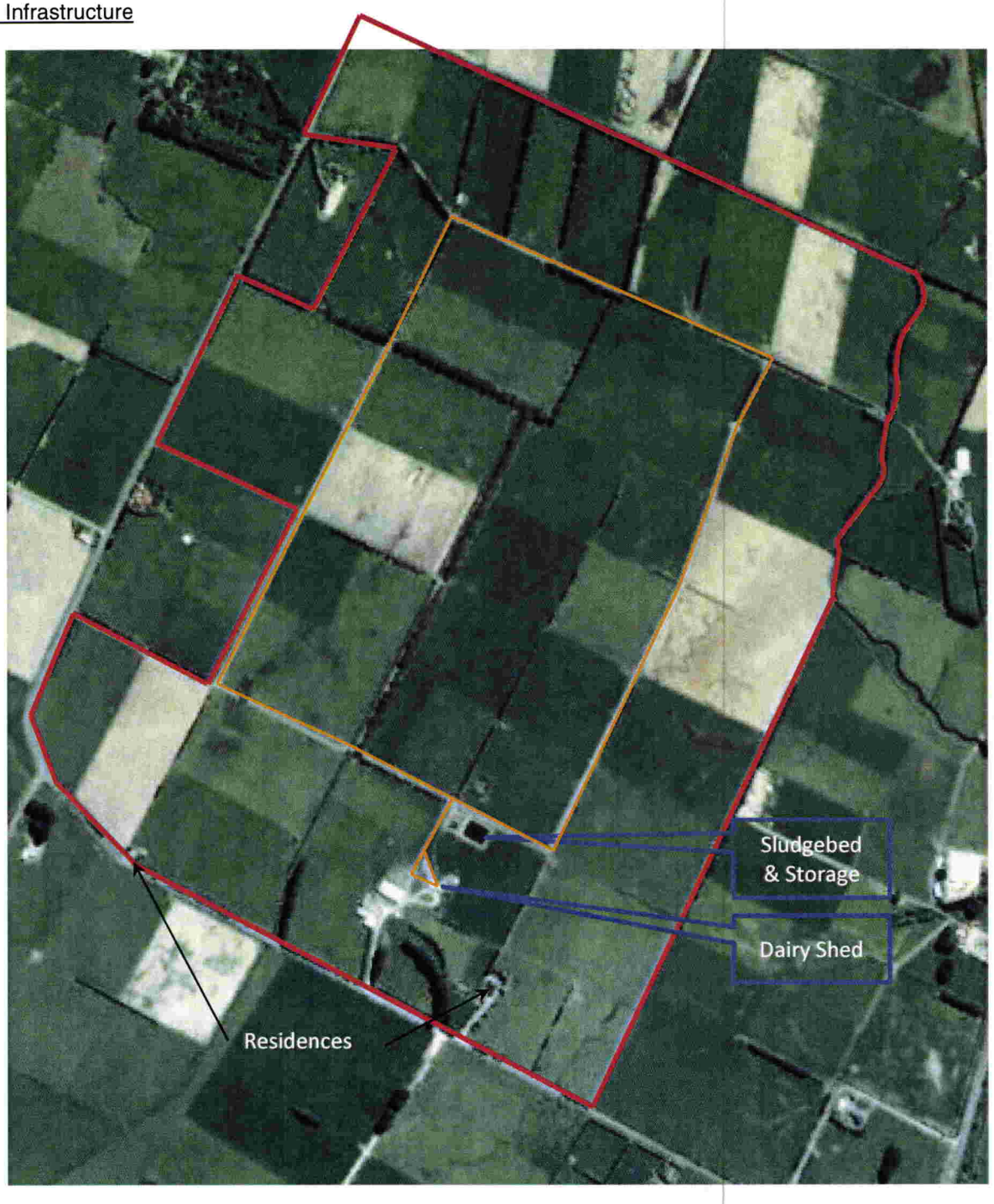
B: MAPS

1. Boundaries

Paddocks and areas.

