Woldwide Four Limited and Woldwide Five Limited

Resource Consent Application to the Southland Regional Council:

- For two land use consents for a farming activity
- For two discharge permits to discharge effluent to land
- For two water permits to abstract groundwater for dairy purposes
- For two land use consents to use existing effluent storage ponds
- For two land use consents for wintering sheds

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Reviewed by:	Grace Baldwin
Client Review:	Abe de Wolde
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Attachment B: Farm Scenario Plan- WW5 (nutrient budget report)
Attachment C: FEMP for WW4
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Attachment E: DESC for WW4 and WW5
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1. INTRODUCTION

1.1 Executive Summary of the application

The applicant (Abe and Anita de Wolde of Woldwide Four Limited, and Woldwide Five Limited) have recently purchased a neighbouring sheep block known as "Cochran's Block". The applicant wishes to split Cochran's block and incorporate it into the existing milking platforms for their two adjoining dairy farms: Woldwide Four (WW4) and Woldwide Five (WW5). The addition of this land to both dairy platforms triggers the need to apply for land use consents for the farming activity under Rule 20(e) of the PSWLP. The "farming activity" for both WW4 and WW5 extends across a dry stock block located near Merrivale named Woldwide Runoff (WRO) and accordingly, WRO is included in the landholdings for both WW4 and WW5.

The proposal will be undertaken in two phases. Under phase 1, a portion of Cochrans block will be added to each dairy platform will allow the herd sizes on each farm to increase to maximum current discharge permit levels. Phase 1 will continue for a maximum of five years from the date of granting.

Under phase 2, the applicant will construct a 1050 cow wintering shed on each farm as a major mitigation measure in order to remove intensive winter grazing from the Central Plains area and ensure the farming activity does not result in an adverse effect on water quality in the receiving environment.

This application seeks consent under Rule 20 (e) for the farming activities on WW4 and WW5 which extend to WRO. The assessment of effects contained within this application includes a full assessment of the activities occurring and the actual and potential effects on the environment from the proposed farming activity in its entirety across the WW4 and WW5 landholdings which both include WRO.

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 application and are also included in the attached Farm Environmental Management Plans which support the application for WW4, WW5 and WRO.

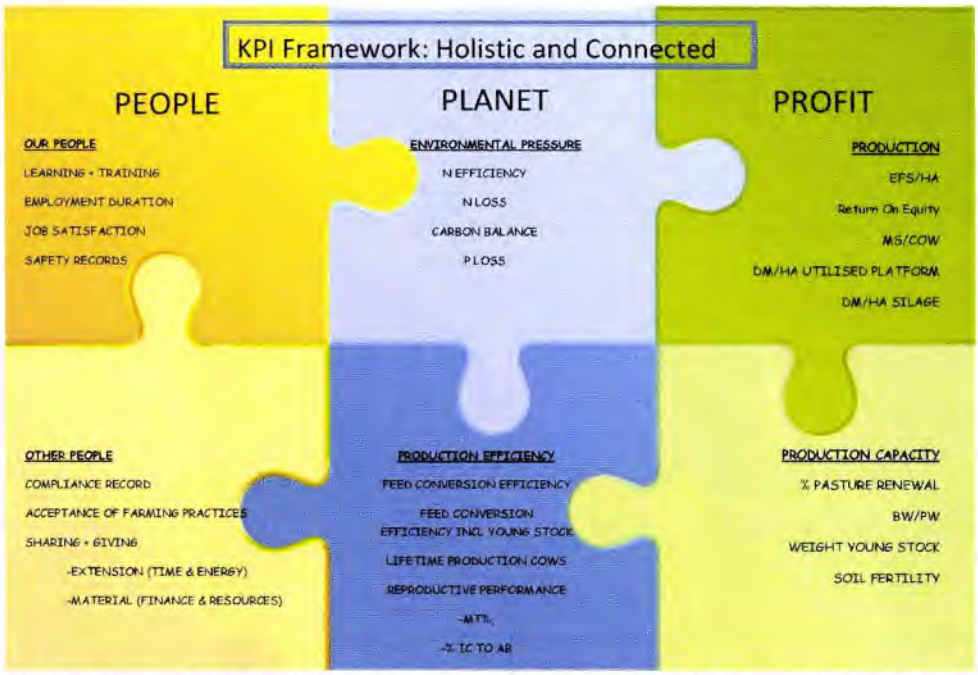
This proposal includes the recommendation that a nitrogen output limit is imposed on the resulting land use consents for WW4 dairy platform/Gladfield and the WW5 dairy platform only. This limit ensures that the activity is undertaken at a nitrogen loss level which is equal to or less than the baseline when modelled using the latest version of Overseer. Other methods to control and restrict nutrients are imposed by way of the implementation of the Farm Environmental Management Plans.

Applicants Philosophy

Abe and Anita de Wolde of Woldwide Farming Group have created a farming philosophy. In their words:

Sustainability (environmental, economic and social) has been at the core of all we do at Woldwide

Farming group. To us these principles flow out of a desire to be good stewards, and they are all interlinked as shown in the picture.



We were the first to build free stall barns in Southland to reduce outside crop wintering and we were the first (and only) ones to feed fresh grass to our cows in winter to reduce silage making losses and runoff. In 2013 we were supreme winners of the Southland Ballance Farm Environment Awards.

Ever since we came to New Zealand we have been trying to improve the sustainability of our farms with a long decision-making horizon and an innovative mind-set. We have now come to a point in our farming career where we wish to cap our growth ambitions and truly focus on environmental sustainability. Keeping our stock off wet soils in winter is pivotal in this endeavour. We aim to have all our adult stock from all our farms indoors within five years (and work on housing all young stock after that). We believe wintering animals outside on wet soils is very damaging for the following reasons:

- *Nitrogen is lost because it is deposited on the ground (in the mud) when there are no plants actively taking it up and locking it in.*
- *Sediment and top soil are displaced because of the following reasons:*
    - *o The ground is disturbed when it is wet*
    - *o Root structures are destroyed*
    - *o Overland flow (of Phosphate, sediment, bacteria) increases due to soil compaction*
    - *o Rain events during cropping season when soils are worked up fine and crops have not yet established can be very risky*
- *Lots of chemicals are used in the cultivation of winter crops*
- *It takes 85 m of wrap to produce a bale of baleage and we want to reduce our reliance on this*

We are convinced that 90 % of the environmental issues caused by farming in Southland stem from the 10 % of ground that is winter cropped. Just because something is common practice does not mean that the effects are acceptable. It is time to change this!

It needs to be kept in mind though that land previously used for winter cropping is vacated under our new plans and a small increase of stock numbers is needed to make up for that.

Our passionate desire is to go beyond compliance and to produce top quality food with a reduced environmental footprint. And that is the mindset behind this application.

1.2 The Applicant

Applicant Postal Address:	Woldwide Four Ltd and Woldwide Five Ltd C/- Abe and Anita de Wolde 104 Shaws Trees Road RD3 Winton
Address for Service:	C/- Tanya Copeland Landpro Limited PO Box 302 Cromwell 9342

1.3 Purpose of Documentation

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

2. DETAILS OF THE PROPERTY

2.1 Woldwide Four (WW4)

WW4 is located 10km to the north of Otautau township and includes the dairy platform and the associated support block called Gladfield. Figure 1 shows the spatial extent of the current dairy platform, the proposed addition to the dairy platform, the location and extent of Gladfield block and the extent of the proposed effluent discharge area.

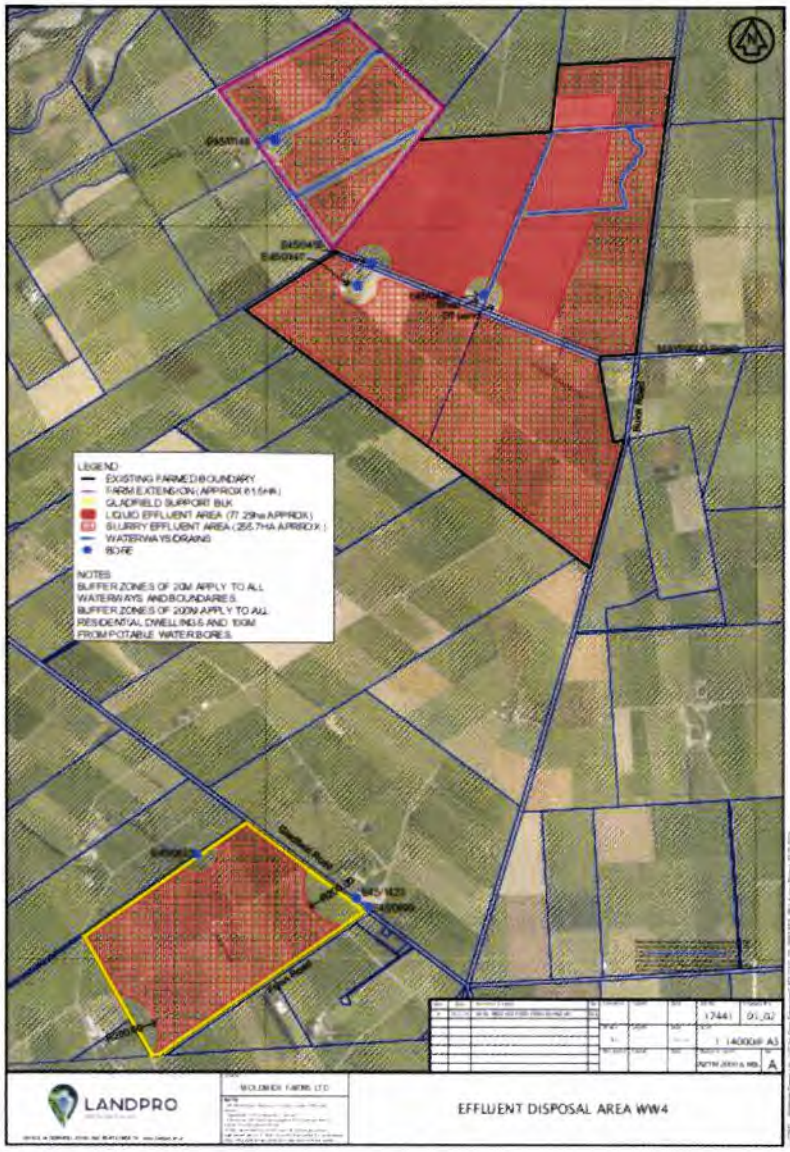


Figure 1: Proposed farm boundary and effluent discharge area for WW4

Property Details under the proposal – WW4	
Property address	305 Mayfield Road, Bayswater
Property owner(s)	Woldwide Four Ltd
Legal Description	Lot 7 DP 152 Lot 11 DP 152 Lot 12 DP 152 Lot 26 BLK III DP 210 (Gladfield) Lot 7 DP 238 (new block from Cochran's) Lot 10 DP 152 Lot 11 A DP 152 Pt Lot 2 DP 4262
Property area (ha)	380 ha effective (302ha effective dairy platform, 78ha Gladfield)
Location	NZTM2000 1221173E, 4884494N
Proposed land use	Expanded dairy platform to include 63ha new block Continuation of supplement growing on Gladfield block – no change to extent of Gladfield block
Peak cows	1000
Stocking rate	3.3 cows/ha
Discharge Permit	FDE from 1000 cows Wintering barn effluent from 1050 cows Underpass effluent Low rate application Deferred storage Use of existing pond which meets pond drop test criteria New effluent storage facilities to cater for liquid and slurry effluent
Water Permit	Groundwater abstraction

2.2 Woldwide Five (WW5)

WW5 is located 10km to the north of Otautau. Figure 2 shows the spatial extent of the current dairy platform, the proposed addition to the dairy platform and the extent of the proposed effluent discharge area.

Under the proposal, 70ha of Cochran's block will be added to the WW5 dairy platform from Cochran's block and 45ha will be added to WW5 from Collies block.

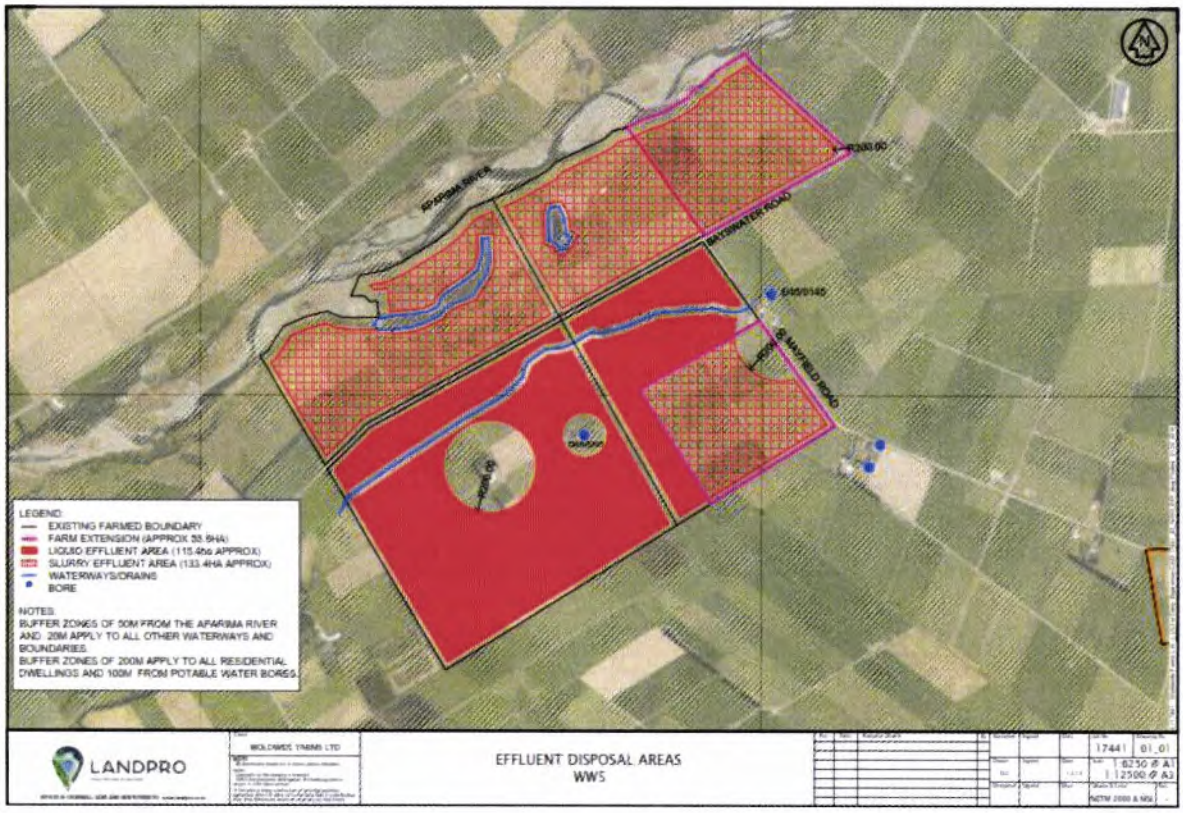


Figure 2: Proposed dairy farm boundary and effluent discharge area for WW5

Figure 3: Proposed dairy platform boundary with addition of a portion of Cochrans block (blue) and Collies block (yellow)

Property Details under the proposal– WW5	
Property address	760 Bayswater Road, Bayswater
Property owner(s)	Woldwide Five Ltd
Legal Description	Lot 1 Deposited Plan 344176, Lot 2 Deposited Plan 344176, Lot 1 Deposited Plan 310140, Part Lot 12 Deposited Plan 238 and Lot 2-3 Deposited Plan 478843, Lot 1 Deposited Plan 12253 Lot 1 DP 478843 (new block called Collies Block) Lot 7 DP 238 (new block from Cochrans) Lot 2 DP 310140 (new block from Cochrans)
Property area (ha)	311 ha effective, 335ha total
Location	NZTM2000 1220657E, 4885096N
Proposed land use	Expanded dairy platform to include 70ha new Cochran's block Expanded dairy platform to include 45ha new Collies block
Peak cows	930
Stocking rate	3.2 cows/ha
Discharge Permit	FDE from 930 cows Wintering barn effluent from 1050 cows Underpass effluent Low rate application Deferred storage Use of new effluent storage pond for slurry and liquid effluent
Water Permit	Groundwater abstraction

2.3 Woldwide Runoff (WRO)

Woldwide Runoff is located 20km to the west of Otautau, on the western side of the Longwood ranges. WRO is comprised of two separate blocks. The Merrivale Block is owned by Woldwide Runoff Limited and the Merriburn block which is leased.

The extent of the property boundary on this block will not change under the proposal.

Figure 4: Current/proposed farm boundary for WRO.

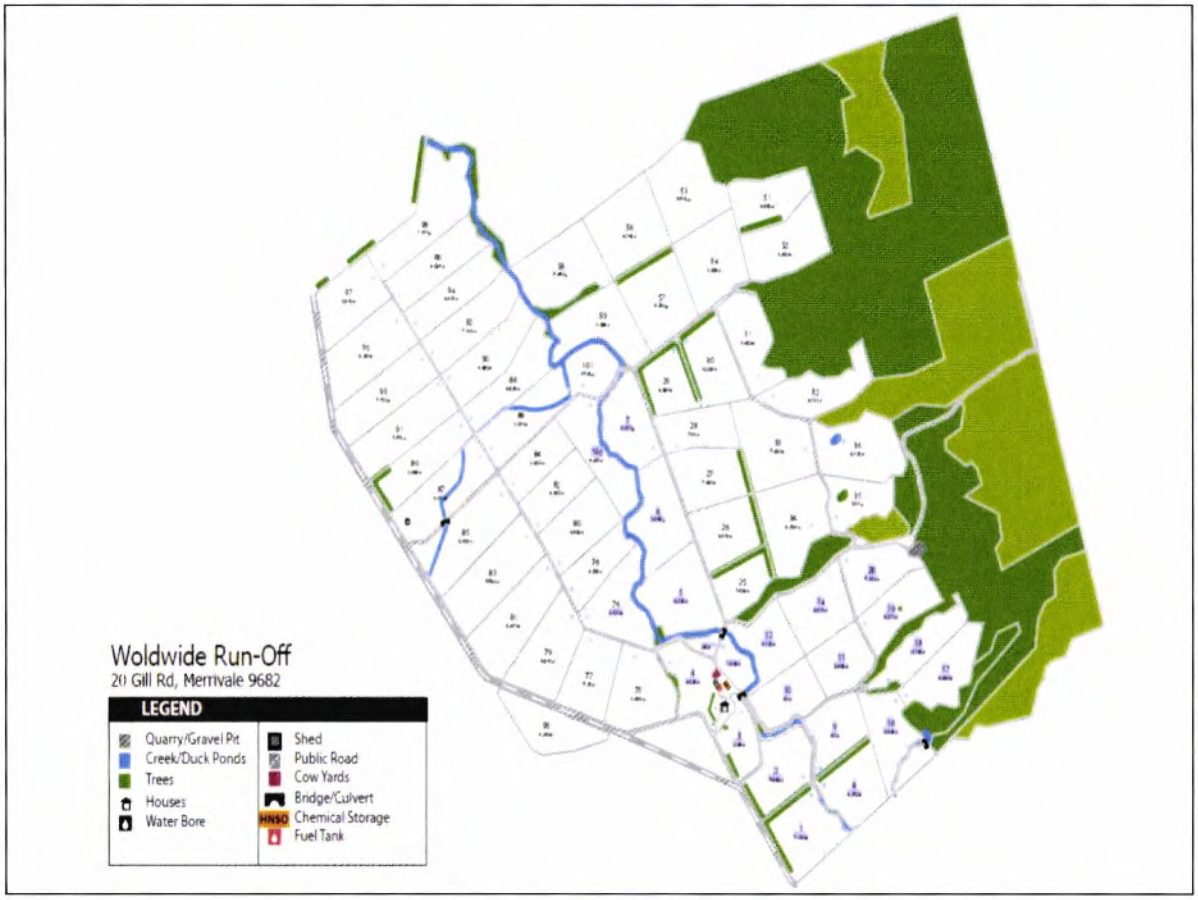


Figure 5: Farm Map for Merrivale Block

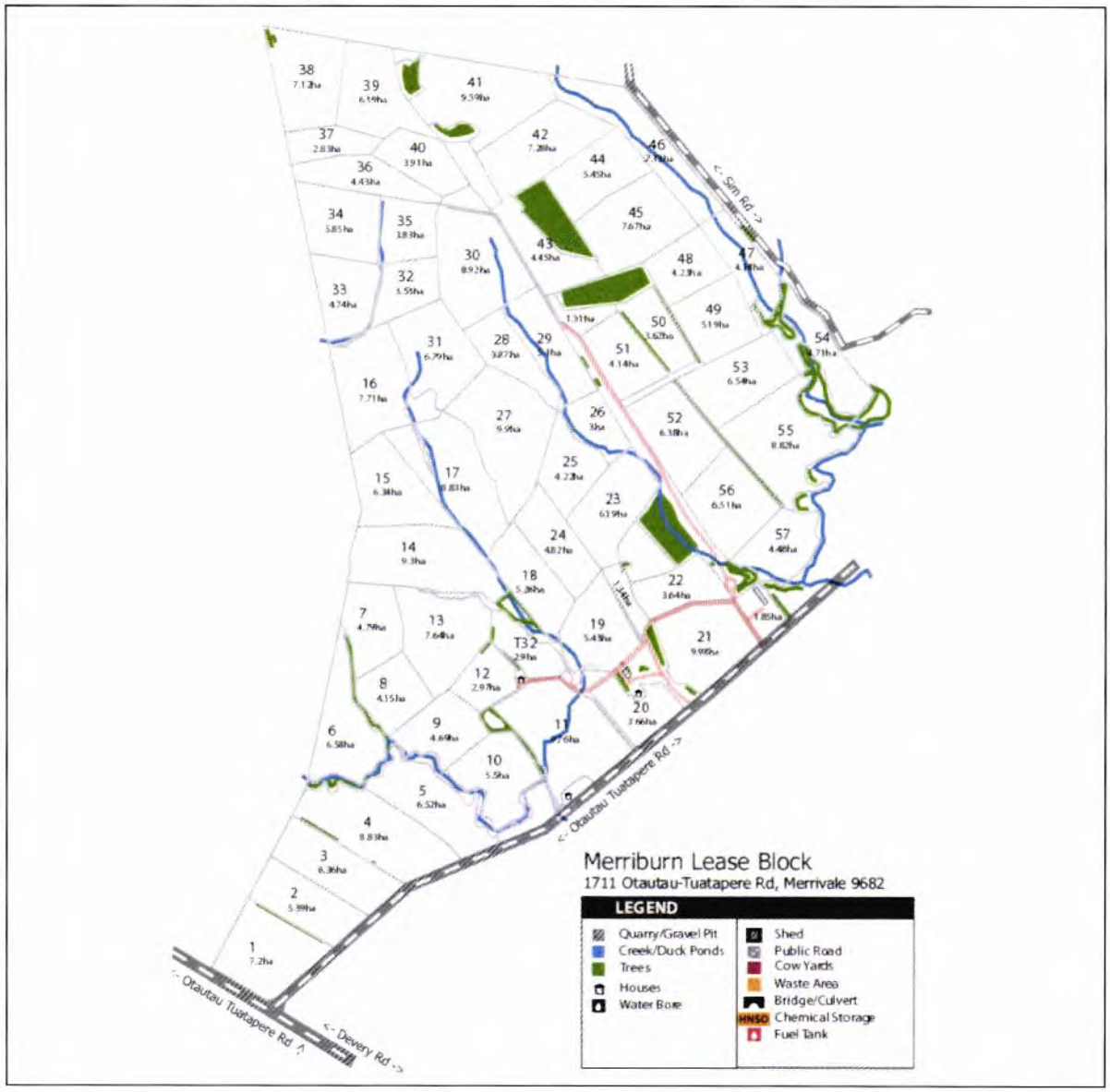


Figure 6: Farm Map for Merriburn Block (leased)