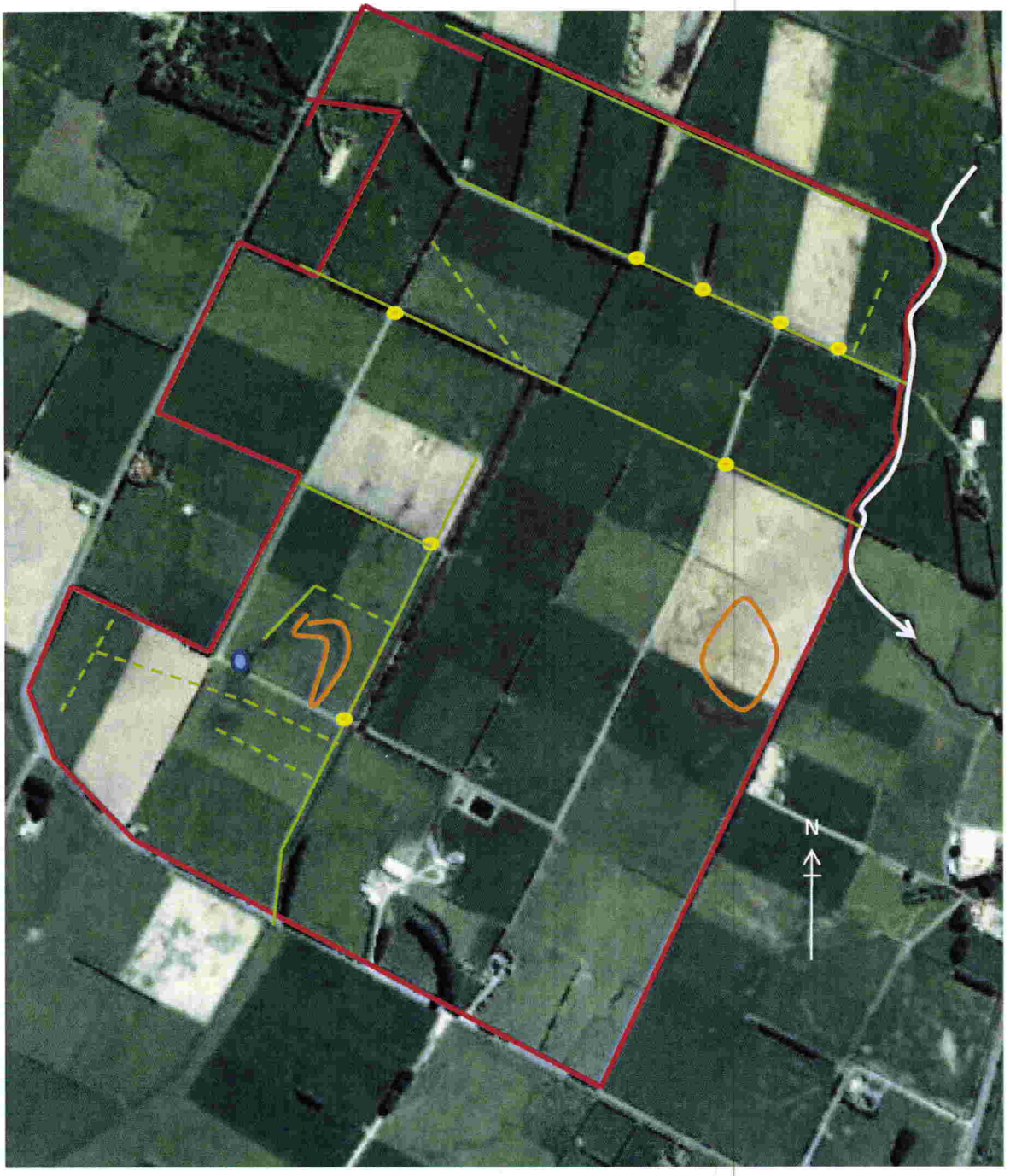


2. Infrastructure



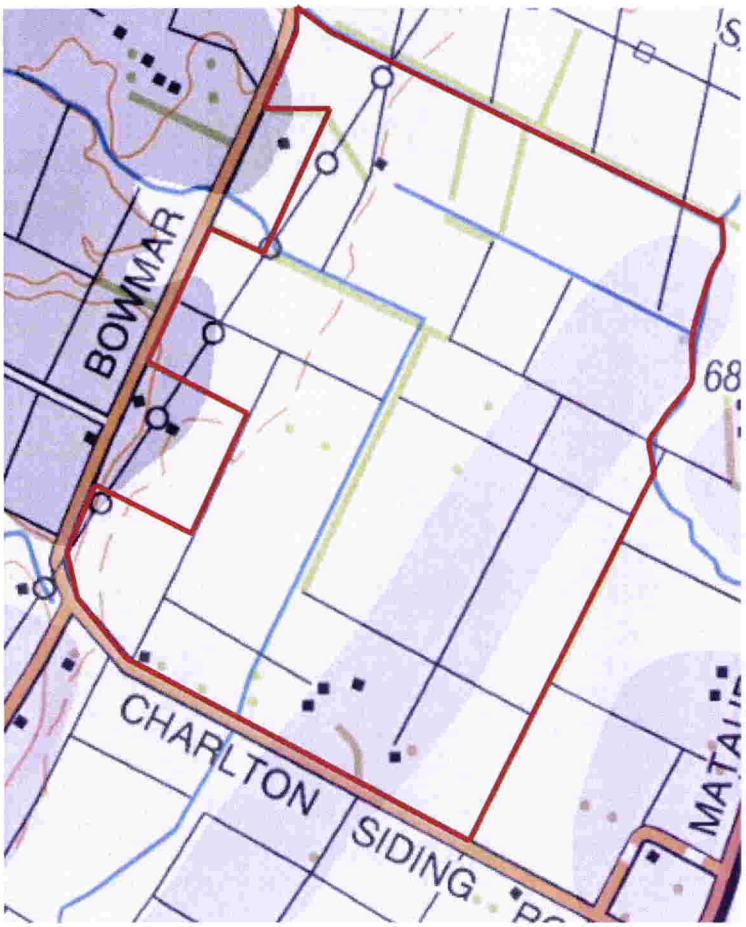
10 Kinloch Street, PO Box 5003, Waikiwi, Invercargill 9843
Phone Invercargill 03 215 4381, Gore 03 208 8443
Email: dairygreenltd@xtra.co.nz

3. Waterways, Stock Crossings and Critical Source Areas.



Charlton Stream Creek which flows along the north east boundary.
Duckpond
Drain
Tile
Crossings/culverts
Critical Source areas

4. Physiographic Zones.



Mataura Lignite terraces

Risks and mitigations

The whole farm is in the Lignite/Marine Terraces zones

Risks and mitigations

Physiographic Zone	Variant	Key Transport Pathways
Lignite Marine Terraces		Overland Flows Drainage in those soils prone to waterlogging

Good management practices for these zones include:

- nutrient management
- riparian management
- effluent management

By adhering to best practice in irrigating effluent as above, the effects of artificial drainage and overland flow are reduced further by:

- protecting soil structure.
- reducing the accumulation of excess nitrogen in the soil during autumn and winter.
- avoiding preferential flow of effluent through drains.
- managing critical source areas to ensure that discharges from such area are mitigated by fencing off or not grazing these areas when risk of overland flows from them are high due to ground conditions and/or weather - condition (or forecasted adverse weather conditions - .

The Environment Southland Fact Sheets and best management practices documentation form part of this FEMP and are in Section O.

5. Riparian Vegetation and Fencing

All water ways are fenced both sides.

Main south drain

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

6. Effluent Mainlines.

——— MDOD 90mm Mainline

With the use of drag hoses the entire consented disposal area can be irrigated.

7. Heritage

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

8. Significant Indigenous Biodiversity

There are no known or apparently recorded Significant Indigenous Biodiversity sites on the property.

C: NUTRIENT BUDGET

1. Plan Objective

This section considers all factors that may influence nutrient use and details the strategies appropriate to achieve good sustainable nutrient management. Of particular interest are P & N for environmental reasons but potassium and magnesium are also important for stock health.

2. Plan Goals

The aim of management is to use nutrients efficiently to achieve good per head performance at a modest stocking rate for the betterment and sustainability of the soils, pastures and water source.

3. Farm System Details

The following assumptions have been made.

I. The farm will milk a maximum of 500 cows on a total 181 hectares.
II. Surplus feed will be conserved as balage and will be fed back out on the property.
III. A low rate and depth effluent application k/line podset system is used on farm, along with deferred effluent application using a buffer storage pond.
IV. The milking season will be between 1st August and 31st May.