Property Details – WRO	
Property address	20 Gill Road – Merrivale block 1711 Otautau Tuatapere Road – Merriburn block
Property owner(s)	Woldwide Runoff Ltd
Legal Description	Merrivale Block: Part Section 7 Block XII Waiau SD Part Section 7 Block XII Waiau SD Part Section 7 Block XII Waiau SD Lot 1 DP 3537

	Merriburn Lease Block: Lot 1 DP 302409 Sec 26 Merrivale Settlement No. 1 Sec 27 Merrivale Settlement No. 1
Property area (ha)	507 ha total, 321 ha effective – Merrivale 385ha total, 338 ha effective - Merriburn
Location	NZTM2000 1201022E, 4893762N – Merrivale NZTM2000 1200812E, 4890495N - Merriburn
Proposed land use	Both blocks are run as a single operating unit. Grazing of dry stock: R1 and R2 heifers, grazing of carry over cows and grazing of mating bulls all year round (includes intensive winter grazing) Production of baleage 100ha of commercial pine plantation 60ha beech forest under sustainable management
Peak dry stock numbers 2018/2019 season	1265 R1 1265 R2 37 carry over cows 70 mating bulls

3. DESCRIPTION OF EXISTING ENVIRONMENT

The following section describes the existing environment separately for the three main blocks: WW4, WW5 and WRO.

3.1 Woldwide Four (WW4)

The existing environment comprises of existing activities which are occurring under enduring resource consents or existing use rights. Permitted activities occurring are also included in the assessment of the existing environment, however a permitted baseline approach is not used in accordance with Policy 39 of the PSWLP.

For this assessment, the existing environment on the area of the proposed WW4 landholding includes:

- The use of land (239ha effective) for dairy farming
- The discharge of FDE and underpass effluent to land from the peak milking of 775 cows
- The abstraction of 100,000 L/day of groundwater
- The use of land (24ha) for intensive winter grazing – Gladfield
- The use of land (54ha) for grass silage production - Gladfield
- The use of land (63ha) for sheep farming – Cochrans block

3.1.1 *Soils, Physiographic Zones and FDE Classifications*

Table 1: Soils, Physiographic Zones and FDE Classifications for WW4

		Soil Type	Vulnerability Factors		
			Structural Compaction	Nutrient Leaching	Waterlogging
	Existing Dairy Platform	Braxton	Moderate	Slight	Severe
	Additional Land (63.3ha)	Braxton	Moderate	Slight	Severe
		Tuatapere	Slight	Moderate	Slight
FDE land classification	Existing Dairy Platform	Category A (Artificial drainage or coarse soil structure)			
	Additional Land	Category A (Artificial drainage or coarse soil structure) Category D (Well drained flat land)			
Physiographic Zone	Existing Dairy Platform	Central Plains			
	Additional Land	Central Plains (39ha) Oxidising (24.3ha)			

Table 2: Soils, Physiographic Zones and FDE Classification for Gladfield block

	Soil Type	Vulnerability Factors		
		Structural Compaction	Nutrient Leaching	Waterlogging
	Braxton	Moderate	Slight	Severe
FDE land classification	Category A (Artificial Drainage or coarse soil structure)			
Physiographic Zone	Central Plains			

3.1.2 *Surface Water Resources*

The dairy platform is located within the Waimatuku Stream and Aparima River catchments. All surface water from the property flows via artificial drainage channels in a southerly direction towards the Waimatuku Stream. These drainage channels intersect with groundwater and eventually move into underground tile drains at the southern boundary of the farm.

The new part of Cochran's block is located within the Aparima River catchment and contains a small tributary of the Aparima within the farm boundary.

Gladfield block is located within the Waimatuku Stream catchment but has no surface water ways.

The Bayswater Bog lies to the south of both the WW4 platform and Gladfield block. The Bayswater Bog is purely rain fed[1] meaning the surrounding surface water and groundwater drainage does not flow towards or through the bog and is recharged only via rainfall on the surface area of the peatland. The Bayswater bog is therefore not considered to be a receiving environment for surface water flow from this landholding.

3.1.3 *Groundwater Resources*

The dairy platform is located within the Upper Aparima and Waimatuku Groundwater Management Zones (GMZ). The new block is located within the Upper Aparima GMZ. Gladfield is located within the Waimatuku GMZ.

3.2 Woldwide Five (WW5)

The existing environment comprises of existing activities which are occurring under enduring resource consents or existing use rights. Permitted activities occurring are also included in the assessment of the existing environment, however the assessment follows Policy 39 of the PSWLP.

For this assessment, the existing environment on the area of the proposed WW5 landholding includes:

- The use of land (262ha) for dairy farming
- The discharge of FDE and underpass effluent to land from the peak milking of 665 cows
- The abstraction of 72,000 L/day of groundwater
- The use of land (28ha approximately) for intensive winter grazing of mixed age cows and additional heifers from a neighbouring farm
- The use of land (70ha) for sheep farming – Cochrans block
- The use of land (45ha) for sheep farming – Collies block

In 2015, WW5 was granted land use consent AUTH-20157537-04, discharge permit AUTH-20157537-01 and water permit AUTH-20157537-02. Land use consent AUTH-20157537-04 was granted to establish a dairy farm on the property on a proposal which detailed that the majority of the proposed dairy platform was to be converted in 2015 and the remaining 45ha Collies block would be purchased by the applicant in 2019 and converted into dairy platform at the time of purchase. The land use consent and the conditions it contained were worded as such to allow for the two phased conversion of this property to occur. At the time, both Environment Southland and Fonterra were encouraging consent holders who were converting farms under these consents to "establish a dairy farm" to get the consents signed off as complete once the farm was converted, the consent given effect to and all conditions were met in order to enable supply to Fonterra to commence. Accordingly, the applicants surrendered the consent with Environment Southland in April 2016. The issue now arises that a consent was surrendered,

[1] M. Hitchcock, June 2014, *Characterising the surface and groundwater interactions in the Waimatuku Stream, Southland*

either mistakenly or unwillingly by both the applicant and Environment Southland which had ongoing conditions and ongoing obligations for the conversion of Collies block.

In order to resolve this situation, this application seeks land use consent under Rule 20(e) for the conversion of Collies block to dairy land in recognition of the fact that the land use consent which has previously approved the conversion of this land to dairy land has been surrendered. In order to give credit for the fact that the conversion of Collies block has already been assessed under proper process in 2015, and that the land use consent was surrendered in error, the applicant has agreed in writing with Environment Southland that this block can be modelled in the baseline models as already being dairy land.

3.2.1 *Soils, Physiographic Zones and FDE Classification*

Table 3: Soils, Physiographic Zones and FDE Classifications for WW5

		Soil Type	Vulnerability Factors		
			Structural Compaction	Nutrient Leaching	Waterlogging
	Existing Dairy Platform	Tuatapere	Slight	Moderate	Slight
		Braxton	Moderate	Slight	Severe
		Upukerora	Moderate	Slight	Severe
	Additional Land (70ha)	Braxton	Moderate	Slight	Severe
		Tuatapere	Slight	Moderate	Slight
		Upukerora	Moderate	Slight	Severe
FDE land classification	Existing Dairy Platform	Category D (Well drained flat land) Category A (Artificial drainage or coarse soil structure) Category E (Other well drained but very stony flat land)			
	Additional Land	Category A (Artificial drainage or coarse soil structure) (33.4ha) Category D (Well drained flat land) (31ha) Category E (Other well drained but very stony flat land) (5.6ha)			
Physiographic Zone	Existing Dairy Platform	Oxidising Central Plains Riverine			
	Additional Land	Central Plains (33.4ha) Oxidising (31ha) Riverine (5.6ha)			

3.2.2 *Surface Water Resources*

The existing dairy platform is located within the Aparima River catchment. The new parts of Cochran's block is also located within the Aparima River catchment.

3.2.3 *Groundwater Resources*

The dairy platform is located within the Upper Aparima GMZ. The new block is located within the Upper Aparima GMZ.

3.3 Woldwide Runoff

For this assessment, the existing environment on the area of the WRO includes:

- The use of land (732ha) for dry stock farming
- The use of land (160ha) for commercial pine plantation and native bush
- The grazing of 1265 R1 and 1265 R2 stock plus a small number of additional mating bulls in the 2017/2018 season
- The use of land (52ha approximately) for intensive winter grazing of dry stock in the 2017/2018 season

3.3.1 *Soils and Physiographic Zones*

Table 4: Soils and Physiographic Zones on WRO

	Soil Type	Vulnerability Factors		
		Structural Compaction	Nutrient Leaching	Waterlogging
	Waimatuku	Slight	Moderate	Slight
	Makarewa	Moderate	Slight	Severe
	Malakoff	Slight	Severe	Slight
FDE land classification	Category C (Sloping Land) Category D (Well drained flat land) Category A (Artificial drainage or coarse soil structure)			
Physiographic Zone	Bedrock / Hill Country (Overland flow variant) Oxidising (Artificial drainage variant) Gleyed (No variant) Peat Wetlands (No variant)			

3.3.2 *Surface Water Resources*

WRO is located within the Fenham and Merry Creek catchments.

3.3.3 *Groundwater Resources*

WRO is located within an unclassified groundwater management zone

4. ASSESSMENT OF THE EXISTING ENVIRONMENT

4.1 Aparima River

The Aparima is the smallest of Southland's four main catchments. It extends from the Takitimu Mountains west of Mossburn to the Jacobs River Estuary at Riverton and the headwaters drain alpine, native tussock and forested land.

Figure 7: Aerial extent of Aparima catchment showing water quality monitoring sites (white dots)

The closest state of the environment (SOE) water quality monitoring site for the Aparima River catchment is at Otautau, however it only records ecological indices. This assessment has used the SOE water quality monitoring site at Thornbury which measures both water quality and ecological indices. Information from the Land and Water website (www.lawa.org.nz) collates water quality data from a number of sources and provides the most recent water quality data available. **Table 5** below gives a summary of the state and trend measured at the Thornbury site for key river water quality indicators.

Table 5: Summary of Measurement and State Aparima River at Thornbury

Variable	State	Quality	NOF Band Annual Median	Trend
E.Coli	In the worst 50% of all lowland rural sites	195 n/100ml (median)	A	Meaningful improvement
Clarity	In the best 50% of all lowland rural sites	2.03 metres (median)	N/A	Indeterminate
Total Oxidised N	In the worst 50% of all lowland rural sites	0.675 g/m^3 (median)	A - median B – 95%ile	Meaningful improvement

		1.595 g/m^3 (95%ile)		
Ammoniacal N	In the best 25% of all lowland rural sites	0.0038 g/m^3 (median) 0.0148 g/m^3 (maximum)	A – 99% species protection level. No observed effect on any species tested.	N/A
Dissolved Reactive P	In the best 50% of all lowland rural sites	0.0065 g/m^3 (median)	N/A	Indeterminate

The water quality trends indicate that the overall water quality in the Aparima River is good with all relevant water quality parameters rated as A and one B (TON 95%ile) with either no trend or meaningful improvement. The ecological data for the Thornbury site shows that Macroinvertebrate Community Index was rated as fair with occasional ratings of good between 2007 and 2017 - suggesting the river is in fair to good ecological condition indicative of fair to good water quality and/or habitat. The EPT richness (species sensitive to water quality) shows fluctuations between 28% and 55% for the period 2008 to 2016.[2]

4.2 Waimatuku Stream

The Waimatuku Stream flows from the vicinity of the Bayswater Bog in a southerly direction towards the sea in the absence of a receiving estuary.

[2] https://www.lawa.org.nz/explore-data/southland-region/river-quality/aparima-river/aparima-river-at-thornbury/

Figure 8: Aerial extent of Waimatuku Stream catchment showing water quality monitoring site

There is a state of the environment (SOE) water quality monitoring site on the Waimatuku Stream at the Lorneville Riverton Highway. Information from the Land and Water website (www.lawa.org.nz) collates water quality data from a number of sources and provides the most recent water quality data available. **Table 6** below gives a summary of the state and trend measured at this site for key river water quality indicators.

Table 6: Summary of Measurement and State Waimatuku Stream at Lorneville[3]

	State	Quality	NOF Band Annual Median	Trend
E.coli	In the worst 25% of all lowland rural sites	500 n/100ml (median)	B	Indeterminate
Clarity	In the worst 50% of all lowland rural sites	1.12 metres (median)	N/A	Indeterminate
Total Oxidised N	In the worst 25% of all lowland rural sites	3.35 g/m^3 (median) 5.5 g/m^3 (95%ile)	C - median C – 95%ile	Meaningful improvement

[3]https://www.lawa.org.nz/explore-data/southland-region/river-quality/waimatuku-stream/waimatuku-stream-at-lorneville-riverton/

Ammoniacal N	In the worst 50% of all lowland rural sites	0.0104 g/m^3 (median) 0.0416 g/m^3 (maximum)	A – 99% species protection level. No observed effect on any species tested.	N/A
Dissolved Reactive P	In the worst 25% of all lowland rural sites	0.042 g/m^3 (median)	N/A	Meaningful degradation

The water quality trends indicate that the Waimatuku Stream catchment has degraded in regards to dissolved reactive phosphorus over the period 2008 to 2016. Conversely, total oxidised nitrogen concentration has improved, albeit at relatively high absolute concentrations. The overall impact of the trends in nutrient concentrations is not clear at this stage. There is very limited published information on periphyton extent or macroinvetebrate community status in the Waimatuku Stream, so it is difficult to assess the current status or trend in biological quality of the stream. However, it is accepted that any increase in nutrient concentrations is likely to create the potential for an increase in periphyton and/or other plant biomass in the stream.

4.3 Fenham and Merry Creeks

WRO is located within both the Fenham and Merry Creek catchments. Both creeks are tributaries of the Orauea River which flows south-westerly towards Tuatapere township and joins the Waiau River. There is a SOE monitoring site on the Orauea River at Orawia Pukemaori Road which is used to measure water quality information data. The Land and Water website (www.lawa.org.nz) collates this water quality data and provides the most recent water quality data and trends available. **Table 7** below gives a summary of the state and trend measured at this site for key river water quality indicators.

Table 7: Summary of Measurement and State of Orauea River at Orawia[4]

	State	Quality	NOF Band Annual Median	Trend
E. coli	In the worst 25% of all lowland rural sites	315 n/100ml (median 5 year)	E	Likely improving
Clarity	In the worst 25% of all lowland rural sites	1.13 metres (median 5 year)	N/A	Indeterminate
Total Oxidised N	In the worst 25% of all lowland rural sites	0.415 g/m^3 (median)	A - median	Meaningful improvement
Ammoniacal N	In the best 25% of all lowland rural sites	0.0005 g/m^3 (median)	A – 99% species protection level.	N/A
Dissolved Reactive P	In the worst 50% of all lowland rural sites	0.011 g/m^3 (median)	N/A	Indeterminate

[4] https://www.lawa.org.nz/explore-data/southland-region/river-quality/waiau-river/orauea-river-at-orawia-pukemaori-road/

The water quality medians indicate that the Orauea catchment is degraded in regards *E. coli*, however there is a definite trend of improvement. High *E. Coli* levels are a concern for overall water quality within a waterway due to human health risks. Typically *E. coli* contamination of waterways is caused by stock contact with surface water, point source discharges from septic tanks, wastewater treatment at upstream towns and effluent discharges to land reaching surface water. A high proportion of land within the Orauea catchment is both intensive and extensive sheep farms which is likely to contribute to the high *E. coli* levels because stock on sheep farms are not excluded from waterways in the same manner in which it is compulsory on dairy farms. The other activities listed above may also be contributing factors. *E. coli* is rated as E band in the National Objectives Framework (NOF) of the National Policy Statement for Freshwater Management. An E band rating equates to an average infection risk of greater than 7%.

Conversely, total oxidised nitrogen concentration has improved and is rated as A band under the NOF which means that water quality is considered suitable for the designated use and associated with a high conservation values ecosystem where there is unlikely to be effects even on sensitive species. The national bottom line value is 6.9 mg/L which far exceeds the 0.415 mg/L median at this site.

The median dissolved reactive phosphorus (DRP) is below ANZECC guideline levels and is not showing an evident trend. The raw data shows that DRP is low on the majority of the sampling dates, with spikes most likely occurring during rainfall events where phosphorus can be transported to surface water bodies via runoff and erosion.

The overall impact of the trends in nutrient concentrations is not clear at this stage, however the receiving water is considered low in relation to nitrogen and phosphorus concentrations overall. There is very limited published information on periphyton extent or macroinvetebrate community status in the Orauea River, so it is difficult to assess the current status or trend in biological quality of the stream. However, it is accepted that any increase in nutrient concentrations is likely to create the potential for an increase in periphyton and/or other plant biomass in the stream.

4.4 Upper Aparima GMZ

The proposed farm boundaries for WW4 and WW5 lie within the Upper Aparima GMZ according to Beacon Mapping. The Upper Aparima GMZ is classified as a terrace aquifer. The Upper Aparima GMZ encompasses the flat-lying portion of the upper Aparima River catchment. The quaternary gravel deposits of the Upper Aparima groundwater zone occur in a series of broad alluvial terraces that flank the recent floodplain of the Aparima River. The gravel deposits underlying the higher terrace surfaces tend to be relatively clay-bound and weathered incorporating early-mid Quaternary gravels deposited by the Aparima River along with locally derived alluvial fan deposits sourced from the surrounding foothills. The terrace aquifers are recharged by direct rainfall recharge and infiltration of runoff from the surrounding hills and streams which drain the hills. There is limited riparian recharge from the Aparima River except along the riparian margins. Lincoln Environmental (2003) estimated mean annual

land surface recharge in the Aparima groundwater zone at 417 mm/year. Groundwater is discharged into the Aparima River via spring-fed streams or throughflow through the unconfined aquifer along the riparian margin of the river.[5]

WW4 and WW5 are situated at the very south-eastern extent of the Upper Aparima groundwater zone and is in close proximity to the mapped boundary extents of both the Lower Aparima groundwater zone and the Waimatuku groundwater zone.

Groundwater quality in the Upper Aparima groundwater zone is varied with groundwater nitrate concentrations measured between 0.4 and 8.5 mg/L from monitoring bores within the wider groundwater management zone (Beacon mapping). The variation in groundwater nitrate nitrogen concentrations is synonymous with the variation in soil types and properties (land uses) within the area. The section of the groundwater management zone beneath the landholding mapped for the 2007-2012 period as having groundwater nitrate nitrogen concentrations between 3.5 and 8.5 mg/L which is consistent with the presence of free draining soils underneath parts of the applicant's subject property which are prone to low denitrification potential and therefore the accumulation of nitrate within the soil profile.