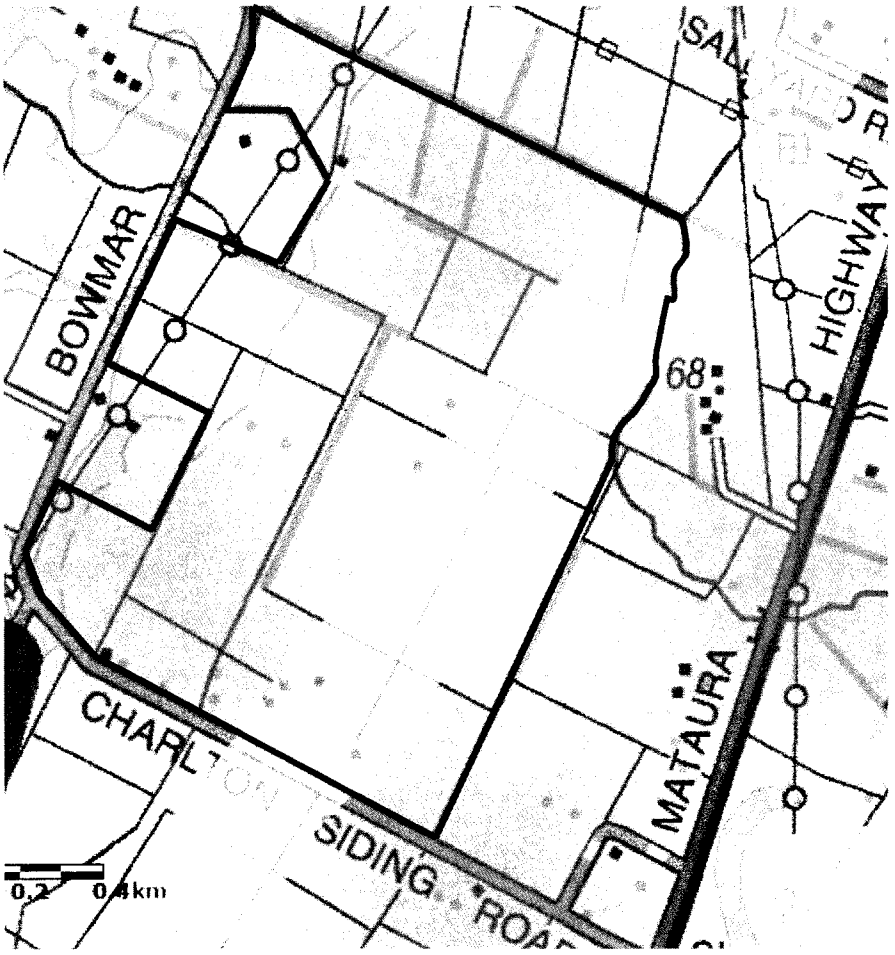
4. Optimum Soil Test Values

As a guide the following soil test values or ranges are recommended.

pH	*Ca*	*P*	*S*	*K*
6-6.2	12+	22-25	10-12	6-8

5. Soils and Properties

As below the farm consists of the Jacobstown and Gore types, although the distinction between the two is somewhat blurred in the field with profiles appearing very similar.



Type	Compaction	Nutrient Leaching	Erodibility	Organic matter loss	Waterlogging
Jaccobtown	Severe	Slight	Slight	Slight	Severe
Gore - Yellow	Moderate	Very Severe	Minimal	Moderate	Nil

i. Infiltration Rates

The infiltration rates for effluent on these soils will vary widely depending on recent compaction and grazing history, ground cover, contour etc.

6. Environmental Management Actions Recommended

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

I. Soil and herbage testing to monitor soil chemistry and manage fertiliser and lime application to maintain optimum soil fertility levels. Testing is done annually.

II. Fertiliser management plan prepared for each soil type with guidance from Overseer output reports.
III. Stock are excluded stock from streams.(since 2002).
IV. Tracks and lanes are sited away from streams. Lanes constructed to divert run off away from potential waterway ingress. Lanes and race water tables are be designed to shed water to pasture for riparian treatment where practical.
V. Effluent concentration will be measured and effluent application depth managed for optimum use of nutrients.
VI. Stock will be managed in a placid manner to reduce the collection of effluent at the dairy shed.
VII. Wintering most cows off the property.

7. Fertiliser Application Best Management Practices

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

I. The spreaders used to apply fertiliser to be 'spread mark' accredited and ideally have tracmap or a similar recording system to show proof of placement.
II. Buffer distances are maintained such that there is no direct contamination of waterways from the application of fertiliser.
III. Best practice is to have a 20m buffer between fertiliser placement and waterways. Fertiliser is not applied to saturated soils.
IV. Nitrogen containing fertilisers are only applied to actively growing pastures.
V. Fertiliser not be applied when air drift can occur beyond the farm boundaries.
VI. Large fertiliser dressings should be achieved through split dressings rather than a single application.

Less soluble phosphate fertilisers, i.e. reverted super phosphate fertilisers, are less likely to leach or run off particularly if heavy rain occurs after application.

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

- Application must not occur within 30m of a neighbouring residential unit without approval. Spray drift must also be minimised elsewhere.

- There must be no direct discharge to water and no discharge when soil moisture exceeds field capacity. For permanently flowing waterbodies (including artificial drains), fertiliser in riparian plantings where stock are excluded can only be applied to establish the planting. If there is no riparian planting, a setback of 10m is required.

8. Effluent Best Management Practices

Test effluent strength; apply a depth that corresponds with nutrient content of the effluent. The soil test values for the paddocks receiving effluent will be considered and the depth of application adjusted to suit. At all times the management of the effluent system will comply with the discharge consent conditions.

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

- 8 ha/100 cows land area. It is recognised that for typical farm dairy effluent a minimum of 8ha per 100 cows is required as an effluent receiving area. In practice the area available will be in excess of this i.e. a minimum of 40ha is recommended for 500 cows and a minimum of 41ha will be available.

- 10 days post grazing before effluent application.

- Application of sludge – less than 7mm thick to suitable ground, with climate conditions permitting

- Apply maintenance rates of nutrient to as much of the farm as possible rather than load up smaller areas with all the effluent/nutrient.

9. Potential Nutrient Loss Effects of Dairying

Indices	*Average NZ Farm*	*Dairy Farm*	*Average NZ Dairy Farm*
N/loss to water, kg N/ha/yr	5-20	33	24-42
P loss to water, kg/ha/yr	-	1.0	-

Nitrogen and phosphate losses are at the low median end of the typical dairy farm losses range due to the low stocking rate and low importation of nutrients.

10. The effect of effluent Application

Effluent will be applied to the Jacobstown and Gore soil types. Most of the area in the designated discharge area is in the Gore type.

The total effluent disposal field as per the above graphic is a minimum of 41ha hectares.

11. Nutrient Management Fact Sheets

The following factsheets are included in Appendix B

- Stop your nutrients going underground

D: GOOD MANAGEMENT PRACTICES

1. Objectives

"As good environmental stewards and responsible citizens, manage the farm dairying system so as to take all practical steps to preserve soil structures and avoid contamination of ground and surface water, nutrient leaching, and silting."

a: Land

Key strategies to achieve this objective:

- Fencing of all waterways.
- Excluding stock from high risk critical collection source areas and attendant transport swales and when the ground is near or at field capacity.
- Maintain adequate buffer zones from waterways during tillage.
- Implementation of Intensive Winter Grazing plan.
- Stock management to avoid excessive pugging.

b: Effluent and Nutrients

Key strategies to achieve this objective:

- Prepare, implement and monitor a Nutrient Management Budget to maximise the returns and minimise losses from the resource particularly N, P & K.
- Subject to soil moisture and weather conditions, irrigate at every practical opportunity to keep the storage pond as empty as possible.
- Ensure that all staff are trained and competent in the system operation, and are aware of the need to be vigilant in operation the effluent system and the farm's drainage networks.
- Document each day the system operational details to ensure the system is monitored to maximise the use of the nutrients and minimise risk of nutrient losses.
- Ensure by regular and programmed checks that the supporting effluent infrastructure is in good condition, is inspected regularly and maintained.
- Ensure by regular inspection (that coincides with effluent application) that the farm's drainage does not contain any obvious signs of dairy effluent contamination.
- Stay abreast of new and emerging technologies for incorporation into the system that will improve, environmental and farm outcomes, whilst reducing input effort and costs.
- Controlled, judicious and justifiable use of fertiliser and other imported nutrients including nutrients in imported feed.

2. Key risks

a. Environmental

i. Leaching of nutrients

Once in waterways the nitrogen, phosphorus and potassium can have an adverse effect on aquatic life through eutrophic effects.

ii. Silting

Streams and waterways can become blocked with silt as a result of water transporting soils by overland flow to drainage as a result of cultivation or excessive pugging. This soil not only blocks drains, impeding drainage but also conveys to waterways the nutrients resident in it.

iii. Farm Dairy Effluent

Over application of Farm Dairy Effluent or high point discharges to land can have a serious effect not only on soil properties but can also leach through the soil profile into ground water or enter ditches or water ways via overland flows.

There are also other potential adverse effects, such as odour, which can be the result of result of poor or incomplete management.

Excess application of effluent over moled soil and tile lines can result in the rapid transport of effluent to waterway.

Other sources can be from feed pads, leachate from silage bunkers, etc

b. Animal health

Over application of effluent to the soil will result, in time, of a buildup of excess levels of various nutrients especially potassium. Potassium will have an adverse effect on the uptake of magnesium and can have a serious effect on cow health.

c. Legal

The illegal discharge of effluent to land e.g. to a non-consented area, irrespective of if it pollutes waterways or wetlands can result in legal action and severe penalties have been imposed by courts.

Discharges of only a few cubic metres have resulted in fines of tens of thousands of dollars for farm owners, or sharemilkers, contract milkers, farm workers (or a combination of all) per incident where effluent is discharged in a manner that it reaches a waterway or has the potential to reach a waterway.

All staff need to be aware of the farm's consent conditions – as ignorance of them is no defense in law – and understand how they relate to the use of the farm's effluent collection transport, storage and irrigation system.

d. Personal

Carelessness in dealing with effluent can result in pathogens being transferred to staff resulting in illness and infection.

3. Physiographic Zones and Transport pathways

These zones are shown on a map in Section B(4) **Physiographic Zones**

See also Section B(4) Waterways, Stock Crossings and Critical Source Areas.

This zones and especially the Gore soil; type within it, has have the potential for N and P to leach to waterways through overland flows or through the soil profile or both.

Good Management Practices for these transport pathways are listed in section 6 below.

4. Review

General good management practices and those specific to the transport pathways to be implemented in the current year are contained in the tables in the sections below.

These good management practices will be reviewed annually as part of the overall review of the Farm Management Plan.

5. General Good Management Practices
1 June 2016 – 31 May 2017

Strategy Type	Summary of Management Practices	Relevant section in Farm Management Plan	For Review June 2017
Capital	Fencing and enhancing riparian areas according to an agreed riparian enhancement plan.	E: Riparian Management	
	Look to copsing or creating wetlands in discharge critical source areas where there are risks of point discharges to water.	E: Riparian Management	
	Upgrading FDE handling equipment as new technology improves the utility and risks of these systems.	H(1): Overview of Effluent Collection, Storage and Irrigation system	
	Culverts or bridges at stock crossings	E: Riparian Management	
Operational	Utilising a nutrient management plan	C: Nutrient Budget	
	Stock exclusion from streams and wetlands	E: Riparian Management	
	Tracks and lanes sited away from streams and lane runoff diverted to land	K: Other Environmental Issues	
	Grass buffer strips	F(2) Cultivation	
	Cows will be wintered off the milking platform as a permitted activity.	G: Intensive Winter Grazing	
	Restricted grazing of draining pastures in autumn/spring	G: Intensive Winter Grazing	
	Strategic placement of winter grazing of forage crops. Adhere to winter grazing plans using best practices,	G: Intensive Winter Grazing	
	Restricted grazing of cropland	G: Intensive Winter Grazing	
	Not grazing stock in Critical Source Areas (these may have to be temporarily fenced off) when the ground is near or at field capacity or when these areas are flowing to drainage.	G: Intensive Winter Grazing	
	Care in irrigation of FDE, especially when the ground is near or at field capacity.	I: Effluent System Management	
	Increased land application area to ensure N & K returns are not excessive	I: Effluent System Management	
	Minimise effluent volumes at source	I: Effluent System Management	
	Low depth FDE irrigation	H(1): Overview of Effluent Collection, Storage and Irrigation system	
	Appropriate FDE storage volume to allow for deferred irrigation	H(2): Volumes	

	Ensure all data and maps are kept up to date and available and all staff are trained and informed of any changes.	I: Effluent System Management	
	Ensure programmed maintenance is done in and around FDE and silage leachate collection and piping infrastructure around the dairy shed silage bunkers, cow yards etc.	J: Monitoring, Maintenance & Operating procedures	
	All fencing around riparian areas is maintained, (or replace as required) with stock excluded from the riparian areas.	E Riparian Management	
	Reduce runoff- cutoffs and shaping of lanes, move troughs and gateways from water flow paths	K: Other Environmental Issues	

6. Good management Practices for Key Transport Pathways

1 June 2016 – 31 May 2017

Transport Pathway	Mitigation Measure	Summary of Management Practices	Relevant section in Farm Management Plan	Review June 2017
Artificial Drainage	Reduce P use or loss	• Use low solubility P fertiliser forms • Nutrient Budget • Keep soil Olsen P levels at biological optimum • Soil test regularly • Use proof of placement for fertiliser	C: Nutrient Budget	
Artificial Drainage, Deep Drainage	Reduce accumulation of surplus N in the soil, particularly during autumn and winter	• Milking Stock wintered off milking platform • control the duration of grazing of pasture and fodder crops especially in the shoulders of the season. • optimize timing and amounts of irrigation input • resow bare areas as soon as possible • Check following application of FDE	G Intensive Winter Grazing I: Effluent System Management	
Artificial Drainage	Avoid preferential flow of effluent through drains	• Deferred irrigation • low rate application • observe buffer zones and placement guidelines eg not over tile drains • observe discharge consent conditions	I: Effluent System Management A: attached Discharge Consent	
Artificial Drainage	Capture contaminants at drainage outflows		n/a	