A 2011 report by Dr Clint Rissmann undertook regional mapping of groundwater denitrification potential and aquifer sensitivity throughout the Southland region. The report categorized different areas with a Combined Denitrification Potential (CDNP) sensitivity based on both surficial and sub-rock denitrification potential. The CDNP is a measure of the sensitivity of aquifers to nitrate contamination and a low or very low CDNP aquifer will have a high to very high sensitivity to nitrate accumulation. Conversely, a high or very high CDNP aquifer will have a low or very low sensitivity to nitrate accumulation due to the prevalence of denitrifying conditions.[6]

Figure 9 below shows the spatial distribution of CDNP and aquifer sensitivity as mapped by Dr Rissmann. The subject property is mapped as having low to very low dentification potential and is therefore classified as being highly sensitive to nitrate contamination. The map shows a domination of the green/light green colours indicating that the majority of the southern Southland region shares similar low denitrification potential.

[5] Environment Southland, *Upper Aparima Information Sheet*

[6] C. Rissmann, 2011, *Regional Mapping of Groundwater Denitrification Potential and Aquifer Sensitivity,* Environment Southland

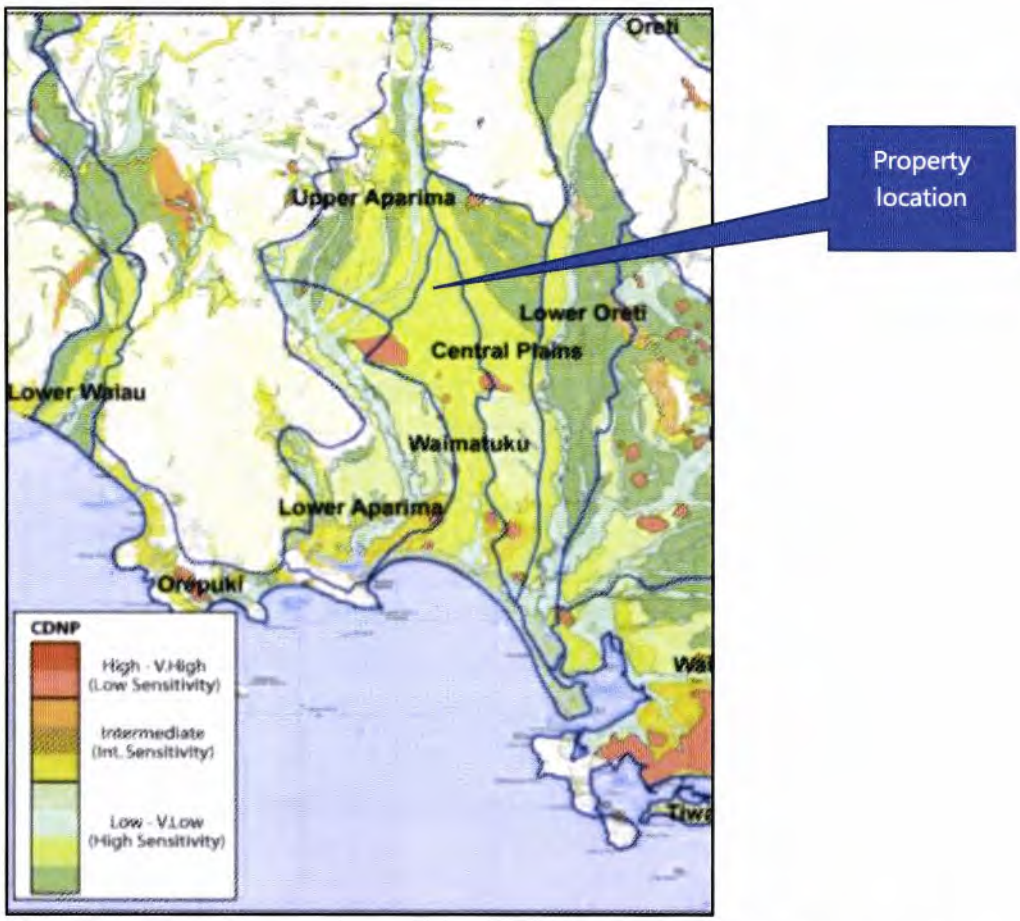


Figure 9: Spatial distribution of Combined Denitrification Potential (CDNP)(Aquifer Sensitivity)[7]

Very little information is published regarding the extent of groundwater and surface water interaction in this location. The proximity of the property to the main stem of the Aparima River suggests that there may be some level of riparian recharge along the riparian margins[8]. Typically terrace aquifers are recharged by direct rainfall recharge and infiltration of runoff from the surrounding hills and streams which drain the hills. Lincoln Environmental (2003) estimated mean annual land surface recharge in the Aparima groundwater zone at 417 mm/year. The direction of groundwater flow can be significant in terms of quantifying effects on water quality from the proposed activity,

4.5 Waimatuku GMZ

The proposed WW4 farm boundary including Gladfield is likely to drain to the Waimatuku GMZ. Although this property is technically not mapped by Beacon as being in the Waimatuku groundwater zone, the direction of drainage systems on farm, particularly from the area of Braxton soils, suggest both surface water and groundwater drainage drain away from the Aparima River. The Waimatuku

[7] C. Rissmann, 2011, *Regional Mapping of Groundwater Denitrification Potential and Aquifer Sensitivity,* Environment Southland

[8] Environment Southland, *Upper Aparima Groundwater Zone Information Sheet*

GMZ was the subject of an intensive MSc thesis study by M. Hitchcock in 2014 titled *Characterising the surface and groundwater interactions in the Waimatuku Stream, Southland.* Hitchcock studied the groundwater flow movements throughout the Waimatuku Stream catchment using potentiometric surveys. **Figure 10** from the thesis below show modelled groundwater flow directions throughout the catchment and appears to confirm this by also indicating that groundwater flow underneath the applicant's property flows in a south to south-easterly direction.

We can then expect that groundwater from beneath the property flows partially towards the Bayswater Bog, partially towards the Waimatuku Stream and partially towards the Aparima River however we cannot determine in what ratios. Where groundwater flows towards the Bayswater Bog, which is a raised peat bog (as seen from the contour lines) from the location of the dairy farming activity, it may undergo a certain amount of nutrient attenuation as a result of the sub-surface and wetland ecosystem processes. Where groundwater from the location of the dairy farming activities flows south easterly towards the Waimatuku Stream or towards the Aparima River there will be higher connectivity with surface water and less opportunity for attenuation of nutrients.

In equilibrium, the Waimutuku Stream is a source of groundwater recharge further down the catchment where groundwater flows at a tangent to the stream[9] and can act to mitigate potential effects based on this connectivity by providing additional groundwater baseflow and therefore dilution.

[9] M. Hitchcock, June 2014, *Characterising the surface and groundwater interactions in the Waimatuku Stream, Southland*

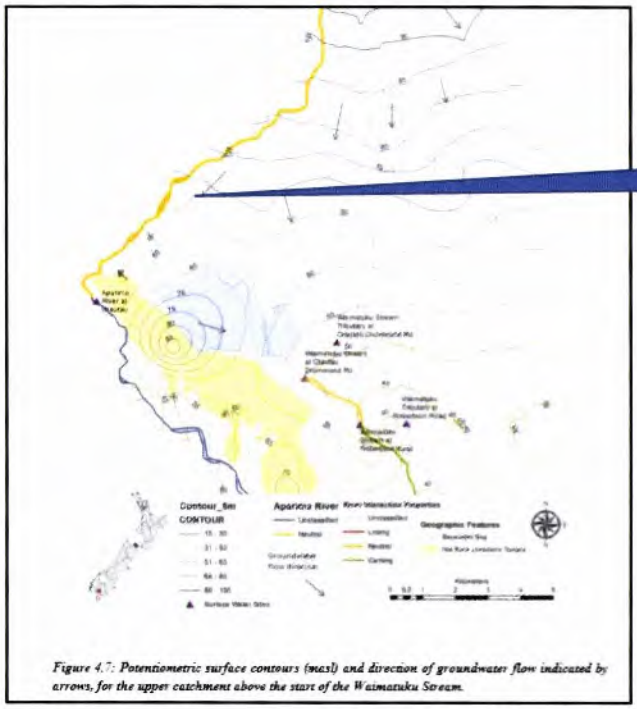


Figure 10: Potentiometric surface contours and direction of groundwater flow for the Waimatuku Stream[10]

The thesis concluded that the Waimatuku Stream was highly connected with groundwater providing a steady and large discharge to the surface water system. **Figure 11** below is an abstract from this report which clearly shows the surface water and groundwater relationships in the Waimatuku Stream catchment with the correlation between rainfall, stream flow, soil moisture and groundwater level.[11]

[10] M. Hitchcock, June 2014, *Characterising the surface and groundwater interactions in the Waimatuku Stream, Southland*

[11] M. Hitchcock, June 2014, *Characterising the surface and groundwater interactions in the Waimatuku Stream, Southland*

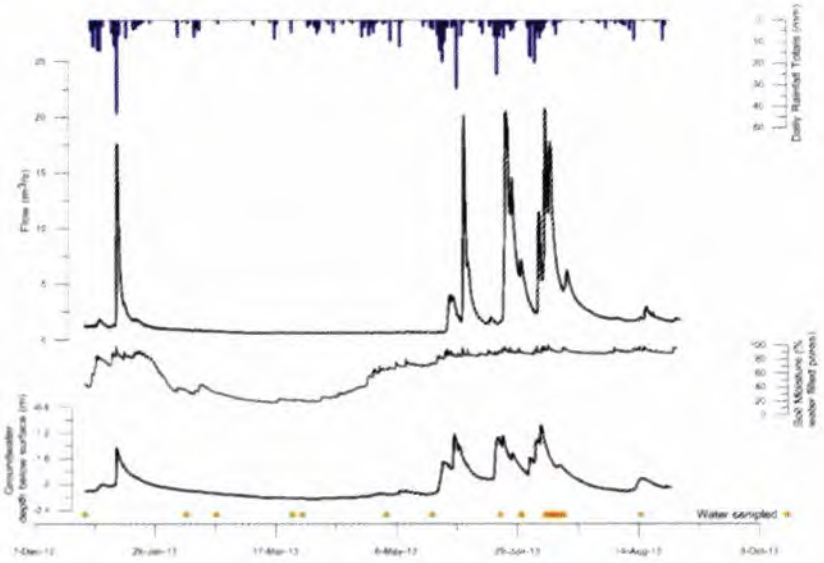


Figure 4.1: Catchment responses during the research period of December 2012 through to August 2013. Top to bottom including: Rainfall (mm daily total) at Otahuti; Stream flow at Township Road (m^3/s); Soil moisture (% water filled pores) at Isla Bank; Groundwater level (m) below the surface at Isla Bank; and day water sample collected indicated by orange star.

Figure 11: Rainfall, Stream Flow, Soil Moisture and Groundwater Level in the Waimatuku Stream

The nearest shallow groundwater monitoring to WW4 is from Bore D45/0350 which is located on the effluent discharge area on WW5 and is drilled to a depth of 6m and is therefore only representative of shallow drainage water quality. This bore has returned groundwater nitrate nitrogen results of 2.1 g/m^3 (December 2017), 0.97 g/m^3 (April 2017) and 3.0 g/m^3 (November 2016). *E.coli* results have returned as 134, 11 and 15 MPN/100mL in all three corresponding samples.[12]

4.6 Unclassified GMZ

WRO is located in an area of unclassified groundwater management zone. Groundwater nitrate levels in the vicinity of WRO are in the range 0.01 – 1.0 g/m^3, regarded as pristine to modern day background levels. Due to a combination of the topography, depth of groundwater and drainage channels there is a low risk of nitrate accumulation in groundwater in this area. This is supported by the very low mapped nitrate levels.

[12] Source: Environment Southland, water quality data D45/0350

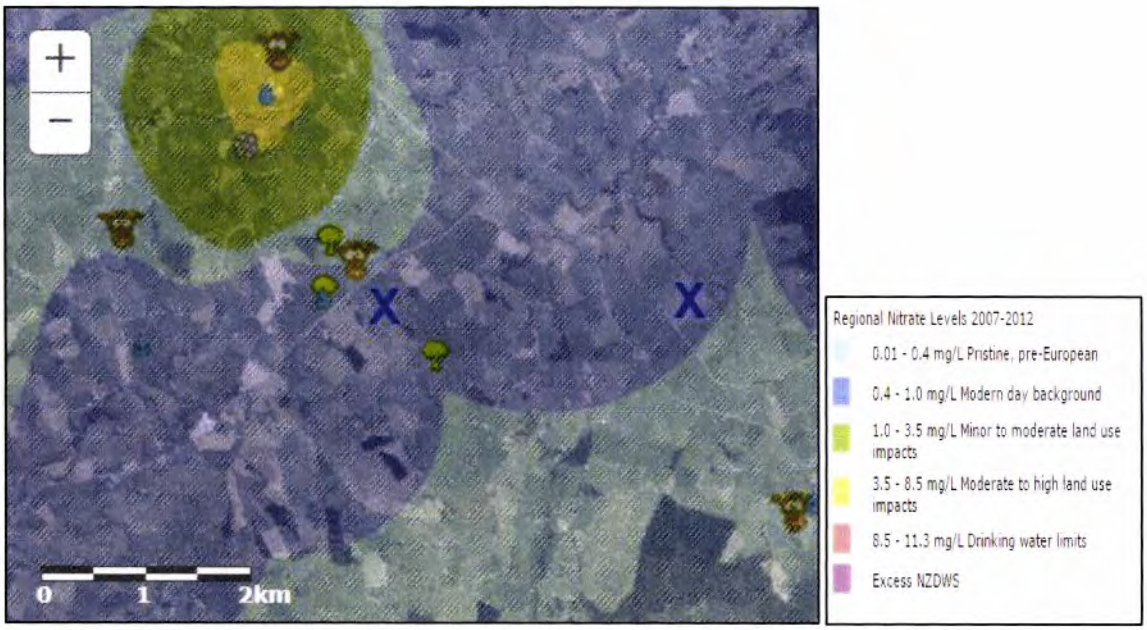


Figure 12: Groundwater nitrate in the vicinity of WRO (approximate location of WRO blocks marked with X)[13]

4.7 Jacobs River Estuary

The Aparima River discharges into the Jacobs River Estuary approximately 40 km downstream of the property boundary for WW5 (which is within the Aparima River catchment) near the township of Riverton. This estuary drains three nearby catchments namely the Pourakino River, Opouriki Stream and the Aparima River.

[13] Beacon mapping service, Environment Southland website, accessed 13 February 2019.

Figure 13: Aerial extent of the three catchments that drain to Jacobs River Estuary at Riverton

Section 3.6 in the Regional Coastal Plan describes the key values for the Jacobs River Estuary at Pourakino River. As a summary, the key values relevant to this application are the high values placed on the estuary for waterfowl and waders habitat. The area has high recreational value with activities such as shooting, whitebaiting, fishing and boating. The estuary does not have particularly high natural character values but Ngai Tahu regard the northern areas as having historical pa sites. Water quality and thereby ecosystem health are sensitive to excessive levels of microbes, sediment and nutrients. [14]

The Jacobs River Estuary is not listed in Appendix A of the PSWLP as a sensitive waterbody nor is it listed in the Operative Southland Regional Water Plan.

A literature search showed no published monitoring or scientific study of the Jacobs River Estuary since 2013. A 2012/13 broad scale habitat mapping report made various conclusions about the overall state of the estuary. Of relevance to this application, the report states that

[14] Regional Coastal Plan for Southland – March 2013 – Chapter 3 page 14

"The rapid increase in nuisance macroalgal growth since 2003, combined with the presence of soft muds, have seen widespread gross eutrophic conditions develop in the sheltered upper reaches of both arms (gross nuisance conditions now cover 30% of the estuary, compared with 4% in 2008 and <4% in 2003). These conditions have caused the displacement of seagrass beds, are stressing saltmarsh habitat, are causing significant adverse ecological impacts to sediment dwelling organisms, and creating conditions unfavourable for birds and fish. Aesthetic and amenity values in these parts of the estuary are now also severely compromised. The primary driver of the eutrophication symptoms being expressed is considered to be excessive catchment nutrient loads. In Jacobs River, >80% of the nutrient load is likely to be entering from the more heavily developed Aparima Arm, with many of the impacts evident in the Pourakino Arm also likely to be driven by inputs from this source. [15]

The 2013 report contained the following table which summarised the broad scale mapping results for the estuary. The table below shows that eutrophication indices deteriorated between 2003 and 2013 going from a Fair gross eutrophic condition area to Very Poor. [16]

Table 8: Summary of broad scale condition ratings for Jacobs River Estuary 2003-2008 and 2013

RATINGS			CONDITION RATINGS			CHANGE RATINGS
Major Issue	Overall Rating	Indicator	2003	2008	2013	Change from 2003 Baseline
Muddiness	POOR	Soft mud area	Very Poor	Very Poor	Very Poor	Small Increase
Eutrophication	POOR	Low density macroalgal cover	Low	Moderate	Moderate	Early Warning Trigger - trend of increase
		High density macroalgal cover	Low	Very High	Very High	Very Large Increase
		Gross eutrophic condition area	Fair	Poor	Very Poor	Very Large Increase
Habitat Modification	MODERATE	Seagrass Coefficient/area	Fair	Fair	Fair	Very Large Decrease
		Saltmarsh area	Moderate	Moderate	Moderate	Small Decrease
		Densely vegetated margin area	Poor	Poor	Poor	Small Decrease

An earlier 2009 report by the same authors assessed the macroalgal coverage of the Jacobs River Estuary based on the preceding three years of data. This report highlighted that the overall rating of the estuary for macroalgal condition as fair. However, the report noted that the central basin of the estuary surrounding the outlet of the Aparima River had low macroalgal counts due to extensive flushing. The higher macroalgal areas were in the sheltered upper arms of the estuary which are prone to sedimentation, runoff from the surrounding farmland and low flushing. [17]

[15] Wiggle Coastal Management, Stevens and Robertson, 2013, *Jacobs River Estuary Broad Scale Habitat Mapping 2012/13*

[16] Wiggle Coastal Management, Stevens and Robertson, 2013, *Jacobs River Estuary Broad Scale Habitat Mapping 2012/13*

[17] Wiggle Coastal Management, Stevens and Robertson, 2013, *Jacobs River Estuary Macroalgal Monitoring 2008/09*

5. ACTIVITY CLASSIFICATION

5.1 Consents Required for WW4

The following resource consents are required under the Regional Water Plan for Southland, 2010 (RWPS), Proposed Southland Water and Land Plan, 2018 (PSWLP) and Regional Effluent Land Application Plan ,1998 (RELAP)

Table 9: Applicable Rules for WW4

Consent	Plan	Rule	Activity Status
Land Use Consent – to use land for a farming activity **PHASE 1 & 2**	RWPS	17A	Permitted – no new dairy shed proposed
	PSWLP	20 (e)	Discretionary
Land use consent for the use of existing effluent storage facilities **PHASE 1 & 2**	RWPS	N/A	Permitted
	PSWLP	32D (b)	Discretionary
Discharge Permit to discharge agricultural effluent to land **PHASE 2**	RWPS	50 (d)	Restricted discretionary
	RELAP	5.3.2	Discretionary (sludge discharge)
	PSWLP	35 (c)	Discretionary
Water Permit to abstract groundwater for dairy shed wash down and stock drinking **PHASE 2**	RWPS	23 (d)	Discretionary
	PSWLP	54 (d)	Discretionary
Land use consent for a wintering shed **PHASE 2**	RWPS	N/A	Permitted
	PSWLP	35A (b)	Discretionary

Overall, the proposal for WW4 is a **discretionary** activity.

5.2 Consents Required for WW5

The following resource consents are required under the Regional Water Plan for Southland, 2010 (RWPS) and Proposed Southland Water and Land Plan, 2018 (PSWLP) and Regional Effluent Land Application Plan ,1998 (RELAP).

Table 10: Applicable Rules for WW5

Consent	Plan	Rule	Activity Status
Land Use Consent – to use land for a farming activity **PHASE 1 & 2**	RWPS	17A	Permitted – no new dairy shed proposed
	PSWLP	20 (e)	Discretionary
Land use consent for the use of an existing effluent storage facility **PHASE 1 & 2**	RWPS	N/A	Permitted
	PSWLP	32D (b)	Discretionary
Discharge Permit to discharge agricultural effluent to land **PHASE 2**	RWPS	50 (d)	Restricted discretionary
	RELAP	5.3.2	Discretionary (sludge discharge)

Consent	Plan	Rule	Activity Status
	PSWLP	35 (c)	Discretionary
Water Permit to abstract groundwater for dairy shed wash down and stock drinking **PHASE 2**	RWPS	23 (d)	Discretionary
	PSWLP	54 (d)	Discretionary
Land use consent for a wintering shed **PHASE 2**	RWPS	N/A	Permitted
	PSWLP	35A (b)	Discretionary

Overall, the proposal for WW5 is a **discretionary** activity.

5.3 Consents Required for WRO

The use of land at WRO for a farming activity at WW4 and WW5 is a **discretionary activity** under Rule 20 (e) of the PSWLP. This application seeks that the land at WRO is included in the land use consents sought under Rule 20 (e) for WW4 and WW5 respectively. A separate land use consent for WRO is not sought.