7. Good Management Practices Fact Sheets:

The following fact Environment Southland sheets are included in Appendix B

- General Good Management Practices
- Physiographic Zone: Martaura Lignite measures
- Artificial Subsurface Drainage

- Deep Drainage of Nitrogen
- Critical Source Areas

E. RIPARIAN MANAGEMENT

1. Streams, Creeks and Ditches.

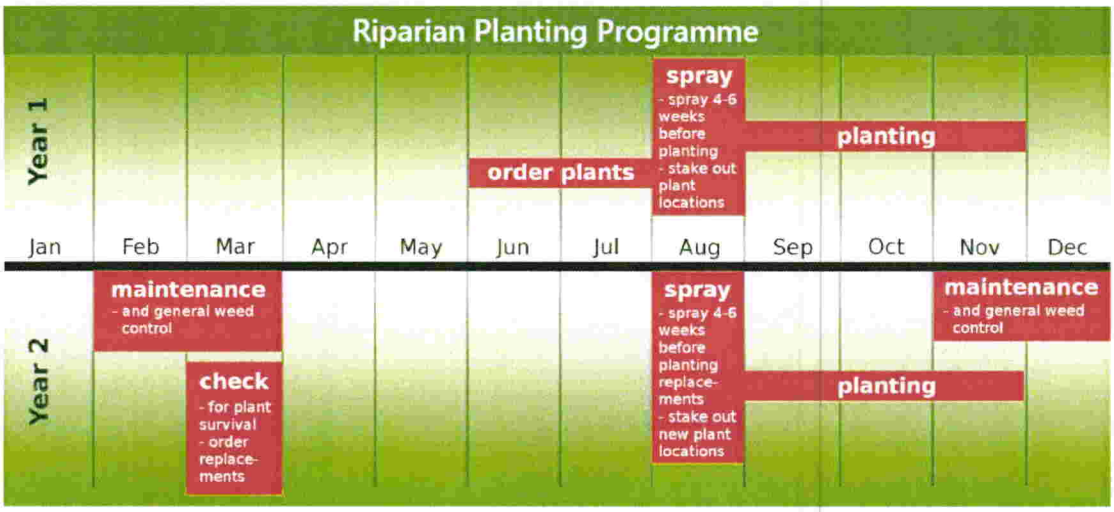
- Both sides of all waterways are riparian fenced. Fences will be replaced where damaged.
- Regular riparian fencing checks are to be completed and any breakages/breaches are to be repaired immediately.
- Calves or any other stock that are found in the riparian areas are to be removed immediately.
- Weed spray in early (November) or late summer (February/March).
- Repair or prevent any bank erosion to protect fencing and plants.
- Check all crossings are contoured to channel silt and manure onto pasture.
- Remove drainage cleanings and spread over paddocks to utilize the nutrients and to prevent material returning to the water way.

2. Weeds and Pests

a: Plant Pests

I. Thistles – especially Nodding – destroy plants prior to them seeding.

- Where sprays are to be used in riparian strips ensure they are proven and certified aquatic safe.



Extract from Environment Southland Fact Sheet: Maintaining Riparian Zones

3. Riparian Management Fact Sheets

The following Environment Southland Fact sheets are included in Appendix B

- Maintaining Riparian Zones

- Techniques for Weed Control
- Pest Animals in Riparian Zones

F: CULTIVATION

1. Area of Cultivation

Up to 15ha of crop may be sown on the milking platform each year as a spring supplement for the cows returning from off farm wintering. It is also possible that an area of 15ha area may be sown in summer turnips as mitigation against dry summers.

In both cases the areas selected will be part of the usual re-grassing rotation. The intention is to re-grass the whole property over the next 8-10 years.

2. Cultivation Good Management Practices

I. Where drainage depressions in crop paddocks are likely to channel sediments and nutrients to drainage these will be left uncultivated to act as sediment traps.

II. Choose paddocks away from waterways to plant winter feed crops.

III. Plough lines will be kept at least 3 metres back from the top of banks.

3. Cultivation Areas 2016/17

Paddocks

Paddock 3

G: INTENSIVE WINTER GRAZING

1. Stock Grazing Management

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

It is intended that less than 10 cows will be wintered on the farm during June and July. All other cows q will be will be wintered off.

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

I. Paddock Selection

Judicious paddock selection based on the soil moisture content is the key tool. This is important not only to avoid overland flow, pugging, etc but to ensure that the pasture and soils are not damaged to any extent that would inhibit spring pasture growth.

The farm contour gives the flexibility of being able to move away from waterways to better draining soils during wet weather.

Budget nutrients to help reduce loss of valuable fertiliser to surface water.

Use nitrification inhibitors on pasture to reduce nitrate loss over the winter and early spring months.

II. Back Fencing

The eating off of the excess feed will not (for spring growth reasons) result in the paddocks being eaten down hard, or pugged.

- If break fencing is to be used, the breaks, once eaten off, will be back fenced.
- Breaks should be sequenced to insure that grazing is towards the watercourse.
- If practical place baleage in the paddock before soil becomes too wet thereby preventing heavy vehicles from damaging the ground.

III. Water

Where breaks do not encompass a trough, a portable trough will be used to avoid pug lanes between the water troughs and the feed breaks.

IV. Buffer Zones

There will be the fenced buffer zones along the water ways, but higher risk areas over tiles or drainage depressions (swales) will be temporarily fenced off and not grazed.

VI. Wet Weather

In wet weather, where there is risk of pasture and soil damage, care must be taking to avoid grazing, supplement feeding and pugging within 10 metres of a waterway or drain.

2. Supplementary Crop Feeding

- Keep stock back at least 3 metres back from the top of stream banks – steeper ground will require a wider buffer zone – a buffer of 10 to 15 metres may be needed.
- Identify swales in the paddock that will carry overland flow when it rains heavily. Temporarily fence them off during winter grazing.
- Break feed towards the water way.
- Provide transportable troughs for stock drinking water.
- Back fence stock off land that has been already been grazed.
- Exclude all stock from surface water where possible.
- Place baleage in paddock before soil becomes too wet thereby preventing heavy vehicles from damaging the ground.
- Minimise use of heavy vehicles when feeding out hay/silage etc.

3. Intensive Winter Grazing Fact Sheets

The following Environment Southland fact sheets are included in Appendix B

- Preparing for Winter
- Stop your farm going down the drain

H: COLLECTED AGRICULTURAL EFFLUENT

1. Overview of effluent collection, storage and irrigation system

I. The effluent from the dairy shed flows by gravity to a stone trap and to a 10m³ primary pump sump to the north of the dairy shed.
II. From this sump the whole effluent is pumped to the sludge bed further to the north where the solids are removed and the filtered effluent gravities is pumped to the concrete lined 1550 m³ storage pond.
III. When field moisture conditions permit the stored effluent is pumped to the discharge area via an underground mainline system to a k/line pod set.

2. Volumes

a: Sources

I. Cowshed - 500 cows x 50l/cow per day 25.0m³.
Cow-yards, and hardstands around the dairy shed – 830m². (undiverted)
830m²x 950mm =788m³

b: Amount

I. Total effluent generated per day is estimated at not more than 25.0 m³ per day. (500 cows @ ~50L/Cow per day). ie, 7600m³ per 304 day season.
II. To this must be added water off the hardstands of around 788m³ per season.
III. Water collected on the ponds etc will add another 1,330m³ a season
IV. Over the season this will result in around ~9,718m³ to be irrigated.

At average 18m³ hr pumping rate this will require ~540hrs per season to irrigate to pasture.

See section 3(b) below

Farm irrigation days by year

Given that there is between 140 and 256 of irrigable days in a milking season irrigation of between 3.8 and 2 hours every irrigable day would be required.

c: Storage Volumes

The volume of the effluent storage pond is 2,013m³.

3. Application Rate and Depth

The application rate, separation distances, depth, uniformity and intensity are to be checked annually in accordance with section 4: Land Application of the guideline "A Farmer's Guide to Managing Farm Dairy Effluent – A Good Practice Guide for Land Application Systems" (2013).

a: Depth of Application:

The depth of application will be determined by analysing the effluent annually for N, P & K content. A nutrient budget will then be completed (updated) so as to determine the appropriate volume of effluent to apply.

Example:

The effluent is found to contain 300 mg/l potassium.

Applying 10 mm depth of effluent over 1 ha will apply 30 kg of potassium per hectare.

Estimate

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

1 mm of irrigated effluent depth equals

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

So if 15mm of effluent is irrigated over 1 ha, the nutrient application will be:

45.0 kg per hectare of N,
52.5 kg per hectare of K
3.0 kg per hectare of P

It is advised that not more than half the annual potassium requirement be applied per application of effluent i.e. the annual requirement of potassium (often around 60kg per hectare per annum) should be applied in two increments of not more than 30kg of effluent per hectare or as per the above application 10mm depth of effluent per application.

b. Application Rate

The irrigation pump is a 7.5kw Alpha closed impellor pump. By using the pump curve the following can highest application rate can be calculated.

Head loss due operate K/line podset	23.0m
Static lift	3.0m
100m MDOD90mm Friction loss	1.5m
100m MDOP63mm Draghose	2.7m
Total Head	30.2m

30m head is 2.94 or near enough to 3 bar.

Using the K/line pod manufacturer (RX Plastics Ltd) data, a single k/line pod will deliver 1.030m³/hr for a depth of 2.3mm/hr at 3 bar.

Pressure and flows of the Naan 5022

Nozzle (mm)	P bar	Q m3 / hr	Application Depth (m)
3.2 Green	2.0	0.570	1.43
	3.0	0.700	1.43
	4.0	0.810	1.43
3.5 Blue	2.0	0.660	1.65
	3.0	0.810	1.65
	4.0	0.930	1.65
4.0 Black	2.0	0.850	2.13
	3.0	1.030	2.13
	4.0	1.180	2.13

Application table from the RX plastic technical manual

The farm's Kline podsets are fitted with the 4.0mm black nozzles.

The farm's podsets have 24 pods per set. Hence in a continuous pumping scenario the volume irrigated will be 24.7m³ an hour. However the minimum volume as depth is completely dependent on the setting of the pulsing system with can be set to pulse irrigate volumes less than 1mm/hr. eg a single pulse of 15 minutes duration in the hour would be 2.13mm/hr divided by 4 = 0.53mm/hr.

4. Records

Each paddock irrigated will be recorded. This will also provide an annual record of the total depth of effluent applied.

a: Application Log book

A log book is to be maintained setting out what paddocks were irrigated when, at what rate (including settings) and to what depth.

For example

Date	Paddock	Soils/comments	Settings	Time/depth	Staff
12/09/20xx	B43 - boundary end	dry	Nozzle 6 in	1 pass at 10km/hr	RXD
13/09/20xx	B44 - Road end	2mm Rain overnight			Pete
13/09/20xx	B44 - mid section	Heavy dew			Pete

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

b: Drainage Monitoring Log Book

Date	Paddock/outfall #	Soils/comments	Staff ID	Comments
12/04/20xx	23/a	Running clear.	John	Did not irrigate in swale or CSA

13/04/20xx	24/a/c - Road end	No discharge	Bob	
13/04/20xx	26/a	No discharge	Bob	

c: Maintenance Log Book

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

I: EFFLUENT SYSTEM MANAGEMENT

1. Person In charge

The person in charge of the Effluent Management system will be ?????? (sharemilker)

2. System Training

a: Training

I. All new staff will be trained in the operation of the system as and when employed. Details are to be recorded in the staff training log.

b: Resources – shed operations manual.

I. Effluents system Operational tip sheets. - also displayed in the Dairy Shed.
II. Irrigation map marked up with drainage outfalls, irrigation areas, etc
III. Copies of Environment Southland consents.

3. Effluent minimisation.

There are management practices and operational methodologies that can be used to minimise effluent voided on lanes, tracks and hardstands and around gateways. These include:

- Allowing the herd to walk in rather than be driven.
- Splitting the herds into small herds for faster movement.
- Not using tracks and lanes as standoffs.
- Do not supplement feed cows on or along the edges of lanes.
- Wet the yard before the cows arrive.
- Minimisation of freshwater shed water use in yard hose down.
- Ensure there are no excessive volumes lost through the D gate platform washer.

4. Discharge area.

Only a portion of the farm platform is consented for effluent disposal, less the usual margins along waterways, boundaries etc. The total area will be not less than 41 ha.

See attached Environment Southland discharge consent and map for details.

5. Paddock Selection

Paddocks will be selected according to their moisture status and grazing management history. A sequence of paddocks can be pre-planned for irrigation. As each is grazed and then spelled for the required period it can then be irrigated. Prior to irrigation occurring a visual assessment of the soil will be made along with data from the Environment Southland soils moisture irrigation site at www.es.govt.nz/. If paddocks are pugged or are likely to have very low infiltration rates the irrigation depth will be reduced or the paddock rescheduled for irrigation after the soil conditions have improved.

The critical factor is that paddocks should not be irrigated when, or where, irrigation will result in the moisture levels reaching field capacity. Field capacity is the point at which drainage starts either by passing down through the soil profile or flowing over the surface (overland flow).

Irrigation is to be avoided when the soil temperature is less than 5° C.