5.4 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.

WW4

The applicant will operate under the existing discharge permits under Phase 1 of the application.

WW4 currently operates under Discharge permit AUTH-20181320-01 which permits the milking of 850 cows with effluent spread over a 56ha block using a slurry tanker, travelling irrigator and pods. The existing effluent pond has an active storage volume of 3,801m^3. WW4 holds Water Permit AUTH-20181320-02 to abstract 100,000 L of groundwater per day for dairy purposes.

Discharge Permit 20181320-01 for WW4 does not need to be amended during phase 1 for the following reasons:

- The discharge permit already specifies that effluent will be applied to Lot 7 and 10 DP 152 which is not changing.
- Condition 1 refers to the effluent discharge being in accordance with the application submitted for APP-20181320 which is not changing in nature, scale or extent under this proposal.
- Condition 1 refers to the "discharge of agricultural effluent to an area of 56 hectares as per the plan attached as Appendix 1." The current Appendix 1 map accurately reflects the 56ha which is being utilised under this proposal. Condition 1 does not specifically refer in any way to the farm boundary as having specific relevance or restriction to the consent holder in fulfilling the requirements of Condition 1. The mapping of the farm boundary on the Appendix 1 map therefore only gives context to the discharge area, and does not define the nature, scale and extent of the discharge activity.

- Condition 2 states that "Notwithstanding these conditions, this permit shall be exercised in accordance with the Collected Agricultural Effluent Management Plan." This proposal does not seek to alter the nature, scale and extent of the discharge activity as described in the existing Collected Agricultural Effluent Management Plan.
- Condition 8 states that "Where there is inconsistency between the plan attached as Appendix 1 and the conditions of this consent, the conditions of this consent shall prevail." We believe that the imposition of Condition 8 gives a significant amount of clarity that the effluent discharge activity is appropriately outlined and restricted.
- Alongside all of the other consent conditions, the Council should be satisfied that the consent clearly describes what was applied for and is lawful.

<u>WW5</u>

WW5 operates under Discharge permit AUTH-20157537-01 which permits the milking of 800 cows with effluent spread over a 126ha block using low rate pods. Effluent is also spread on this property from a neighbouring WW3 farm which has been included in both the current and proposed models. The farm has effluent storage capacity of 166m^3. WW5 holds Water Permit AUTH-20157537-02 to abstract 72,000 L of groundwater per day for dairy purposes.

Discharge Permit 20157537-01 does not need to be amended under phase 1 for the following reasons:

- The discharge permit already specifies that effluent will be applied to Pt Lot 12 DP 238, Lot 13 DP 238, Lot 1 & 2 DP 344176, Lot 1 DP 310140, Lot 1 DP 12253 which is not changing.
- Condition 2 refers to the effluent discharge being in accordance with the application submitted which is not changing in nature, scale or extent under this proposal.
- Condition 2 refers to the "discharge of agricultural effluent to an area of 126 hectares as per the plan attached as Appendix 1." The current Appendix 1 map accurately reflects the 126ha which is being utilized under this proposal. Condition 2 does not specifically refer in any way to the farm boundary as having specific relevance or restriction to the consent holder in fulfilling the requirements of Condition 2. The mapping of the farm boundary on the Appendix 1 map therefore only gives context to the discharge area, and does not define the nature, scale and extent of the discharge activity.
- Condition 5 states that "Where there is inconsistency between the plan attached as Appendix 1 and the conditions of this consent, the conditions of this consent shall prevail." We believe that the imposition of Condition 5 gives a significant amount of clarity that the effluent discharge activity is appropriately outlined and restricted.
- Condition 10 (d) states that "This permit shall be exercised in accordance with the Farm Effluent Management Plan at all times. Where there is inconsistency between the Farm Effluent Management Plan and the conditions of this consent, the conditions of this consent shall prevail. "This proposal does not seek to alter the nature, scale and extent of the discharge activity as described in the existing Farm Effluent Management Plan.
- Alongside all of the other consent conditions, the Council should be satisfied that the consent clearly describes what was applied for and is lawful.

WRO

The other activities located on WRO which are not considered to form part of the respective farming activities, nor located on the landholdings for WW4 and WW5 include:

- Commercial pine plantation
- Rotten rock quarry operation
- Native bush block

These activities are permitted activities under the PSWLP as they do not contravene Section 13(1), 14(2), 14(3) or 15(1) of the RMA as detailed in Rule 4 of the PSWLP and they are located outside of the respective landholdings for which land use consent is sought under this application.

Table 11: Activities for which Consent is not required for WW4, WW5 and WRO

Activity	Compliance with the relevant permitted rules of the RWPS and PSWLP
Incidental discharges from farming (Rule 24 PSWLP)	The land use associated with this discharge will be authorised under Rules 20, 25 or 70 once consents are granted.
Establishment of a New Dairy Farm (Rule 17A RWPS)	The proposal does not seek to intensify the existing operation by the addition of a new dairy shed, so this rule does not apply.
Fertiliser (Rule 10 RWPS & Rule 14 PSWLP)	All practicable measures will be taken to minimise fertiliser drift beyond the target areas. Fertiliser will be applied to selected areas of the farms in accordance with nutrient budget recommendations, and soil tests to avoid excess leaching of 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 will be 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 proposed silage stacks have a couple of clean water diversions along their length. These diversions work in a similar way to yard diversions where the pipe is manually blocked off which diverts runoff either to the effluent system or to farm drainage depending on whether the stack is full within the immediate catchment area or not. These forms of manual diversion are extremely common place and are very simple to operate.
The use of land for feed pads/lots (Rule 35A of the PSWLP)	WW5 has three small pads which are used for less than 120 adult cattle and are constructed in accordance with Rule 35A including all separation distances. These will be used during phase 1 of the application.
Cleanfill, Farm Landfills and Offal Holes (Rules 53, 54 & 55 of the RWPS, and Rules 42 & 43 of the PSWLP)	No more than 500 m^3 of material will be discharged within cleanfill sites. Stormwater will be directed away from fill areas and no unauthorised material will be placed into proposed fill areas. No naturally formed limestone rock is known to reside within the property. Excavation of fill holes do not intercept springs and are not below the seasonal mean groundwater level in that location. Sensitive areas can be easily avoided when undertaking these associated

Activity	Compliance with the relevant permitted rules of the RWPS and PSWLP
	activities. Offal sites are to be covered and the surfaces to be restored to a similar state as surrounding land upon closing.
Drainage of Land (Rule 9 RWPS & Rule 13 PSWLP)	It is not anticipated that any discharge from subsurface drains would result in a conspicuous change to the colour and/or clarity of the receiving waters at a distance of 20 metres from the point of discharge. The proposed good management practices will significantly reduce the likelihood of any contaminants reaching the subsurface drains.

6. DETAILS OF THE PROPOSAL FOR WW4

6.1 Overview of the proposal

Woldwide Four Limited will be undertaking an increase to the size of the milking platform and number of cows on farm in two phases. Phase 1 will continue for a maximum of five years from the date of granting of the land use consent and involves expanding the dairy platform and increasing actual cows milked on farm to existing discharge permit levels. Phase 2 will continue thereafter at the expiry or surrender of the phase 1 consents for the duration of the consents sought (15 years) and includes an increase in cow numbers and the construction of a wintering shed. This gives a total consent period sought for the entire proposal of 20 years cumulatively.

Phase 1:

- A land use consent for the farming activity to increase the size of the dairy platform by 63ha to convert a portion of Cochran's block to dairy platform.
- The applicant will exercise existing discharge permit AUTH20181320-01 and water permit AUTH20181320-02 which permit the milking of up to 850 cows.
- A land use consent for the use and maintenance of existing effluent storage facilities to hold effluent generated on the farm.

Phase 2:

- A land use consent for the farming activity to increase the size of the herd to 1000 cows and continue to utilise the expanded dairy platform from phase 1.
- A land use consent for the construction of a 1050 cow wintering barn on the farm
- A discharge permit to discharge farm dairy effluent, underpass effluent, silage leachate and wintering shed slurry to land from the peak milking of 1000 cows.
- A land use consent for the use and maintenance of existing effluent storage facilities to hold effluent generated on the farm.

Note: New effluent storage facilities will be required for phase 2. Consents to construct, use and maintain these new effluent storage facilities will be applied for prior to the commencement of phase 2 when exact details, plans and locations are finalized. According to s91 of the RMA, additional consents that may be required can be requested for the purpose of better understanding the nature of the proposal. In this instance, this proposal should be able to be fully understood without the exact details of the storage facilities as this application details their minimum storage requirements using DESC, material they will hold and timeframe for construction.

6.2 Land use consent application for farming activity

A land use consent is sought for the proposed farming activity which we are determining includes all activities located on the landholding which are directly associated with the operation of the applicant's dairy farm for 365 days of the year. The proposed farming activity extends across the WW4 dairy platform, Gladfield support block and WRO, and accordingly, one land use consent is sought to legalise the activities on this land.

The proposed farming activity will occur in two phases. Phase 1 of the proposal is to add 63ha of an existing 136ha sheep farm named Cochran's block to the existing dairy platform on WW4 and to increase cows to consented discharge permit levels. In order to facilitate phase 2 of the proposal, a 1050 cow wintering shed will be constructed on the dairy platform within a maximum 5 year timeframe which will allow for the increase of the herd size to 1000 cows (from 850 cows). Under phase 2, intensive winter grazing will cease on the Gladfield block and the block will be used for grass silage production as a cut and carry block. All mixed age stock will be wintered in the wintering sheds. R2s will be either wintered in the wintering sheds or at WRO with an assessment of effects for both scenarios assessed in this application and the AEE for WRO respectively.

Table 12: Farm areas and stocking rates for WW4 under the proposal

	TOTAL FARM AREA (HA)	EFFECTIVE AREA (HA)	STOCKING RATE
Existing	349	337	3.2
Proposed phase 1	412	398	2.1
Proposed phase 2	412	398	3.1

Overseer 6.3.0 has been used to describe the current farm system to create a baseline model for the existing land use (based on the existing environment described in Section 3.1). The baseline model consists of one nutrient budget based on actual data from the applicants records to create five year average input values for the preceding five years.

Overseer 6.3.0 has then been used to model the farm system under phase 1 to estimate nutrient outputs under this part of the proposal. Nutrient inputs have been carefully considered to ensure viable farm systems are modelled.

Phase 2 has been modelled using **an example Overseer nutrient budget for WW4** to give an prediction of how the wintering barn can maintain and/or reduce nutrient losses when included in the farm system. The meaning of **an example Overseer nutrient budget** is that the model uses more assumptions and typical industry-wide input values due to the inherent uncertainties which exist modelling a farm system so much further into the future. This example model must only be viewed as an example, not representing the exact and absolute farm system the applicant proposes to implement in the future. We also note that Environment Southland consent staff have advised the applicant that a nutrient budget for phase 2 is not considered a requirement for this application, however the applicant has chosen to provide one to strengthen their proposal and to show that nutrient losses can be reduced to baseline levels.

Please refer to the Farm Scenario Plan in Appendix A for a full description of the baseline and proposed phase 1 farm systems and the winter barn example for WW4: Cochrans block, WW4 platform and Gladfield. This report details the inputs which have been used and this report has not repeated these

farm system details to avoid duplication. The AEE section of this document assesses the inputs used in the proposed phase 1 model as both mitigation methods and good management practices.

The Overseer nutrient budgets have been prepared by Mark Crawford of Ravensdown who is a Certified Nutrient Management Adviser (CNMA). These Overseer budgets have been used to show the annual amount of nitrogen and phosphorus discharged from WW4.

The summary outputs for the **baseline model** are:

Table 13: Summary outputs for the baseline model

Land Use	Nitrogen Losses (total kg)	Nitrogen Losses (kg/ha/year)	Phosphorus Losses (total kg)	Phosphorus Losses (kg/ha/year)
Self-contained dairy unit	10,558	30	312	0.9
Sheep farm (63 ha)	1,120	19	26	0.4
Current combined	11,678	30	338	0.9

The summary outputs for **proposed phase 1** model are:

Table 14: Summary outputs for proposed phase 1 model

Land Use	Nitrogen Losses (total kg)	Nitrogen Losses (kg/ha/year)	Phosphorus Losses (total kg)	Phosphorus Losses (kg/ha/year)
Proposed phase 1	11,298	27	343	0.8

The summary outputs for the **winter barn example** model are:

Table 15: Summary outputs for winter barn example model

Land Use	Nitrogen Losses (total kg)	Nitrogen Losses (kg/ha/year)	Phosphorus Losses (total kg)	Phosphorus Losses (kg/ha/year)
Winter barn example	11,142	27	368	0.9

Overall, modelling of phase 1 of the application indicates that at a farm system/landholding level nitrogen losses are estimated to reduce by 380 kg N/year and 3 kg N/ha/year compared to the baseline. Phosphorus losses are estimated by Overseer to increase by 30 kg P/year but remain the same on a per hectare basis compared to the baseline.

Overall, modelling of phase 2 (winter barn example) of the application indicates that at a farm system/landholding level nitrogen losses are estimated to reduce by 536 kg N/year and 3 kg N/ha/year compared to the baseline. Phosphorus losses are estimated by Overseer to increase by 5 kg P/year and 0.1kg P/ha/year compared to the baseline.

The overall intention of the land use consent under phase 2 is to operate at a nitrogen loss level (predicted by Overseer) equal to or less than the nitrogen loss level outputs from the baseline model. Please see Section 8.3 for specific details on how we propose to condition nitrogen loss outputs in the land use consent to account for Overseer version changes.

6.3 Discharge permit application

Phase 1:
The applicant will be operating under the existing discharge permit AUTH- 20181320-01 under phase 1 of the proposal. This discharge permit allows for the milking of up to 850 cows and the discharge of Farm Dairy Effluent (FDE) via low rate irrigation and slurry tanker. Under phase 1, the applicant will increase actual cow numbers milked on farm to consented cow numbers. Land use consent is sought under phase 1 for the use of the existing effluent storage facilities (see Section 6.6)

Our assessment is that AUTH-20181320-01 does not need to be amended for phase 1 as described in Section 5.3 of this report.

Phase 2:
A new discharge permit is sought for phase 2 of the proposal. A discharge permit is required to allow for the discharge of FDE from 1000 cows, underpass effluent, silage pad leachate and wintering shed slurry from a maximum of 1050 cows.

The effluent generated in the wintering shed and held within the sludge bunker is more solid in nature than typical FDE and could be considered a sludge. The PSWLP provides for a very simple definition of sludge: "*The solid residues from effluent*". The PSWLP does not provide a definition for the term slurry. We have used an Agresearch document by Houlbrooke et al which has characterised and evaluated dairy manures and slurries. The following diagrams are an excerpt from this report and indicates that barn slurry has an average of 8% dry matter which classifies it as liquid. Effluent from herd homes has an average of 23% dry matter which classifies it as semi-solid.

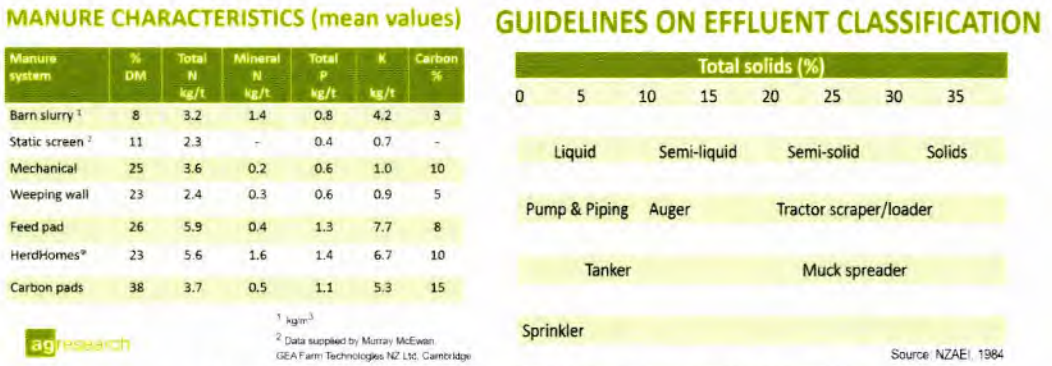


Figure 14: Effluent characteristics and classifications[18]

The applicant has taken a conservative approach and classifies effluent from the wintering sheds as slurry which means that the effluent generated in these sheds requires a discharge permit in order to apply the slurry to land on both the dairy platform and Gladfield block.

Table 16: Discharge Permit application summary

Discharge Permit Details:	
Replacement of consent no.	AUTH-20181320-01
Number of dairy cows	1000
Type of milking shed	Rotary Shed
Winter milking?	No milking between 16 June and 31 July other than slipped cows
Wintering barn?	Yes – for 1050 cows
Feed pad/stand off pad?	No separate structure present but the wintering shed used can be used as a standoff pad for milking cows for approximately 10 hours per day during May and August.
Other sources of effluent?	Stock underpass Silage leachate
Effluent treatment	FDE: Slurry scraped from yard to concrete sludge pit, liquids drained to liquid effluent storage facility Wintering Barn: scraped to slurry effluent storage facility Underpass effluent: directed to liquid effluent storage facility Silage leachate: directed to slurry effluent storage facility
Storage available (m^3)	3801m^3 existing pond will be re-constructed with a liner in phase 2 to provide liquid storage. New pond – 7,979m^3 for slurry effluent storage
Storage required (m^3)	Liquid effluent: 3,660m^3 (as per attached dairy effluent storage calculator for FDE from 1000 cows in Attachment E)) plus underpass effluent Slurry effluent: 7,979m^3 for wintering shed effluent, silage leachate and excess sludge bunker effluent

[18] Houlbrooke et al, Dairy Manures and Slurries: Characteristics and Evaluating current practice, AgResearch accessed at http://envirolink.govt.nz/assets/Envirolink/1204-ESRC15320Dairy20manures20and20slurries-characteristics20and20evaluating20current20practice20.pdf on 1 February 2019

Disposal area (ha)	Liquid effluent: 78ha discharge area Slurry effluent: Approx 320ha being the remainder of dairy platform and entire Gladfield block
Irrigator proposed	Pods, slurry tanker and travelling irrigator
Application rate and depth	Travelling irrigator: Maximum depth per application of 8 mm. Total annual application depth of 25 mm Slurry tanker: 2.5mm depth per application maximum. Typical application at 1.5mm depth Pods: Max application rate 10mm/hr
Monitoring proposed	Groundwater every 6 months

6.3.1 *Effluent management system description*

Farm dairy effluent

- The dairy shed yard is mechanically scraped to collect the more solid component of the effluent (slurry) which is scraped into a 100m^3 concrete sludge bunker at the far end from the dairy yard. The yard has a downward gradient towards the milking shed to effectively allow solid and liquid effluent to be separated by gravity on the yard. The slurry is stored in the above ground concrete bunker for a maximum of 4 weeks before it is applied to land using an on-site slurry tanker. Slurry is applied to the remainder of the farm outside the liquid effluent discharge area.

- The rotary platform and dairy shed are washed twice daily with a maximum of 25,000 L equating to 25 L/cow/day. This volume has been measured by the applicant and is accurate for the system on farm.

- Liquid effluent collected from the yard, dairy shed and underpass is pumped either directly out to the 78ha effluent discharge area using a combination of low rate pods, slurry tanker and travelling irrigator or stored in the effluent storage pond (to be constructed).

- The slurry tanker can apply effluent at a depth of 1.5-2.5mm per application and will be preferentially used when a lower soil moisture deficit exists. The travelling irrigator applies effluent at a depth of 7-8mm and will be preferentially used when a higher soil moisture deficit exists. The low rate pods apply effluent at a maximum rate of 10mm/hr and can be used all year round provided an adequate soil moisture deficit exists.

6.3.2 *Storage*

The effluent storage at the farm under phase 2 will consist of three primary storage areas:

- Liquid effluent from the washdown of the platform and rainwater on the yard is stored temporarily in a pump sump before it is applied directly to the approved liquid discharge area.

- Liquid effluent will also be stored in the 3,801m^3 re-constructed lined effluent storage pond and applied to land with a combination of the pods, slurry tanker and travelling irrigator. This

will be completed prior to phase 2 commencing and will require a further land use consent application to be made when details are finalised as discussed above.

- Underpass effluent is pumped to the liquid effluent storage pond.
- Slurry from the yard is stored in the 100m^3 concrete pit attached to the far end of the yard and applied to land using a slurry tanker on a monthly basis. Slurry collected during the first two weeks of June and during spring is stored with wintering shed effluent in the slurry effluent storage facility.
- All wintering shed effluent is stored for the duration of winter in the new slurry effluent storage facility and applied to land from October through to May when soil moisture conditions are suitable.

Note: Consents will be applied for to re-construct, use and maintain any new or existing effluent storage structures under phase 2 prior to the commencement of this discharge permit.

Liquid effluent

The Dairy Effluent Storage Calculator (DESC) attached in Attachment E shows that **3,660m^3 of pumpable liquid storage is required** (90th percentile probability) to enable effective deferred irrigation for liquid FDE and underpass effluent (included in the other catchments section total 480m^2).