The following will be marked up on the shed map. These will be updated each year as crop/regrassing rotations, drainage, fencing changes, etc affect the relative risks.

a: Tile lines

These, where known, are marked on the irrigation plan, and irrigation should not be done directly over them if there is any risk of irrigation creating drainage.

b. Wind

Consideration needs to be given when high winds are predicted for example in the equinox seasons to ensure that spray drift does not end up in unintended places such as within minimum distances from water ways or outside the farm boundary.

The most obvious odour risk area is the drift or irrigation upwind of Charlton Siding Road or Bowman Road.

6. Coverage area

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

i. 20 metres of any surface watercourse;
ii. 100 metres of any potable water abstraction point;
iii. 20 metres of any property boundary, (unless the adjoining landowner's consent is obtained to do otherwise);
iv. 100 metres of any residential dwelling other than residential dwellings on the property;
v. Dairy shed effluent shall not be discharged onto any land area that has been grazed within the previous 10 days;
vi. Effluent shall not be discharged over tile lines/moles where the soil is at or near field capacity.

7. Irrigation

a: Field moisture conditions

i. Visual survey

Paddocks to which effluent is to be applied should be visually inspected, prior to irrigation to gain an understanding of any high traffic areas to be avoided, location of water trough, moles, drains etc.

b: Near Field capacity

When soils are near field capacity, the depth of application limited to 10 mm

During operation of the system the irrigated area will be checked to ensure there is no ponding.

Should irrigation be necessary when soils are fully moist, the 10 cm soil temperature shall be a minimum of 7°C before irrigation commences and a maximum of 5.0mm applied.

8. Drainage Monitoring

a: Map

i. There will be a map in the cowshed that shows all known tile lines on the property along with their outfalls (and any open inlets).
ii. This is to be updated as the tile network is expanded or unknown installations are located.
iii. It is to be updated when paddocks are re-moled.

b: Tile end marks

i. All tile outfalls are marked on the watercourse banks with a yellow painted stake.
ii. Each has a unique identifier.

c: Monitoring

i. Tile outfalls should be regularly monitored when effluent FDE irrigation is done in their vicinity or when it is possible that there may be moles that run to the tiles when the ground moisture conditions plus the proposed irrigation volumes are approaching field capacity.
ii. If there is any discolouration irrigation should stop immediately.

9. Sludges Removal

a: Timing

i. Screenings bins emptying is best done when there are crop paddocks or lea awaiting cultivation.
ii. Emptying will only be done when ground moisture conditions are suitable.

10. Off Season Water Diversion

All the sources of effluent are fitted with "not in use" clean water/rainwater diversion systems. (These are separate from the roof water systems)

The areas from which the rainwater is to be diverted should be well washed with clean water and inspected for any effluent residues prior to the diversion being enacted.

12. Irrigation pump

Irrigation Pump

J: MONITORING, MAINTENANCE AND OPERATING PROCEDURES

1. Daily

I. Minimise water use at the cow shed;
II. Check the storage and irrigation system for operating faults during and following use;
III. Evaluate the soil moisture situation and calculate the optimum settings for the next application;
IV. Check and record in log any tile outfalls draining from the irrigation area after irrigation;
V. Update the effluent irrigation log with settings, location, depth and method of application.
VI. Check lane/track edge cutouts to ensure they are not blocked and there is no risk of large single point discharges. (especially after heavy rainfall events).
VII. Check the trough in the paddock the cows are leaving to ensure it has not been leaking due to animal activity.
VIII. Ensure TIMS/KIMS has sufficient battery power for the days operation.

2. Weekly

a: Storage Facilities

I. Clean out shed yard traps weekly or more frequently as required and during wet periods;
II. Remove solids and spread on land when dry;
III. Check inlet and outlet pipes are clear of blockages;
IV. Check and clean grates and sumps in dairy shed and yard as required.
V. Check galleries/floor drainage around storage structures.

b: Pumps

I. Check pumps grease /oil if required;
II. Note operating pressure during irrigation and confirm it is in the 'normal' range;

c: Pipelines

I. Check for leaks and blockages in pipes and joiners.

d: Safety

I. Guards and fittings
II. Signage
III. Equipment

3. Annual Maintenance

I. Check pumps and motors and have them serviced as required.
II. Assess condition of pipeline, repair and replace parts as necessary.
III. Update irrigation maps for new fences, tiling, moling etc;
IV. Training of new staff in system operation;
V. Refresher and training of all staff on the location, purpose and use of safety equipment and fittings.

4. End of Season

I. Ensure the storage ponds are pumped down as far as is practical.
II. Turn on rainwater diversion.
III. Check the pond lining membrane for damage.

5. Beginning of Season

I. Turn off rainwater diversion
II. Prime pumps and check their operation

6. Breakdowns

I. In the event of power failure, vacuum pump or motor breakdown:

- Contact repairer immediately to assess problem;
- Limit or cease water use in the dairy yard and scrape effluent where possible;

II. In the event of pipe blockages:

- For underground pipes: Clear if possible or if too difficult, contact blocked drain repairer to water blast.
- If not able to clear blockages, replace the blocked section.

7. General:

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

K: OTHER ENVIRONMENTAL ISSUES

1. Lanes and Races

Run off from races can in some situations constitute an illegal discharge to land. These can be mitigated by:

- Ensuring that lanes and races are not used as feed pads, cow yards, or herd holding areas or that riparian vegetation is adequate to treat storm water.
- Cuts and divots are checked every time they are used, to ensure that there are no high point discharging to land.
- Checking after heavy rain that lane/track edge cutouts, to ensure they are not blocked and there is no risk of large single point discharges.
- Gateway – to avoid compaction around the gateways and reduce lane edge wear, where possible bring the cows out of the paddock at a different gate to which they were let in.
- Ensure that swales away from culverts are kept clear, and discharge is directed away from the waterway.

Annual maintenance to races can often result in the "run back" shaping over culverts and lane edge discharge divot/cutouts not being restored. All lane edges and culverts should be checked after lane maintenance.

2. Animal Pests

I. Rabbits, hares, possums – regular culls using night shooting, poisoning etc.
II. Magpies – trap, shoot whatever!

L: EMERGENCY RESPONSES.

1. Storage Overflow

Where the storage is approaching full and rain events plus continued use could risk overflow, it is recommended that some low rate pulsed pumping be carried out on the driest part of the farm available. Spreading the effluent very thinly over a larger area over a time is preferable to a point source discharge from the pond.

In emergencies or when overtopping is treated due to the soil moisture conditions not being conductive to irrigation, Environment Southland should be contracted for advice.

2. Ponding

Should light ponding be detected immediately stop irrigation.

I. Checks should be made to ensure that there is no overland flow or that the ponding is not draining into tile lines etc.
II. If practical pump out and disburse with pod sets over a wide area or use a vacuum tanker.

3. Drainage

a: Overland Flow

See ponding above.

b: Discharge ex Tile

see c: below

c: Effluent in Open Drains

III. Attempt to immediately contain the contaminants by damming the drain if practical. This can be done by dumping a bale(s) of baleage or hay in the drain and pressing down with either the front end loader, depending on drain size.
IV. Alternately earth and silage wrap can often be used to help seal or form the required plug.
V. If practical pump out and disburse with pod sets over a wide area or use a vacuum tanker.

3. General Procedures

I. Follow consent conditions/notes, mitigate where possible.
II. Advise Regional Council where the consent if and when required by the consent.
III. Seek help.
IV. Advise authorities.

4. Emergency Contacts

Sharemilker		
Environment Southland	0800 768 845	

M: REVIEW

Review whole farm management plan and update by 1 June each year – and complete the version control below.

I. Development targets for coming season/plan.
II. Nutrient Management
    - Overseer Inputs
    - New Overseer report if applicable
III. Good Management Practices
IV. Cultivation Areas
V. Intensive Winter Grazing
VI. Effluent System
    - High risk/low risk irrigation areas due to new moling, tiling etc
    - Any developments in infrastructure – i.e. new/more irrigators, extensions to system, fencing changes
    - Training/retraining, etc.
VII. Emergency Contacts

Ver	Date		Distribution List
1.0			

N: APPENDIX A Farmers Rough Guide to Environment Southland Rules

(8 pages)

O: APPENDIX B Environment Southland Fact Sheets

Nutrient Management

- Stop your nutrients going underground

Good Management Practices

- General Good Management Practices
- Physiographic Zone: Gleyed
- Physiographic Zone: Oxidising
- Artificial Subsurface Drainage
- Deep Drainage of Nitrogen
- Critical Source Areas

Riparian Management

- Maintaining Riparian Zones
- Techniques for Weed Control
- Pest Animals in Riparian Zones

Intensive Winter Grazing

- Preparing for Winter
- Stop your farm going down the drain

Dairy Green Ltd
Practical Engineering Solutions
Consents, Effluent, Stock water, Irrigation
Design through to Installation
Irrigation NZ Accredited Designer

20 March 2017

DE & VJ Stafford,
278 Grange Road,
Papamoa 3118

Dear David

Drop Test Results: DE & VJ Stafford Effluent Pond, 8 – 11 March 2017

1. Background
The current discharge consent for the property is 204546.

As requirement of the regional authority we have carried out a drop test of your existing effluent pond. This was undertaken to assess seepage rates from the pond. The testing was carried out between the 8 and 11 March 2017.

Site and Set Up
The farm is located at Charlton Siding Road, Gore.

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

The dimensions of the storage pond at the water level during the test period were:
North 37.8m
East 28.3m
South 38.5m
West 29.8m

The dimensions of the storage pond at the top bank level during the test period were:
North 40.2m
East 31.3m
South 41.2m
West 32.5m

10 Kinloch Street, PO Box 5003, Waikiwi, Invercargill 9843
Phone 03 215 4381, Fax 03 215 4391
Email: scandrettrural@xtra.co.nz
22/05/2017 10:11:00 AM

The total pond surface area was 17 % greater than the wetted area during the test.

The irrigation pond depth was 3.0m including 0.5m freeboard.

At the time of the test the liquid level was 0.5m below top bank height, i.e. 100% full.

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

3. Test Methodology

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

3.1. Water Level Monitoring Unit

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

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3.2. Meteorological Station

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

- Air Temperature
- Wind speed
- Wind direction
- Rainfall

3.3 Evaporation Loss Monitoring

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

4. Results Recording

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

- The minimum test period has to be 48 hours.
- Readings are to be taken every 10 seconds.
- For maximum accuracy the wind velocity has to be less than 1.0m/sec. This limit has been set because wind at the test site has been observed to have two affects, the first being to cause waves and the second to push water to one side of the pond from the other, (a seiche effect). The accuracy of the laser distance recorder is such it will detect changes as small as 0.2mm. To accurately determine the true pond level requires calm conditions at the start and end of the test period.
- Rainfall and the evaporation bucket liquid volume was measured at the start and end of the test period, the measurement cylinder was rinsed prior to the volume being measured.
- When a period of 48 hours or more has elapsed the information is down loaded and the results interpreted.
- The GPS location of the pond and equipment setup is recorded. For this test the equipment was located at **E**1283340, **N**4881695, in the middle of the west bank.

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Laser set up at the West bank.

5. Results Summary

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

The plot of wind speed and pond height shows that at times wind caused significant waves on the pond surface, particularly during the 9th and 10th.
However a period was identified at the start and end of the test period when the pond surface was stable and accurate height readings were established.

The start time was assumed to be at 14:47:50 hours on the 8 March 2017.
The distance from the laser to the reflective disc on the pond surface was 352.1mm and the wind speed 0.5m/sec.

The finish time was assumed to be at 06:01:00 hours on the 11 March 2017.
The distance reading was 356.6mm and the wind speed 0.9m/sec.

The total time elapsed was 63 hours and 13 minutes, 10 seconds.

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The laser measured a change in distance to the pond surface of a 4.5mm increase. Therefore the pond surface fell 4.5mm over the test period.

There was no rainfall recorded by the Vaisala rain gauge during the test period.
The evaporation calculated for the test period was 5.0mm.

The pond should have lost 5.0mm depth due to evaporation. The pond level decreased by 4.5mm, 0.5mm less than expected. The pond is synthetically lined and the fluid level is above the surrounding ground level. There is no expectation of groundwater ingress.

TABLE 1 : DROP TEST RESULTS SUMMARY, DE & VJ Stafford.

Start Time	8 March, 14:47:50
Finish Time	11 March, 06:01:00
Total Time	63hrs, 13 minutes, 0 seconds
Start Depth (mm)	352.1
Finish depth (mm)	356.6
Change in depth (mm)	-4.5
Rainfall (mm)	+0
Evaporation (mm)	-5.0
Net Change in Depth After	
Rain and Evaporation (mm)	0.5
Net Change per 24 Hours (mm)	0.2
Pond Level, % of Design Depth	100
Net Change if Pond at 75% of	
Design Height. (mm/24hrs)	

6. Conclusion

A discrepancy of 0.2mm per 24 hours is within measuring error. No leakage was detected.
The pond complies with the requirement of the Environment Southland Land and Water Regional Plan for effluent discharge (Rule 35 b. iii.), with a leakage rate of less than 2 mm / day.

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

Yours faithfully

JOHN SCANDRETT
Agricultural & Engineering Consultant

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Review Date: 22/05/20117
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Appended

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

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