A condition of consent is required on the Discharge Permit (phase 2) to ensure that the new effluent storage facility for liquid effluent will be constructed of at least 3,660m^3 in volume.

Slurry effluent

The wintering shed is used for a maximum of 1050 cows for the entire winter period. During some seasons, the shed may only contain mixed age cows with the R2 cows remaining at WRO.

The wintering shed is used as a standoff pad during late Autumn and early spring as a measure to remove cows from pasture. The use of this facility as a standoff pad will change continually every season based on frequency and severity of adverse weather events and soil moisture levels. A conservative estimate is that the wintering shed could be used 24 hours per day for 45 days as a standoff pad.

The applicant has slurry effluent storage available within the concrete bunker for yard scrapings. The applicant has the ability to empty the concrete bunker monthly using the on-site slurry tanker during the majority of the milking season. Slurry from the concrete bunker will preferentially be stored in the same facility as the wintering shed effluent during the first 15 days of June or during spring which is calculated above to equate to 195m^3.

Silage leachate is collected with the slurry effluent. The silage pad is drained by a series of four drains along the length of the pad which can be manually diverted to storage or freshwater discharge depending on whether silage is stacked on this portion of the pad or not. Leachate volumes are therefore hard to calculate due to the changing nature of a silage stack with the pad completely empty

for 3-4 months of the year and partially empty for another 2 months. A conservative estimate sees a catchment of 800m^2 entering the slurry effluent storage facility based on 50% of average annual rainfall.

Below, a manual calculation has been used for slurry effluent including wintering shed effluent, slurry from the yard and silage pad leachate because the applicant wishes to provide storage for all of the slurry effluent produced and does not wish for a model to discount storage volumes based on soil types.

Wintering shed: 1050 cows x 50 L/cow/day x 95 days = 4,988m^3 (includes June, July and August)

Wintering shed: 1050 cows x 50 L/cow/day x 45 days = 2,362m^3 (used as standoff pad)

Slurry from yard: 1000 cows x 3 L/cow/day x 65 days = 195m^3

Silage pad leachate 800m^2 x 0.53m rainfall = 424m^3

Total required for slurry = 7,979m^3

A condition of consent is required on the Discharge Permit (phase 2) to ensure that the new slurry effluent storage facility will be constructed of at least 7,979m^3 in volume.

6.3.3 *Discharge Area*

The **liquid** effluent discharge area will be approximately 78ha which represents an increase from 56ha under the existing discharge permit. Overseer reports state that 62ha is required to maintain N loading at less than 150 kg N/ha/year from effluent. Liquid effluent (FDE plus underpass effluent) will be applied to land all year round as soil conditions permit safe application.

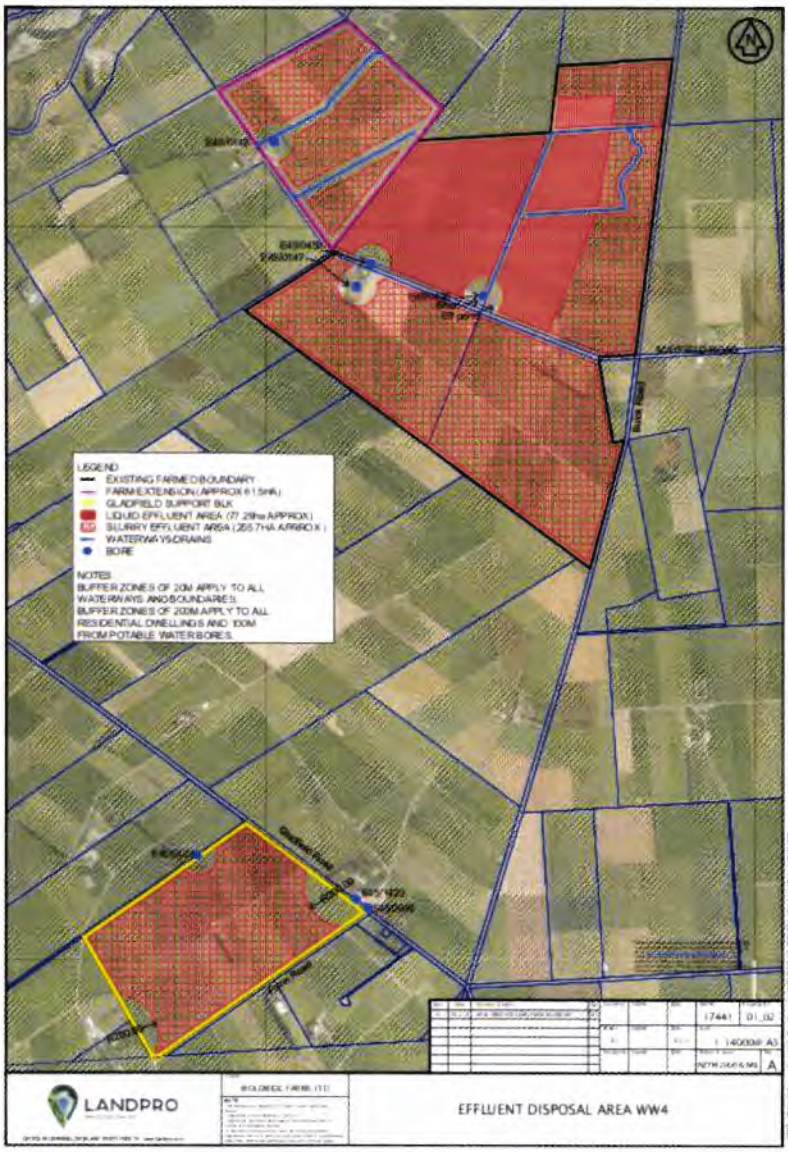


Figure 15: Proposed effluent discharge area

The **slurry** effluent discharge area includes the remainder of the milking platform (i.e blocks/paddocks not in the approved liquid effluent discharge area) and the total area of Gladfield block totals approximately 320ha.

Liquid or slurry effluent will not be applied within the following buffer zones as per standard discharge permit conditions:

- 20 m of any surface watercourse
- 100 m of any potable water abstraction point
- 20 m to any landholding boundary; and
- 200 m of any residential dwelling on a neighbouring property

In addition, the applicant will not discharge effluent where the soil has cracked.

6.3.4 *Discharge Method*

Liquid effluent will be applied to land using low rate pods, slurry tanker and travelling irrigator. Slurry will be applied to land using slurry tanker only. Proposed application rates are:

- Travelling irrigator: Maximum depth per application of 8 mm, total annual application depth of 25 mm
- Slurry tanker: 2.5mm maximum depth per application. Application depths between 1.5mm and 2.5mm.
- Low rate pods: Maximum application rate 10mm/hr

6.4 Water Permit Application

Phase 1:
The applicant will be operating under the existing water permit AUTH- 20181320-02 under phase 1 of the proposal. This water permit allows for the abstraction of 100,000 L/day of groundwater over a 300 day milking season. This volume accounts for shed wash down water and stock drinking water for 850 cows.

Phase 2:
A new water permit is sought for phase 2 of the proposal. A water permit is required to allow for the abstraction of groundwater for shed wash down water and stock drinking water from 1000 cows during the milking season, and the abstraction of stock drinking water during winter for 1000 cows in the wintering shed.

6.4.1 *Allocation*

Under phase 2 of the application, the applicant seeks a continuation of the proposed groundwater abstraction from bore E45/0426 located at NZTM2000 1221869E 4883664N and on Lot 10 DP152.

The applicant is applying for a continuation in the existing volume of groundwater:

Daily Volume= 100,000 L/day over the 300-day milking season (2 August – 31 May approx.)

Daily Volume= 75,000 L/day over the 65-day winter period (1 June – 1 August approx.)

Annual Volume = 34,875m^3

The proposed abstraction rate during the 300-day milking season of 100,000 L/day equates to a rate of take of 100 L/cow/day broken down as 25 L/cow/day for shed wash down water and 75 L/cow/day for stock drinking water for the 1000 cows on the property.

The proposed abstraction rate during the 65-day winter period of 75,000 L/day equates to a rate of 71 L/cow/day for the 1050 cows on the farm over the 65-day winter period.

The proposed abstraction is from the Waimatuku groundwater zone which has a current allocation of 10% of the discretionary allocation specified in the RWPS and 12.4% of the discretionary allocation specified in the PSWLP.

The groundwater abstraction represents no change from the applicant's current abstraction volume.

6.4.2 *Monitoring*

The groundwater abstraction will be monitored at the point of take to ensure compliance with the proposed abstraction volumes. There are 2 x 20,000 L freshwater storage tanks at the dairy shed to ensure the instantaneous rate of take is less than 2 L/sec.

6.5 Land Use Consent Application for wintering shed

The wintering shed will be built on the farm within a 5-year timeframe from the date of granting. Once the shed is built and commissioned, phase 2 of the proposal commences and the applicant will begin exercising the land use consent for the wintering shed and also the phase 2 discharge permit.

The wintering shed will be used to winter the majority of the milking herd from June through till calving dates. Two primary scenarios would exist under the land use consent:

- All mixed age cows and R2 replacements are wintered in the sheds for the winter period totalling 1030-1050 cows.
- All mixed age cows are wintered in the sheds for the winter period totalling 770 and R2 replacements are grazed on fodder crop at WRO and return to the platform towards the end of July/beginning of August for calving.

The wintering shed will be located close to the dairy shed and constructed using the same concept drawings as the existing wintering sheds on the applicant's other dairy farms (Woldwide 1 and Woldwide 2). The concept design includes a central concrete feed lane, individual stalls for loafing, walking alleys with manure scrapers, a drop pit and a slurry effluent storage facility. Effluent is collected from the walking alleys and scraped to the collection point.

Effluent generation figures have been considered and included under the discharge permit application in Section 6.3.2 and are based on the volume of effluent generated by a housed animal 24 hours per day.

The wintering shed will be constructed as to comply with the setbacks listed in Rule 35 of the PSWLP namely, the feed pad/lot will not be located:

1) Within 50 meters from the nearest sub-surface drain, lake, river, artificial watercourse, modified watercourse, natural wetland or another feed pad
2) Within a microbial health protection zone of a drinking water supply site or within 250 meters of a drinking water supply
3) Within 200 meters of a place of general assembly or dwelling not on the same property

4) Within 20 meters of the boundary
5) Within a critical source area

The wintering shed will have a sealed and impermeable base and any liquid animal effluent or stormwater containing animal effluent discharging from the feed pad/lot is collected in a sealed animal effluent storage system which will be authorised under Rule 32B or Rule 32D in the future. Overland flow of stormwater or surface runoff from surrounding land is prevented
from entering the feed pad/lot.

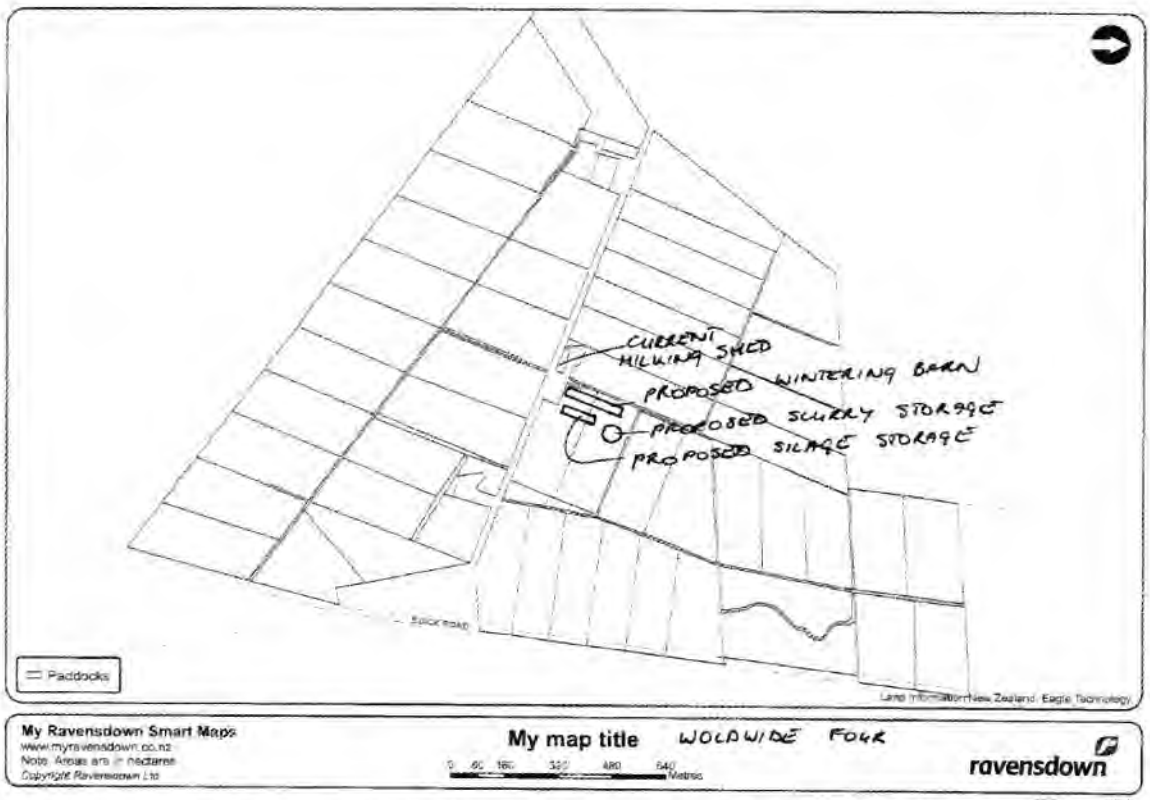


Figure 16: Proposed location of wintering shed and associated facilities

6.6 Land Use Consent Application for the use and maintenance of existing effluent storage facilities

Land use consent is required for the use of three existing effluent storage facilities (pump sump, concrete sludge bed bunker and effluent storage pond) upon the commencement of phase 1 of the proposal.

Concrete sludge bunker

The concrete bunker has a total volume of 100m^3 and is fully lined with concrete and sits partly above ground. The concrete bunker has no visible cracks or defects and there is no evidence that it is leaking or failing. The applicant will undertake a drop test on this structure by July 2019 during the off season.

A drop test prior to this date is not possible as the concrete bunker is a first collection point within the effluent system and effluent cannot be diverted elsewhere for the duration of the drop test.

The applicant proposes that a land use consent is issued requiring the concrete bunker to be drop tested by July 2019 and regularly thereafter. The consent sought would be for 20 years for the continued use and maintenance of this structure (equating for 5 years under phase 1 and 15 years under phase 2).

Pump sump

The pump sump has an approximate volume of 30m^3 and holds liquid FDE prior to discharge to land or transfer to the main effluent storage pond. The structure is essentially an in-ground concrete tank.

The applicant proposes that a land use consent is issued requiring the concrete bunker to be drop tested by July 2019 and regularly thereafter. The consent sought would be for 20 years for the continued use and maintenance of this structure (equating for 5 years under phase 1 and 15 years under phase 2).

Figure 17: Photograph of existing pump sump

Clay lined effluent storage pond

The existing 3,801m^3 effluent storage pond is not showing obvious signs of leakage which has been confirmed in the attached pond certification from Mr Murray Gardyne (Attachment H) A pond drop down test was completed and passed in July 2018 and is also attached in Attachment H. The proposed conditions below ensure a regular pond drop down testing regime is in place.

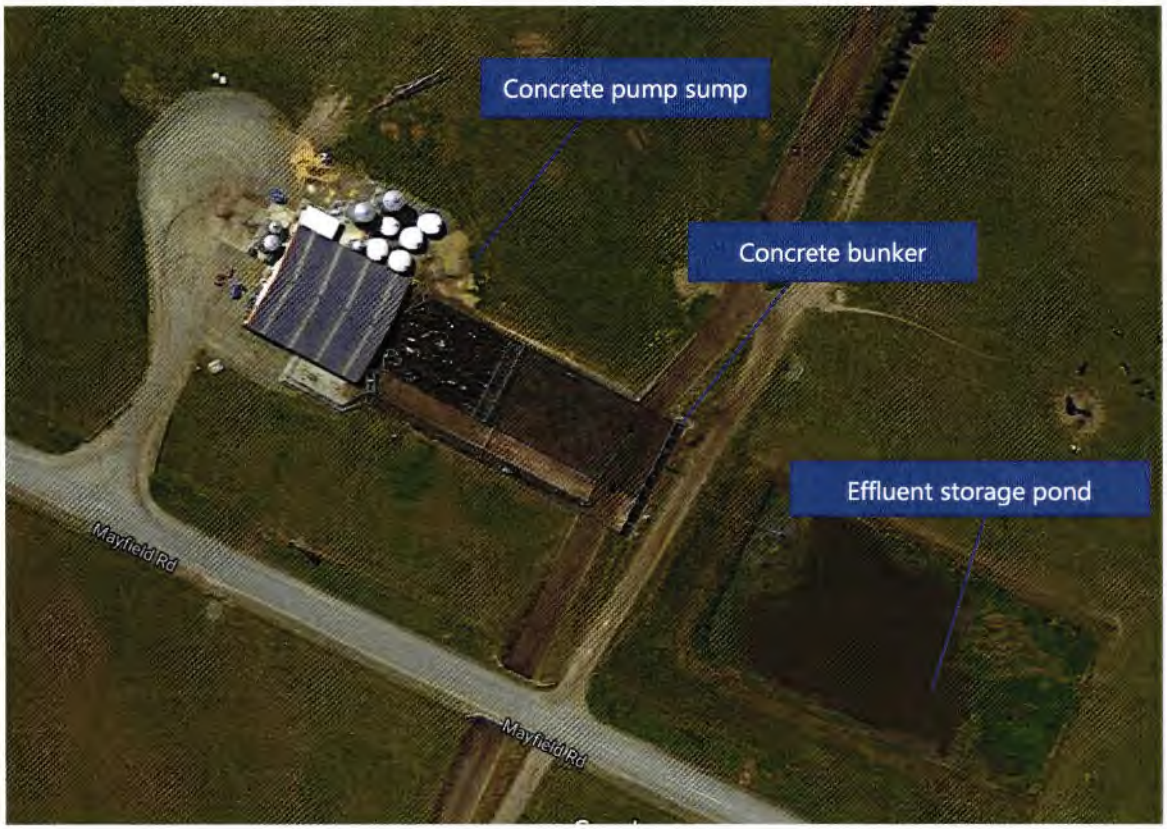


Figure 18: Layout plan of effluent storage facilities

Proposed consent conditions for the existing effluent storage facilities.

Proposed conditions relating to drop test requirements only are included below. The proposed conditions state that the concrete bunker and pump sump will be drop tested by 30 July 2019 and thereafter all three effluent storage facilities will be drop tested regularly. The applicant expects Council to impose other related conditions on these consents (not included below) in relation to the ongoing maintenance and contingencies measures should the ponds fail the drop tests.

1. *This consent authorises the maintenance and use of agricultural effluent storage facilities as described in the application for resource consent dated xxxxxx 2019, and any incidental discharge of agricultural effluent direction onto or into land from the facilities which is within the normal operating parameters of a drop down test as set out in Appendix XX. The effluent storage facilities described in the application are:*
    - *(a) An effluent storage bunker with capacity to store no more than 100 cubic meters of effluent*
    - *(b) An effluent storage pump sump with capacity to store no more than 30 cubic meters of effluent*
    - *(c) An effluent storage pond with capacity to store no more than 3,801 cubic meters of effluent.*

2. *By 30 July 2019, the consent holder shall demonstrate that the concrete bunker and pump sump described in Condition 1 (a) and (b)are structurally sound and fit for purpose by:*
   (a) obtaining written certification from a Suitably Qualified Person, in accordance with Appendix XX of this consent that the structures meet the relevant drop test criteria and
   (b) obtaining confirmation from a Suitably Qualified Person that the structures have no visible cracks, holes of defects that would allow effluent to leak from the structures.

3. *(a) By the 30 of August each year in XXXX, XXXX and XXXX the consent holder shall:*
   i. Obtain written certification from a Suitably Qualified person, in accordance with Appendix 2 of this consent that the structures meet the relevant pond drop test criteria of Appendix 2; and
   ii. Confirmation from the Suitably Qualified person that the structures have no visible cracks, holes or defects that would allow effluent to leak from the structures.
   (b) The certification required by conditions 2 and 3 shall be accompanied by photographs of the structures (date and time stamped) and be supplied to the Consent Authority within one month of receiving the certification.
   (c) The confirmation required by condition 5(a) and (b) shall be undertaken within the same month each year in XXXX, XXXX and XXXX.

7. DETAILS OF THE PROPOSAL FOR WW5

7.1 Overview of the proposal

Woldwide Five Limited will be undertaking an increase to the size of the milking platform and number of cows on farm in two phases. Phase 1 will continue for a maximum of five years from the date of granting of the land use consent which will be specified as a consent condition. Phase 2 will continue thereafter for the duration of the consents.

Phase 1:

- A land use consent for the farming activity to increase the size of the dairy platform by 70ha to convert a portion of Cochran's block to dairy platform and convert 45ha of Collies block to dairy platform
- The applicant will exercise existing discharge permit AUTH20157537-01 and water permit AUTH20157537-02 which permit the milking of up to 800 cows.
- A land use consent for the use of existing effluent storage facilities to hold effluent generated on the farm.

Phase 2:

- A land use consent for the farming activity to increase the size of the herd to 930 cows and continue to utilize the expanded dairy platform from phase 1.
- A land use consent for the construction of a 1050 cow wintering barn on the farm

- A discharge permit to discharge farm dairy effluent, underpass effluent, silage leachate and wintering shed slurry to land from the peak milking of 930 cows.
- A land use consent for the use and maintenance of existing effluent storage facilities to hold effluent generated on the farm.

7.2 Land use consent application for farming activity

A land use consent is sought for the proposed farming activity which we are determining includes all activities located on the landholding which are directly associated with the operation of the applicant's dairy farm for 365 days of the year. The proposed farming activity extends across the WW5 dairy platform and WRO, and accordingly, one land use consent is sought to legalise the activities on this land.

The proposed farming activity will occur in two phases. Phase 1 of the proposal is to add 73ha of an existing 136ha sheep farm named Cochran's block to the existing dairy platform on WW5 and add 45ha of Collies block. Cow numbers will be increased from current levels to maximum consented cow numbers under the current discharge permit. In order to facilitate phase 2 of the proposal, a 1050 cow wintering shed will be constructed on the dairy platform within a maximum 5 year timeframe which will allow for the increase of the herd size to 930 cows (from 800 cows). Under phase 2, intensive winter grazing will cease on the dairy platform. All mixed age stock will be wintered in the wintering sheds. R2 stock will either be wintered in the wintering sheds or at WRO.

Table 17: Farm areas and stocking rates for WW5 under the proposal

	TOTAL FARM AREA (HA)	EFFECTIVE AREA (HA)	STOCKING RATE
Existing	262	241	3.3
Proposed phase 1	335	311	2.1
Proposed phase 2	335	311	3.2

Overseer 6.3.0 has been used to describe the current farm system to create a baseline model for the existing land use (please see explanation of modelling scenario for Collies block in Section 3.2). The baseline model consists of one nutrient budget based on actual data from the applicants records to create three year average input values for the preceding three years since the farm was converted in 2015.

Overseer 6.3.0 has then been used to model the farm system under phase 1 to estimate nutrient outputs under the proposal. Nutrient inputs have been carefully considered to ensure viable farm systems are modelled.

Phase 2 has been modelled using **an example Overseer nutrient budget for WW5** to give an prediction of how the wintering shed can maintain and/or reduce nutrient losses when included in the farm system. The meaning of **an example Overseer nutrient budget** is that the model uses more assumptions and typical industry-wide input values due to the inherent uncertainties which exist modelling a farm system so much further into the future. This example model must only be viewed as an example, not representing the exact and absolute farm system the applicant proposes to implement in the future. We also note that Environment Southland consent staff have advised the applicant that a nutrient budget for phase 2 is not considered a requirement for this application, however the applicant has chosen to provide one to strengthen their proposal and to show that nutrient losses can be reduced to baseline levels.

Please refer to the Farm Scenario Plan in Attachment B for a full description of the baseline, proposed and winter barn example farm systems for the WW5 farm: Cochrans block, Collies block and WW5 platform. Overseer nutrient budgets have been prepared by Mark Crawford of Ravensdown who is a Certified Nutrient Management Adviser (CNMA). These Overseer budgets have been used to show the annual amount of nitrogen and phosphorus discharged from the farm.

The summary outputs for the **baseline model** are:

Table 18: Summary outputs for the baseline model

Land Use	Nitrogen Losses (total kg)	Nitrogen Losses (kg/ha/year)	Phosphorus Losses (total kg)	Phosphorus Losses (kg/ha/year)
Self-contained dairy unit	14,493	55	207	0.8
Sheep farm (73 ha)	1,389	18	30	0.4
Current combined	15,882	47	237	0.7

The summary outputs for **proposed phase 1** model are:

Table 19: Summary outputs for proposed phase 1 model

Land Use	Nitrogen Losses (total kg)	Nitrogen Losses (kg/ha/year)	Phosphorus Losses (total kg)	Phosphorus Losses (kg/ha/year)
Proposed phase 1	15,937	47	231	0.7

The summary outputs for the **winter barn example** model are:

Table 20: Summary outputs for winter barn example model

Land Use	Nitrogen Losses (total kg)	Nitrogen Losses (kg/ha/year)	Phosphorus Losses (total kg)	Phosphorus Losses (kg/ha/year)
Proposed phase 2	15,639	47	245	0.7

Overall, modelling of phase 1 of the application indicates that at a farm system/landholding level nitrogen losses are estimated to increase by 55 kg N/year and remain unchanged on a per hectare basis compared to the baseline. Phosphorus losses are estimated by Overseer to decrease by 7 kg P/year but remain the same on a per hectare basis compared to the baseline.

Overall, modelling of phase 2 (winter barn example) of the application indicates that at a farm system/landholding level nitrogen losses are estimated to reduce by 243 kg N/year and remain unchanged on a per hectare basis compared to the baseline. Phosphorus losses are estimated by Overseer to increase by 8 kg P/year and remain unchanged on a per hectare basis compared to the baseline.

The overall intention of the land use consent under phase 2 is to operate at a nitrogen loss level (predicted by Overseer) equal to or less than the nitrogen loss level outputs from the baseline model. Please see Section 8.3 for specific details on how we propose to condition nitrogen loss outputs in the land use consent to account for Overseer version changes.

7.3 Discharge permit application

Phase 1:
The applicant will be operating under the existing discharge permit AUTH- 20157537-01 under phase 1 of the proposal. This discharge permit allows for the milking of up to 800 cows and the discharge of Farm Dairy Effluent (FDE) via low rate irrigation and slurry tanker.

Our assessment is that AUTH-20157537-01 does not need to be amended for phase 1 as described in Section 5.3 of this report.

Phase 2:
A new discharge permit is sought for phase 2 of the proposal. A discharge permit is required to allow for the discharge of FDE from 930 cows, underpass effluent, silage pad leachate and wintering shed slurry from a maximum of 1050 cows.

The effluent generated in the wintering shed and held within the sludge bunker is more solid in nature than typical FDE and could be considered a sludge. The PSWLP provides for a very simple definition of sludge: "*The solid residues from effluent*". The PSWLP does not provide a definition for the term slurry. We have used an Agresearch document by Houlbrooke et al which has characterised and evaluated dairy manures and slurries. The following diagrams are excerpt from this report and indicates that barn slurry has an average of 8% dry matter which classifies it as liquid and effluent from herd homes has an average of 23% dry matter which classifies it as semi-solid.

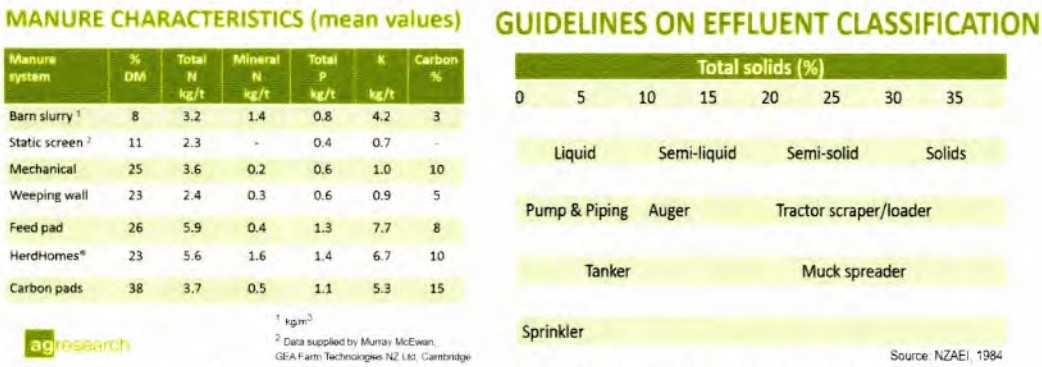


Figure 19: Effluent characteristics and classifications[19]

The applicant has taken a conservative approach and classifies effluent from the wintering sheds as slurry which means that the effluent generated in these sheds requires a discharge permit.

Table 21: Discharge Permit application summary

Discharge Permit Details:	
Replacement of consent no.	AUTH-20157537-01
Number of dairy cows	930
Type of milking shed	Rotary Shed
Winter milking?	No milking between 16 June and 31 July other than slipped cows
Wintering barn?	Yes – for 1050 cows
Feed pad/stand off pad?	Yes – three existing standoff pads not drained to effluent system
Other sources of effluent?	Stock underpass Silage leachate
Effluent treatment	FDE: Slurry scraped from yard to concrete sludge pit, liquids drained to liquid effluent storage facility Wintering Barn: scraped to slurry effluent storage facility Underpass effluent: directed to liquid effluent storage facility Silage leachate: directed to slurry effluent storage facility
Storage available (m^3)	Liquid: 180m^3 in existing tanks. Plus new effluent storage facility to meet DESC requirements. Slurry- 7,955m^3 from wintering shed, silage leachate and excess slurry from concrete sludge bunker. To be constructed under phase 2
Storage required (m^3)	Liquid: 335m^3 (as per attached dairy effluent storage calculator in Attachment E) Slurry: 7,955m^3 for wintering shed,
Disposal area (ha)	Liquid: 126ha Slurry: 133ha
Irrigator proposed	Pods, slurry tanker with umbillical

[19] Houlbrooke et al, Dairy Manures and Slurries: Characteristics and Evaluating current practice, AgResearch accessed at http://envirolink.govt.nz/assets/Envirolink/1204-ESRC15320Dairy20manures20and20slurries-characteristics20and20evaluating20current20practice20.pdf on 1 February 2019

Application rate and depth	Slurry tanker: 2.5mm depth per application Pods: Max application rate 1mm/hr, max depth 1mm. Combined 25mm application rate per year
Monitoring proposed	Groundwater every 6 months

7.3.1 *Effluent management system description*

Farm dairy effluent

- The dairy shed yard is mechanically scraped to collect slurry effluent which is scraped into a 125m^3 concrete bunker at the far end from the dairy yard. The yard has a downward gradient towards the milking shed to effectively allow solid and liquid effluent to be separated by gravity on the yard. The slurry effluent is stored in the above ground concrete bunker for a maximum of 4 weeks before it is applied to land using an on-site slurry tanker. Slurry is applied to the remainder of the farm outside the liquid effluent discharge area.

- The rotary platform and dairy shed is washed twice daily with a maximum of 3,000 L equating to 3 L/cow/day. This volume has been measured by the applicant and is accurate for the system on farm.

- Liquid effluent collected from the yard, dairy shed and underpass is pumped either directly out to the 126ha effluent discharge area using a combination of low rate pods and slurry tanker or stored in the existing and proposed liquid effluent storage tanks.

- The slurry tanker can apply effluent at a depth of 1.5-2.5mm per application and will be preferentially used when a lower soil moisture deficit exists. The low rate pods apply effluent at a maximum rate of 1mm/hr and can be used all year round provided an adequate soil moisture deficit exists.

7.3.2 *Storage*

Currently, effluent storage at the farm consists three primary storage areas:

- Liquid effluent from the washdown of the platform and rainwater on the yard is stored temporarily in a pump sump before it is pumped to the storage tanks.

- Liquid effluent will be stored in the six existing storage tanks plus a proposed additional facility and applied to land using a combination of the pods and slurry tanker.

- Yard slurry is stored in the 125m^3 concrete pit attached to the far end of the yard and applied to land using a slurry tanker on a monthly basis. Slurry collected during the first two weeks of June and during spring is stored with wintering shed slurry effluent.

- All wintering shed effluent is stored for the duration of winter in a new slurry effluent storage facility and applied to land from October through to May when soil moisture conditions are suitable.

Liquid effluent

The Dairy Effluent Storage Calculator (DESC) attached in Attachment E shows that **335m^3 of pumpable liquid storage is required** (90th percentile probability) to enable effective deferred irrigation for liquid FDE and underpass effluent (included in the other catchments section total 480m^2).

A condition of consent is required on the Discharge Permit (phase 2) to ensure that the new liquid effluent storage facility will be constructed of at least 335m^3 in volume.

Slurry effluent

The wintering shed is used for a maximum of 1050 cows for the entire winter period. During some seasons, the shed may only contain mixed age cows with the R2 cows remaining at WRO.

The wintering shed is used as a standoff pad during late Autumn and early spring as a measure to remove cows from pasture. The use of this facility as a standoff pad will change continually every season based on frequency and severity of adverse weather events and soil moisture levels. A conservative estimate is that the wintering shed could be used 24 hours per day for 45 days as a standoff pad.

The applicant has slurry storage available within the concrete bunker for yard scrapings. The applicant has the ability to empty the concrete bunker monthly using the on-site slurry tanker during the majority of the milking season. Slurry from the concrete bunker will preferentially be stored in the same facility as the wintering shed effluent during the first 15 days of June or during spring which is calculated above to equate to 195m^3.

Silage leachate is collected with the other slurry effluent. The silage pad is drained by a series of four drains along the length of the pad which can be diverted to storage or freshwater discharge depending on whether silage is stacked on this portion of the pad or not. Leachate volumes are therefore hard to calculate due to the changing nature of a silage stack with the pad completely empty for 3-4 months of the year and partially empty for another 2 months. A conservative estimate sees a catchment area of 800m^2 entering the slurry effluent facility based on 50% of average annual rainfall.

Below, a manual calculation has been used for slurry effluent including wintering shed effluent, slurry from the yard and silage pad leachate because the applicant wishes to provide storage for all of the slurry produced and does not wish for a model to discount storage volumes based on soil types.

Wintering shed: 1050 cows x 50 L/cow/day x 95 days = 4,988m^3 (includes June, July and August)

Wintering shed: 1050 cows x 50 L/cow/day x 45 days = 2,362m^3 (used as standoff pad)

Slurry from yard: 930 cows x 3 L/cow/day x 65 days = 181m^3

Silage pad leachate 800m^2 x 0.53m rainfall = 424m^3

Total required for slurry = 7,955m^3

A condition of consent is required on the Discharge Permit (phase 2) to ensure that the new slurry effluent storage facility will be constructed of at least 7,955m^3 in volume.

7.3.3 *Discharge Area*

The **liquid** effluent discharge area will be 126ha (115 ha with buffers) which is unchanged from the area approved under the existing discharge permit. Overseer reports state that 55ha is required to maintain N loading at less than 150 kg N/ha/year from effluent. Liquid effluent will be applied to land all year round as soil conditions permit safe application.

The **slurry** effluent discharge area includes the remainder of the milking platform (i.e. blocks/paddocks not in the approved liquid effluent discharge area) and totals approximately 133ha.

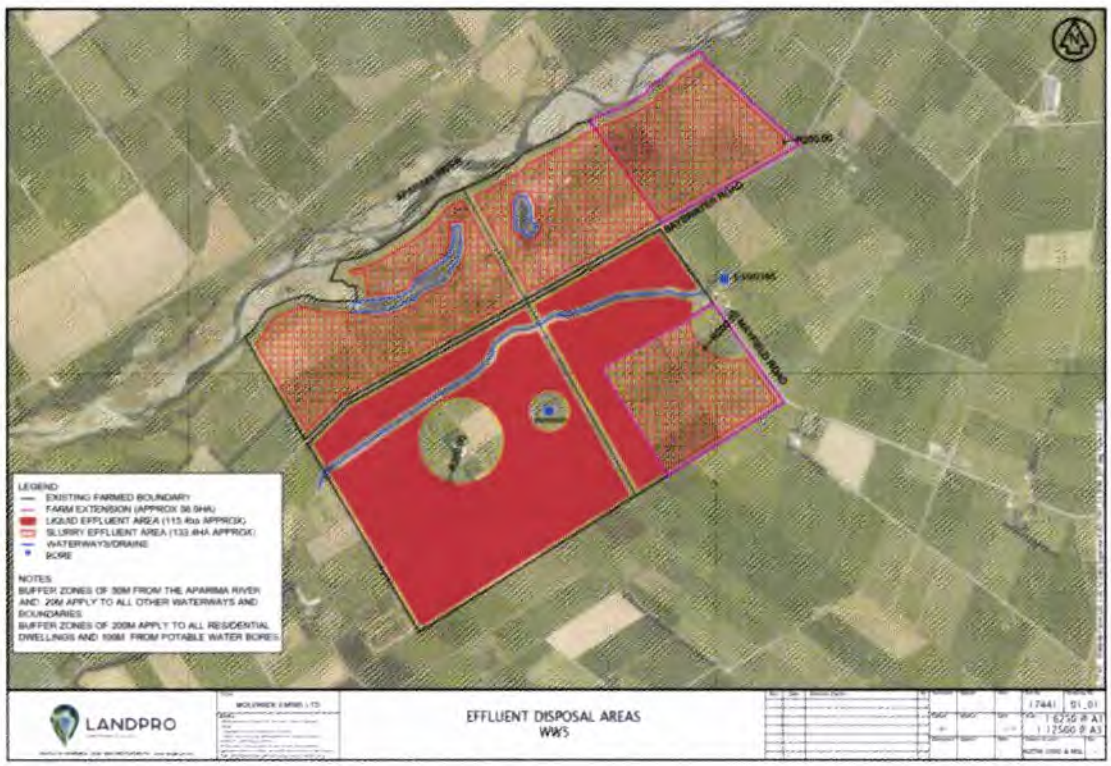


Figure 20: Effluent discharge area map for WW5

Effluent will not be applied within the following buffer zones as per standard discharge permit conditions:

- 20 m of any surface watercourse

- 100 m of any potable water abstraction point
- 20 m to any landholding boundary; and
- 200 m of any residential dwelling on a neighbouring property

In addition, the applicant will not discharge effluent where the soil has cracked.

7.3.4 *Discharge Method*

FDE will be applied to land using low rate pods and slurry tanker. Proposed application rates are:

- Slurry tanker: 2.5mm maximum depth per application. Application depths between 1.5mm and 2.5mm.

- Low rate pods: Maximum application rate 10mm/hr

7.3.5 *Standoff Pads*

There are three standoff pads on the property, left by the previous owner which have not been currently used. When fully constructed, each pad has a rotten rock base which a knap rock layer on top and covered with at least 500mm of bark chips.

Each pad will stand off mobs of about 100 cows, with a maximum of 120 cows held on any of the pads. Cows will be fed ad-lib using baleage in ring feeders.

Effluent will be stored in-situ in the bark and scraped after each season and applied to land in accordance with Rule 38 of the PSWLP.

The standoff pads will be constructed as to comply with the setbacks listed in Rule 35 of the PSWLP namely, the feed pad/lot will not be located:

1) Within 50 meters from the nearest sub-surface drain, lake, river, artificial watercourse, modified watercourse, natural wetland or another feed pad
2) Within a microbial health protection zone of a drinking water supply site or within 250 meters of a drinking water supply
3) Within 200 meters of a place of general assembly or dwelling not on the same property
4) Within 20 meters of the boundary
5) Within a critical source area

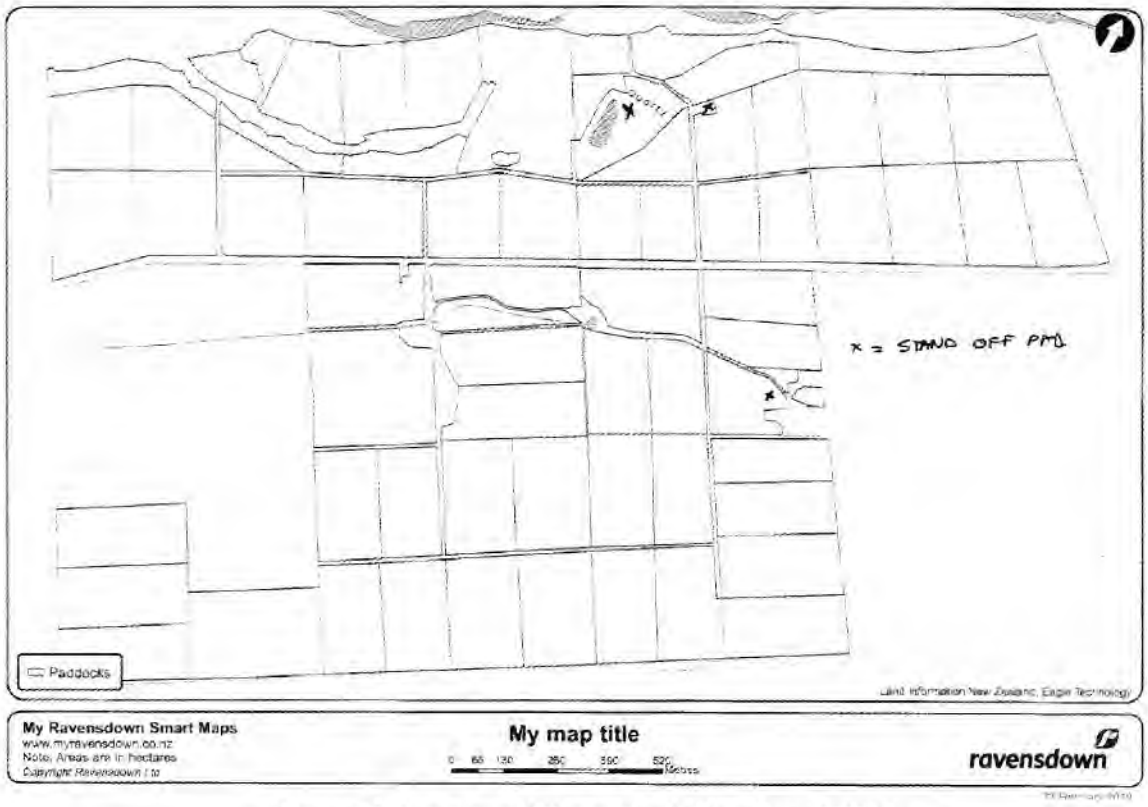


Figure 21: Location of three standoff pads on WW5

7.4 Water Permit Application

Phase 1:

The applicant will be operating under the existing water permit AUTH- 20157537-02 under phase 1 of the proposal. This water permit allows for the abstraction of 72,000 L/day of groundwater for 365 days of the year. This volume accounts for shed wash down water and stock drinking water for 800 cows at a rate of 90L/cow/day accounting for the fact that the yard is scraped not washed.

Phase 2:

A new water permit is sought for phase 2 of the proposal. A water permit is required to allow for the abstraction of groundwater for shed wash down water and stock drinking water from 1000 cows during the milking season, and the abstraction of stock drinking water during winter for 1000 cows in the wintering shed.

7.4.1 *Allocation*

The applicant will continue the proposed groundwater abstraction from bore D45/0345 located at NZTM2000 1219900E 4884030N and on Lot 1 DP12253.

The applicant is applying for the following volumes of groundwater:

Daily Volume= 100,000 L/day over the 300-day milking season (2 August – 31 May approx.)

Daily Volume= 75,000 L/day over the 65-day winter period (1 June – 1 August approx.)

Annual Volume = 34,875m^3

The proposed abstraction rate during the 300-day milking season of 100,000 L/day equates to a rate of take of 100 L/cow/day broken down as 25 L/cow/day for shed wash down water and 75 L/cow/day for stock drinking water for the 1000 cows on the property.

The proposed abstraction rate during the 65-day winter period of 75,000 L/day equates to a rate of 71 L/cow/day for the 1050 cows on the farm over the 65-day winter period.

The proposed abstraction is from the Upper Aparima groundwater zone which has a current allocation of 4% of the discretionary allocation specified in the RWPS and 7.2% of the discretionary allocation specified in the PSWLP

The groundwater abstraction represents an increase from the applicant's current abstraction volume to account for the additional cows on farm.

7.4.1 *Monitoring*

The groundwater abstraction will be monitored at the point of take to ensure compliance with the proposed abstraction volumes. There are 4 x 30,000 L freshwater storage tanks at the dairy shed to ensure the instantaneous rate of take is less than 2 L/sec.

7.5 Land Use Consent Application for Wintering Shed

The wintering shed will be built on the farm within a 5 year timeframe from the date of granting. Once the shed is built and commissioned, phase 2 of the proposal commences and the applicant will begin exercising the land use consent for the wintering shed and also the phase 2 discharge and water permits.

The wintering shed will be used to winter the majority of the milking herd from June through till calving dates. Two primary scenarios would exist under the land use consent:

- All mixed age cows and R2 replacements are wintered in the sheds for the winter period totalling 1030-1050 cows.
- All mixed age cows are wintered in the sheds for the winter period totalling 770 and R2 replacements are grazed on fodder crop at WRO and return to the platform towards the end of July/beginning of August for calving.

The wintering shed will be located close to the dairy shed and constructed using the same concept drawings as the existing wintering sheds on the applicant's other dairy farms (Woldwide 1 and Woldwide 2). The concept design includes a central concrete feed lane, individual stalls for loafing, walking alleys

with manure scrapers, a drop pit and a slurry effluent storage facility. Effluent is collected from the walking alleys and scraped to the collection point.

Effluent generation figures have been considered and included under the discharge permit application and are based on the volume of effluent generated by a housed animal 24 hours per day.

The wintering shed will be constructed as to comply with the setbacks listed in Rule 35 of the PSWLP namely, the feed pad/lot will not be located:

6) Within 50 meters from the nearest sub-surface drain, lake, river, artificial watercourse, modified watercourse, natural wetland or another feed pad
7) Within a microbial health protection zone of a drinking water supply site or within 250 meters of a drinking water supply
8) Within 200 meters of a place of general assembly or dwelling not on the same property
9) Within 20 meters of the boundary
10) Within a critical source area

The wintering shed will have a sealed and impermeable base and any liquid animal effluent or stormwater containing animal effluent discharging from the feed pad/lot is collected in a sealed animal effluent storage system which will be authorised under Rule 32B or Rule 32D in the future. Overland flow of stormwater or surface runoff from surrounding land is prevented
from entering the feed pad/lot.

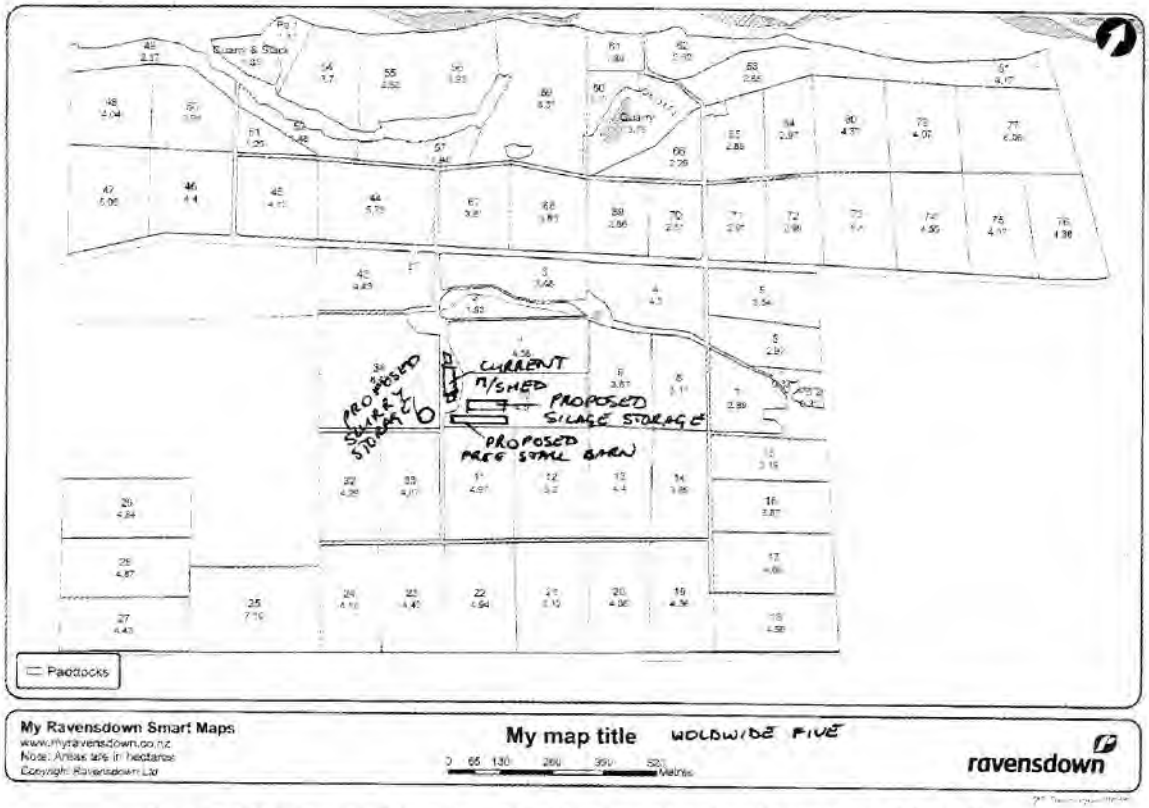


Figure 22: Proposed location of wintering shed and associated facilities

7.6 Land Use Consent Application for the use of an existing effluent storage facility

Land use consent is required for the use of one as existing concrete sludge bunker as a storage facility upon the commencement of phase 1 of the proposal.

Concrete sludge bunker

The concrete bunker has a total volume of 125m^3 and is fully lined with concrete and sits partly above ground. The concrete bunker has no visible cracks or defects and there is no evidence that it is leaking or failing. The applicant will undertake a drop test on this structure by July 2019 during the off season. A drop test prior to this date is not possible as the concrete bunker is a first collection point within the effluent system and effluent cannot be diverted elsewhere for the duration of the drop test.

The applicant proposes that a land use consent is issued requiring the concrete bunker to be drop tested by July 2019 and regularly thereafter. The consent sought would be for 20 years for the continued use and maintenance of this structure (equating for 5 years under phase 1 and 15 years under phase 2).

Figure 23: Layout plan of existing effluent storage facilities

Proposed consent conditions for the existing effluent storage facilities.

Proposed conditions relating to drop test requirements only are included below. The proposed conditions state that the concrete bunker will be drop tested by 30 July 2019 and thereafter will be drop tested regularly. The applicant expects Council to impose other related conditions on these consents in relation to the ongoing maintenance and contingencies measures should the ponds fail the drop tests.

1. *This consent authorises the maintenance and use of agricultural effluent storage facilities as described in the application for resource consent dated xxxxxx 2019, and any incidental discharge of agricultural effluent direction onto or into land from the facilities which is within the normal operating parameters of a drop down test as set out in Appendix XX. The effluent storage facilities described in the application are:*
    (a) An effluent storage bunker with capacity to store no more than 100 cubic meters of effluent

2. *By 30 July 2019, the consent holder shall demonstrate that the concrete bunker described in Condition 1 (a) is structurally sound and fit for purpose by:*
    (c) obtaining written certification from a Suitably Qualified Person, in accordance with Appendix XX of this consent that the structure meets the relevant drop test criteria and

(d) obtaining confirmation from a Suitably Qualified Person that the structure has no visible cracks, holes of defects that would allow effluent to leak from the structure.

3. *(a) By the 30 of August each year in XXXX, XXXX and XXXX the consent holder shall:*

i. Obtain written certification from a Suitably Qualified person, in accordance with Appendix 2 of this consent that the structure meets the relevant pond drop test criteria of Appendix 2; and

ii. Confirmation from the Suitably Qualified person that the structure has no visible cracks, holes or defects that would allow effluent to leak from the structure.

(b) The certification required by conditions 2 and 3 shall be accompanied by photographs of the structures (date and time stamped) and be supplied to the Consent Authority within one month of receiving the certification.

(c) The confirmation required by condition 5(a) and (b) shall be undertaken within the same month each year in XXXX, XXXX and XXXX.

8. DETAILS OF THE PROPOSAL FOR WRO

The land use consent applications for the farming activities for WW4 and WW5 seek consent for all activities located on the landholding which are directly associated with the operation of the respective dairy farms for 365 days of the year. A separate proposal, AEE and nutrient budget has been provided for WRO in Attachments F and G and should be referred to for specific details of the proposal.

The proposed farming activity for WW4 and WW5 includes the grazing of dry stock all year round at WRO. Dry stock includes R1 and R2 grazing, mating bull grazing and carry over cow grazing. In this respect, WRO is considered to be part of the landholding for WW4 and WW5 and the grazing of dry stock at WRO must be included in the respective land use consent applications.

WRO is also a separate and distinct landholding in its own right. WRO operates as a single business entity with an individual set of accounts and company structure. WRO therefore operates as an individual landholding as well as being part of the landholdings for the respective dairy farms. The other activities located on WRO which are not considered to form part of the respective farming activities for WW4 and WW5 include:

- Commercial pine plantation
- Rotten rock quarry operation
- Native bush block

Accordingly, consent is not sought for these activities and this application proposes that the resulting land use consents for WW4 and WW5 which refer to the land parcels on WRO specifically exclude restrictions, references or details regarding these activities which are not part of the farming activity. These activities are permitted activities under the PSWLP as they do not contravene Section 13(1), 14(2), 14(3) or 15(1) of the RMA as detailed in Rule 4 of the PSWLP.

When considering WRO as an individual landholding, the use of land at WRO for the current and proposed activities in their entirety would otherwise be a **permitted activity** under Rule 20(a) of the PSWLP:

- There is no dairy platform on the landholding
- There is no associated discharge permit which specifies a maximum number of cows
- A FEMP in accordance with Appendix N of the PSWLP has been prepared for the landholding and implemented (see attached).
- The landholding contains no more than 100ha of intensive winter grazing
- The good management practices for intensive winter grazing specified in Rule 20(a)(iii)(3) have been implemented and detailed in the FEMP.
- A vegetated strip including stock inclusion will be in place adjacent to any water bodies in accordance with the setbacks in Rule 20(a)(iii)(4-6)

The applicant accepts that the activities at WRO which form part of the farming activity on WW4 and WW5 require land use consent. However, it is important and vital to note that when viewing WRO as

an individual landholding then the current and proposed activities would otherwise be a permitted activity under the PSWLP and would remain so at any point in the future as long as they comply with any requirements, conditions and permissions specified in the RMA, detailed in Rule 20(a) and any applicable regional plans.

The applicant has included WRO in the application as part of the farming activity and landholding for WW4 and WW5 at the request of Environment Southland staff in Attachments F and G, however the matter of whether it should be included in the respective farming activity and the landholdings for WW4 and WW5 is a matter which the applicant wishes to thoroughly discuss and assess at the upcoming hearing.

9. ASSESSMENT OF ENVIRONMENTAL EFFECTS FOR PROPOSAL ON WW4

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.

This assessment of environmental effects (AEE) is broken into two parts: a broad scale/cumulative effects assessment and an assessment of the individual activities within the individual management blocks for both phase 1 and phase 2 individually.

9.1 Broad scale/cumulative effects assessment

The AEE below concludes that the implementation of targeted mitigation measures on-farm will ensure that adverse effects on water quality from activities within the proposal are either avoided or mitigated to levels that are consistent with the relevant regional plan water quality objectives whilst still maintaining a viable, efficient and profitable farm system. The AEE is written in a holistic way and does not solely refer and relate to Overseer outputs because Overseer only models nitrogen and phosphorus lost from the farm to water below the root zone and overland beyond the farm boundary. Overseer does not model nutrient loss into final receiving groundwater or surface water bodies. The amount of these nutrients which may end up in these water bodies depends on a wide range of different factors often collectively referred to as attenuation rates. Similarly, the catchment hydrology and characteristics are critical in affecting the resultant concentration and/or mass loadings of nutrients and other contaminants in water bodies.[20]

This broad scale/cumulative effects assessment includes a catchment scale assessment in relation to attenuation and hydrology processes, characteristics of the catchment and consideration of the state of the receiving environment. This assessment also assesses the proposed activity in its entirety against the actual existing environment, i.e. not using a permitted or consented baseline approach. The term

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

"practicable minimum" is used frequently and is used to portray the fact that any dairy farming activity results in nutrient losses to the environment of some scale and that the applicant has reduced nutrient losses as far as they are practically able to do so given available mitigations, innovations and technology whilst still maintaining an efficient and profitable farm system that meets their social and economic needs. The term "practicable minimum" does not refer to an effect on the environment. The summary to this AEE concludes that water quality will be maintained in the receiving environments given the proposed mitigations, the characteristics of the catchment and the predicted changes to water quality as a result of the proposed activity.

Attenuation

Section 3.4 includes a map of the denitrification potential across the subject catchment. The map shows that the area of the subject landholding has low to very low denitrification with pockets of the lower catchment having higher denitrification potential. Broadly, this means that risk of a greater proportion of the modelled N losses from below the root zone ending up in groundwater and eventually surface water bodies is high, especially on the free draining Tuatapere soils. The applicant has recognised this risk and sited high contaminant loss activities (particularly high N loss activities such as intensive winter grazing and discharge of slurry and liquid effluent) on the lower risk Braxton soils which are more poorly drained with less vulnerability to nitrogen leaching and therefore less risk of N loss below the root zone and through the soil profile. The siting of these activities on lower risk soils has been a conscious decision by the applicant for a number of years and has therefore reduced N leaching risk and is included in the nutrient budgets attached to the application... The Braxton soils are known to be prone to cracking however the attached report in Attachment I from Environment Southland Scientist, Michael Killick confirms that the Braxton soils in this specific location have not shown evidence of cracking thereby reducing potential risks of contaminant loss during dry periods from these soils.

The proposed inclusion of a wintering shed is one of the most effective and significant mitigation measures available for NZ dairy farms for reducing effects of N leaching beyond the root zone through to groundwater and surface water receiving bodies. The wintering shed allows the applicant to remove cows from pasture and hold them inside during high risk drainage periods. In doing so, N deposited via urine and dung patches is collected within the effluent system and can be redistributed to pasture evenly, at a lower rate and timed to avoid high risk drainage periods. This significantly reduces the risk of N leaching through the soil profile as it is preferentially used in the root zone. As a result, the mitigation measures put forward by the applicant, as detailed in the AEE tables below, will reduce the amounts of nitrogen that drain to groundwater within the Waimatuku GMZ and the Aparima GMZ to a practicable minimum and effects on these water bodies will result in the maintenance of water quality.

Groundwater nitrate concentrations are of particular concern to human health. The risk of bottle fed infants getting 'blue baby syndrome' from consuming high nitrate nitrogen water is widely accepted and is the primary driver for the current NZ Drinking water standard for nitrate nitrogen. The proposal sees a reduction in drainage N concentrations at a block level predicted by Overseer, particularly with the removal of intensive winter grazing from the Gladfield block. Other studies indicate that other

contaminants, or dietary nitrate sources, may also play a role in the syndrome.[21] A recent Danish study suggested a link between groundwater nitrates and bowel cancer. The study found that those people exposed to nitrate levels in excess of 9.3 mg/L (NZ drinking water standard is 11.3 mg/L) had a 15% increased carcinogenic risk. In December 2018, Agriview NZ published an article attempting to correlate the Danish study within the New Zealand agricultural context. The article noted that "most of the international research conducted throughout the past four decades on this topic has found either a negligible or only slight correlation between nitrates in drinking water and colon/bowel cancer rates" and also that "the idea that colon cancer is heavily influenced by diet surfaces in many of the studies evaluating its link to the intake of nitrate through drinking water." The article further noted "Ian Shaw, professor of toxicology at the University of Canterbury, says it is this very factor that makes the associations between water nitrate and colon cancer unconvincing:

"In my opinion nitrate is associated with colon cancer because it can be converted to nitrite by gut bacteria and form nitrosamines with dietary amino compounds. Nitrosamines are profound carcinogens. Links with water nitrate would, therefore, not be definitive because other components of the diet would be necessary to facilitate carcinogenesis. If exposure to an appropriate dietary mixture, plus the right bacterial species in the microbiome do not coincide carcinogenesis will not occur. This is a complex scenario that cannot be attributed to a single exposure to a single chemical."

In other words, attributing high colon cancer rates to nitrates in drinking water would be oversimplifying things to a considerable level. One must consider the variations of diet and lifestyle also considered potential factors for increasing colon cancer risk, and this is something the Danish study failed to do."[22]

In summary, the evidence about the current state of nitrate nitrogen concentrations in groundwater in this area and the Overseer modelling that strongly indicates that drainage nitrogen concentrations at the level predicted by Overseer will not have a significant adverse effect on actual existing groundwater quality.

Phosphorus, Sediment and Microbial losses

The loss of P, sediment and faecal indicator microorganisms may enter surface water bodies via artificial drainage channels via fertiliser application, intensive winter grazing activities, effluent application or by the grazing of animals during high drainage periods (such as late autumn and mid-spring). The AEE below has identified specific good management practices (GMPs) and further mitigations required to mitigate against losses of contaminants via artificial drainage pathways from these specific activities to a practicable minimum.

Another factor to consider is the risk of P, sediment and microbial losses directly or indirectly to surface water bodies within this catchment via overland flow – primarily occurring from runoff from laneways

[21] https://en.wikipedia.org/wiki/Blue_baby_syndrome accessed 8 February 2019

[22] https://www.agriview.nz/forum/2018/12/11/investigating-the-nitrate-colon-cancer-link accessed 8 February 2019

and via critical source areas. Overall losses of these contaminants directly to waterways is considered low risk in this catchment and on the applicants' property due to the flat topography. Overseer gives an estimate of what P may be lost directly to the environment from laneways, waterway crossings and critical source areas in the 'other sources' output within the model. The model does not consider sediment and microbial losses, however as all three contaminants typically enter surface water bodies via the same transport pathways then P loss modelled by Overseer can be used as a proxy for estimating sediment and microbial losses to the environment also.

The problem with the 'other sources' output estimated by Overseer is that it is not spatially explicit and does not account for site-specific mitigation measures which may be in place on a farm to mitigate losses directly to waterways from these laneways and critical source areas. The nutrient budgets provided with this application model an increase in total P loss of 30kg over the whole farm between the baseline and the winter barn example model. The key driver for this increase in P loss is from 'other sources' as classified in Overseer and equates for about 50% of total P losses. Overseer is known to assume 30% of P deposited on a lane is lost directly to water[23]. Therefore, when a dairy farm is expanded such as in the proposal, more lanes generally need to be constructed, and the model then assumes that additional phosphorus is lost from those lanes.

GMPs and mitigation measures to reduce P, sediment and microbial losses

As part of the proposed dairy expansion, the applicant will be constructing new lanes and new culvert crossings to allow access from the current dairy platform to the new block. The applicant will be implementing specific critical source area GMPs which are detailed in the FEMP that will seek to minimise potential P loss via overland flow from these new lanes and/or culvert crossings such as the fencing of all waterways, establishing vegetated riparian margins, contouring lanes to direct runoff to pasture, installing bargeboards on culvert crossings and locating laneways away from waterways. The implementation of these GMPs by the applicant are not rewarded by Overseer as the model is not spatially explicit as explained above.

The following calculations have been adapted from workings by Mo Topham, Farmwise Consultant (CNMA) and seek to explain how actual P losses (and sediment and microbial losses by proxy) have been reduced to a practicable minimum and are likely to be lower than those modelled by Overseer due to the implementation of these GMPs which are not rewarded in Overseer. According to a Massey University publication[24], a lactating cow consumes 0.4kg P per week or 16.6 kg P per milking season. Of this amount consumed 66% or 10.9kg is estimated to be deposited as dung. Assuming cows spend 2 hours per day (or 8% of their day) on the lanes then 0.87 kg P of this dung deposited would be deposited on lanes within the platform. Overseer assumes that 30% of the P in this dung is then lost directly to

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

[24] https://www.massey.ac.nz/~flrc/shortcourses/IntroNotes&MastTest.pdf accessed 24 January 2019

waterways. Research indicates that there is opportunity to mitigate these losses as described above which are likely to reduce P loss by 38% to 58% beyond that modelled by Overseer[25].

In the examples below, the baseline has been assessed to be currently implementing laneway P loss management at GMP level at the lower end of effectiveness estimates (38% reduction). Under the winter barn example, laneway P loss GMP will be improved and extended by:

- The addition of 1.5km of vegetated buffer zones around riparian areas, including fences around waterways which will ensure that dung deposited on the laneway near where it crosses a waterway will be captured and filtered by the vegetation.
- New culvert crossings (constructed under permitted activity rules) with appropriate cut-outs to direct runoff to pasture primarily. The secondary area of filtration and capture is the vegetated riparian buffer zone
- Contouring of the new lane along its entire length to direct runoff to pasture
- Locating the new lane perpendicular to the two waterways on the new block to maximise buffer distance between the new lane and surface water bodies

The implementation of these expanded and improved GMPs has been assessed to conservatively add a further 10% improvement (up to a total of 48% reduction).

Under the baseline:

850 cows x 10.9kg P x 0.08 x 0.3 = 222kg P

222 kg P x 38% effectiveness = 84.36 kg P mitigation with current laneway mitigations.

Under the winter barn example:

1000 cows x 10.9kg P x 0.08 x 0.3 = 261 kg P

261 x 48% effectiveness = 125 kg P mitigation with current, improved and extended laneway mitigations.

[25] https://www.mfe.govt.nz/sites/default/files/assessment-strategies-mitigate-impact-loss-contaminants-agricultural-land-freshwater_0.pdf accessed 24 January 2019

The baseline Overseer model estimates total P losses at 338kg P - 84.36 kg P of mitigations = 253 kg P revised Overseer P loss to water.

The phase 2 Overseer model estimates total P losses at 368 kg P – 125kg P of mitigations = 243 kg P revised Overseer P loss to water.

Therefore, P losses will be less than those predicted by the Overseer models appended to this application. P losses are likely to be 10kg P less under phase 2 than the baseline accounting for the lack of reward in Overseer for laneway mitigations which will be implemented under both scenarios to differing degrees of effectiveness. P losses have therefore been reduced to the practicable minimum under the proposal. The implementation of targeted GMPs and mitigation measures should result in no adverse effects on the environment

Hydrology of the catchment

Section 4.5 described the high level of connectivity between both the Waimatuku GMZ and the Upper Aparima GMZ with surface water bodies. This connectivity provides for a large and steady discharge of groundwater to surface water bodies with a high correlation between rainfall, stream flow, soil moisture and groundwater levels.

The Waimatuku Stream is also recharged via the Bayswater Bog which is a 210 hectare raised peat wetland. The Bayswater Bog derives its water and nutrients solely via rainfall over the surface area and discharges flow to the Waimatuku Stream and the Aparima River. This means that surface water from the land surrounding the raised peat wetland is diverted around the bog and doesn't flow through it towards the Waimatuku Stream. [26]

Catchment Characteristics

The WW4 farm sits within both the Aparima River and Waimatuku Stream catchments. The Aparima River is a braided gravel bed river and for the majority of its reach, drains farmland of the Southland plains and discharges to the Jacobs River Estuary. According to a 2014 Aqualinc Report[27], the Aparima River catchment is 156,474ha comprised of 102 dairy farms, 10 forestry blocks and 233 sheep and beef farms. The Waimatuku Stream is different to many Southland streams in the fact that its headwaters are fed by a large swamp and is fed along its reach by springs. The Waimatuku Stream underwent significant river bed works in the 1920's to straighten the bed which has created uniform bank margins

[26] Robertson, C. 1983. Hydrological Characteristics of Bayswater Peat Bog. Southland Catchment Board Publication No. 95

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

and moved the river bed away from swampy areas in the catchment and stopped the meandering nature of the river[28].

Nutrient Load to the Jacobs River Estuary

We have used some of the workings in this report to illustrate how nutrient load can be reduced within a water body. The calculations below are purely an illustration to demonstrate potential nutrient load reductions and are based on significant assumptions and generalised workings and should not be treated as absolute figures in the context of this application.

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

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

The table estimates the total source load within the catchment at 2133 T N/year undergoing attenuation to result in an estimated 1300 T N/year as a nutrient load within the receiving waters at the Jacobs River Estuary.

Table 22: Estimated loads of nitrogen and phosphorus in the eight study catchments[29]

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

[28] https://www.lawa.org.nz/explore-data/southland-region/water-quantity/surface-water-zones/waimatuku-surface-water-zone/ accessed 4 February 2019

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

Aqualinc further estimates that in the Jacobs River Estuary catchment, dairy farming contributes 50% of nitrogen load and 64% of phosphorus load. In the context of WW4, a quarter of the farm is within this catchment and therefore may contribute 1,781 kg N to this receiving water based on the Overseer modelling and the attenuation rate from Table 22 above. Our modelling shows that WW4 may contribute 52 kg P to receiving waters in this catchment including attenuation.

The report then estimated how much these loads may reduce if mitigation scenarios are imposed on only dairy farms within the catchment. For the Jacobs River Estuary catchment, N could be reduced by 18% and P reduced by 31% under the full suite of mitigations (M3).

Table 23: Estimated reductions in the agricultural source loads under three levels of mitigation for all dairy farms in the catchment[30]

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

The full suite of mitigations assessed by Aqualinc includes:

Table 24: Description of mitigations assumed to apply under each mitigation level[31]

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

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

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

In the context of WW4, and according to the table above, the farm is currently operating at M3 level excluding the provision of wetlands which is not practical on the property. The mitigations proposed in the application are more specific, comprehensive and likely to be more effective at reducing N, P, sediment and microbial contaminant losses compared to M3 level. Our Overseer modelling showed approximately a 4.5% reduction in overall N losses with the implementation of the improved GMPs and mitigation measures and an estimated 2% reduction in overall P losses using calculations of GMP effectiveness outside of Overseer. Using these estimates, then the proposed WW4 farm may reduce its contribution to nutrient load within this catchment by a further 89kg N/year and 1 kg P/year with the implementation of the proposal in its entirety.

Nutrient load information is difficult to find on the smaller 6,138 ha Waimatuku catchment. The catchment characteristics are similar, with possibly a greater percentage of the catchment developed and farmed as either dairy land or sheep and beef farms. Total nutrient load will be smaller than the Jacobs River Estuary catchment but the principles of a reduction in nutrient load to the receiving water bodies will apply equally to this catchment. Approximately 312ha of WW4 is contained within the Waimatuku catchment which represents 5% of the land area of the catchment. This is in comparison to the section of the farm within the Aparima catchment which represents 0.06% of the catchment area. The portion of WW4 in the Waimatuku catchment may contribute roughly 5,343 kg N and 155 kg P. The implementation of the proposed mitigation measures and further refinement of the GMPs within the application will reduce this contributing load to the receiving waters by 240 kg N (4.5% reduction) and by 6 kg P (2% reduction) at the minimum.

As the figures above show, the applicant's operation represents a small proportion of the total Aparima River catchment and therefore contributes a small proportionate amount of total nutrient load to the Aparima River (approximately 0.1%). The applicant's operation represents a larger portion of the Waimatuku Stream catchment and will therefore contribute a larger proportion of total nutrient load to this water body. Currently the applicant is operating their dairy farms under restrictions imposed on the discharge activity only and there is no capping or restriction on the amount of nutrients "lost" to the environment contributing to the nutrient load in the receiving waters. Under the proposal, the applicant volunteers both an ongoing restriction on the level of nitrogen outputs modelled by Overseer

and the ongoing implementation of specific GMPs and mitigation measures. The result of long term restrictions on the applicant as an operator is that they will be unable to further increase their contribution to contaminant load within either of the receiving water catchments. The Aqualinc report discussed above concluded that if mitigations were implemented on all farms within the catchment, not just dairy farms, then both N and P loads would decrease even more significantly to 30% for N and 39% for P. Therefore, in time, as other operators in the catchment are restricted in the same manner then there is an expectation that overall nutrient loads will reduce which will further improve water quality.

Nutrient Concentrations

As described above, the proposal will see a 4.5% and 2% reduction in the applicant's contribution to nitrogen and phosphorus load respectively for both the Aparima River and Waimatuku Stream catchments. A reduction in the long-term average concentration of these nutrients in these waterways is highly likely. Section 4.1 and 4.2 of this report detailed the median concentration of nutrients within both the Aparaima River and Waimatuku Stream between 2009 and 2017. For example, WW4 contributes in the vicinity of 0.1% of the nutrient load to the Aparima catchment and the proposal is likely to result in a 5% improvement to nutrient load. Nutrient concentrations are then likely to follow suit and result in a 0.005% improvement to median nutrient concentrations in the Aparima River catchment. The median concentrations would then reduce by such a miniscule amount that the reduction in nutrient concentration would be unlikely to show in water quality testing or show a reduction in water quality effects within this catchment on a year end basis. The applicant's contribution to the Waimatuku Stream total nutrient load is proportionally larger. Therefore, nutrient concentration reductions based on the mitigation measures in the proposal may be discernible in water quality testing and there may be a more measured improvement in water quality within the Waimatuku Stream. As both receiving waters are showing signs of water quality degradation, it can be concluded that the proposal is likely to at a minimum maintain water quality, and at best, marginally enhance water quality on a long-term basis.

This illustration shows that the applicants operation contributes small proportions of the total nutrients to the receiving waters. Improvements made under the proposal are likely to reduce total nutrient load and nutrient concentration but in isolation from other farms will only have an extremely small impact on long-term water quality. This highlights the importance of catchment wide implementation of water quality mitigation measures and the ongoing restriction on the applicant's operation in accordance with nutrient output limits to give certainty that water quality will not be further degraded in the long term.

Summary

The proposal will result in a reduction in P, N, sediment and faecal indicator organisms lost to the environment and a concurrent reduction in the resulting concentration of these 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 the existing trends of improving water quality.

9.2 Overseer Modelling for WW4

Overseer models have been included to support this application at the request of Environment Southland as it is their current preference to have Overseer models to guide an assessment of the overall proposal. Overseer nutrient budgets for the proposed landholding need to be provided by May 2019 according to Appendix N of the PSWLP.

The baseline Overseer model is an accurate description of the applicant's farm system averaged over the preceding five years. All inputs into the model have been taken from five years of farm records and/or accounts and are actual figures and therefore fairly represent the scale of the farm system as it has been operating since 2013.

The proposed phase 1 model is a predictive model which estimates inputs based on what is planned to happen for the next five years.

The example phase 2 model is also a predictive model which estimates inputs based on what is planned to happen at least five years in the future. This example model uses more assumptions and typical industry-wide input values due to the inherent uncertainties which exist modelling a farm system so much further into the future. This example model must only be viewed as an example, not representing the exact and absolute farm system the applicant proposes to implement in the future. We also note that Environment Southland consent staff have advised the applicant that a nutrient budget for phase 2 is not considered a requirement for this application, however the applicant has chosen to provide one to strengthen their proposal and to show that nutrient losses can be reduced to baseline levels.

In recent months, 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[32] and Overseer Ltd's review contracted to Enfocus titled Using Overseer in Water Management Planning.[33] 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 N 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 improvement in N 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 in light of the fact that the Resource Management Act is an effects-based piece of legislation.

The applicant requests that the land use consents for phase 1 and 2 include a restriction on the nitrogen output from the baseline (current combined) Overseer model. An example condition would be:

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

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

X	(a) The subject land shall only be used in a manner such that when modelled with the current version of OVERSEER, the OVERSEER estimated losses of N to water shall not exceed the Nitrogen Baseline (current combined). The determination of compliance with this condition will be made using the modelled N loss from the most recent reporting year. (b) The Nitrogen Baseline means the OVERSEER estimated N loss to water using the current version of OVERSEER using (as far as possible) the original OVERSEER input file information provided with the application for consent *dated February 2019* to demonstrate the long-term baseline N loss to water from the consented activity.	This condition essentially provides a compliance limit, which is assessed based on the baseline file provided in the application. The condition ensures that version changes in Overseer are accounted for.

This application proposes that there are no P output loss figure limits imposed as a consent condition. The reason being is that Overseer models farm system P losses at a block scale based on topography, land use, soil type and climate. The calibrations within Overseer for phosphorus are not spatially explicit and although assume good management practice around critical source areas, do not reward spatially specific mitigations. It is therefore difficult for users of Overseer/consent holders to lower P output figures by implementing specific mitigation measures because the modelled P loss output would not be able to accurately reflect these initiatives. The GMPs detailed in the FEMP relate in detail to mitigating P, sediment and microbial losses and the application details further mitigation measures which will be implemented under the proposal. Imposing a requirement to implement these GMPs and mitigations measures is a meaningful and effective way of managing the risk of P loss to water.

The applicant accepts that the resulting land use consents for phase 1 and 2 will need some restrictions on inputs to ensure there is certainty over the scale of the activity and of the implementation of the mitigations which are crucial to the proposal only as opposed to determining the nature of the farm system. The applicant suggests inputs from the nutrient budget be inserted into the consent conditions for the following matters:

- Land area to be used as WW4 milking platform and land area to be used as Gladfield block
- Liquid effluent discharge area
- Slurry effluent discharge area
- Peak cow numbers milked
- Minimum and maximum number of cows housed in wintering barns (this restriction in effect controls the number of cows wintered off site)

Overseer is an incredibly useful tool to be able to understand the nutrient interactions of a farm system based on soil properties, rainfall, drainage and feed requirements. The output from the model gives an indication of how much nutrient may be lost beyond the root zone. The model does not tell us what the environmental impact of these losses is likely to be. 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. The assessment in Sections 9.3 and 9.4 attempts to show how the applicant has assessed the suitability of individual activities within the proposal against likely effects, available mitigations and likely outcome in terms of whether effects are likely to be avoided, mitigated or both.

9.3 AEE for the farming activity under phase 1 of the proposal on WW4

Section 3.1 of this report described the existing environment on the area of the proposed WW4 dairy platform and Gladfield. These activities are currently occurring as either permitted activities or consented activities under current and enduring resource consents. Policy 39 of the PSWLP directs an assessment of the adverse effects from the activity as a whole, where the permitted baseline cannot be used to justify an existing level of effects or used to justify the effects of a proposal.

The assessment below assesses the farming activity in its entirety located on the proposed WW4 dairy platform and Gladfield block and doesn't use a permitted baseline approach to the assessment. This assessment under Section 8.1 is restricted to the proposed activity under phase 1 of the proposal. Activities on WRO are assessed in an attached document in Attachment F.

Table 25: Assessment of effects at activity level for phase 1 on WW4

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
Capital fertiliser applications during conversion of 63ha of sheep land to dairy farming land	The phase 1 Overseer model does not include capital fertiliser applications because it is based on a long term average farm system operating in equilibrium. Therefore N and P losses as result of capital fertiliser applications over the conversion period may be higher than modelled by Overseer. Capital fertiliser applications will apply larger quantities of N, P, K and S to land in order to increase fertility. These applications of larger quantities of nutrients have the potential to result in losses to the environment if applied at rates which exceed the plants ability to utilise these applied nutrients. Excess applied N	Capital fertiliser application timings avoid high drainage periods such as late autumn and winter and periods when soil temperature is less than 7 degrees to mitigate against excess N leaching through the soil profile. All other fertiliser applications will use a little and often approach to avoid the application of excess nutrients which cannot be utilised. Regular soil testing to guide capital fertiliser requirements to avoid the application of excess N and P which cannot be used for plant uptake to mitigate against losses via artificial drainage.	Capital fertiliser applications will only be done as required by the latest soil test results from the Cochrans block and will be undertaken where P, K or S levels are below agronomical optimum levels. P = 20-40 K = 6-10 S= 10-12 Capital P fertiliser applications will be applied at a maximum of 100kg P/ha which may require P fertiliser applications to be split.	Capital fertiliser applications are only undertaken where there is a nutrient deficit and are done at a rate which meets this deficit and avoids the application of excess nutrients. There is a low risks of adverse effects eventuating as application will meet pasture demand. The fertiliser regime described in the nutrient budgets will be the default fertiliser regime and capital fertiliser applications will only be done during the early phase of the land conversion and completed using GMP principles and in according to mitigation measures which should adequately mitigate adverse effects.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	is likely to be lost to water bodies via nutrient leaching and artificial drainage channels on both Braxton and Tuatapere soils. Excess applied P is likely to be lost to water bodies via overland flow on Braxton soils only. Excess N and P in water bodies may lead to water quality degradation resulting in ecological stresses on aquatic life and human health consequences such as blue baby syndrome.			
Cultivation of new pastures on new 63ha block	Short term increase in potential sediment, microbial and phosphorus losses to the environment which can cause ecological stresses on plants and animals due to sedimentation, algae blooms and water temperature increases in waterways and estuaries	Re-sow bare paddocks as soon as possible Use buffer zones around critical source areas and use direct drilling if possible. Cultivation will be undertaken to meet permitted activity criteria in	Further mitigations not required as land is flat which reduces the risk of overland flow of sediment and phosphorus when cultivating land. Riparian buffer zones will be installed with stock fencing and vegetated filter areas .	Adverse effects should be adequately avoided as this is a low risk activity in this location. GMPs provide adequate mitigation of effects.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
		Rule 25(a) of the PSWLP maintaining a 5 meter buffer zone		
Construction of new lanes on new 63ha block	New laneways create high risk areas for sediment, microbial and P losses. Short term increase in potential sediment, microbial and phosphorus losses to the environment which can cause ecological stresses on plants and animals due to sedimentation, algae blooms and water temperature increases in waterways and estuaries	No stockpiling of earthworks material near waterways. Laneways include camber and contouring to direct runoff to pasture and away from waterways Buffer zones will be created in riparian margins to waterways.	The paddock and lane layout have been designed to ensure new lanes are perpendicular to adjacent waterways. Where the lane crosses a waterway, an appropriately sized culvert will be used (within permitted activity rules) with runoff directed to adjacent pasture.	Overseer assumes 30% of dung deposited on lanes is lost directly to waterways, regardless of where the waterways are located in relation to the laneways. Overseer may have overestimated P losses (and sediment losses) in phase 1 proposal model because it doesn't recognise that the applicant will be implementing these GMPs and also siting of the lanes away from waterways as a mitigation measure.
Increase of nutrient losses from the 63ha new block	The land use change on the 63ha block from sheep farming to dairy platform results in an increase of modelled nutrient loss on this specific block of land. The N losses from the 63ha sheep block is modelled to increase by 1,211 kg N and by 19 kg P/ha/year.	N/A	The modelled nutrient losses from the WW4 dairy platform and Gladfield block have been reduced under the proposal by 1,132 kg N to offset the increase in contaminant losses from the 63ha sheep block. This concurrent reduction of losses on the platform and Gladfield block ensures that overall, nutrient losses are kept to a practical minimum The 63ha existing sheep block is located within the same groundwater and surface water catchments as the	The increased modelled contaminant losses from the 63ha block are mitigated by the concurrent reduction in modelled contaminant losses across the remainder of the landholding. The new block and the existing landholding are located within the same catchments and physiographic zones meaning that there will be no modelled increase in

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	Excess nutrients lost from one specific area of land may result in water quality degradation in the receiving waters causing ecological stress for plants and animals.		remainder of the landholding which ensures that the modelled losses entering the receiving water bodies does not increase under the proposal in its entirety. The 63ha existing sheep block is located within the same physiographic zones as the remainder of the landholding which ensures that the modelled losses from these physiographic zones does not increase under the proposal in its entirety. The mitigation measures to reduce modelled nutrient losses (contained throughout this table) are located across the entire landholding and therefore will mitigate against contaminant losses from activities located on both the new 63ha block and the existing platform.	contaminant losses to water bodies in accordance with the physiographic zone policies and Policy 16 of the RWPS.
Increase in nutrient losses from the existing dairy platform	The proposal sees a modelled increase in N and P losses (potentially also sediment and microbial losses) on the dairy platform. The N losses on this particular block of land increase from 9,016 kg N to 9,756 kg N. The P losses increase from 270 kg P to 300 kg P. Excess losses from	N/A	Although total modelled nitrogen and phosphorus losses from the WW4 dairy platform have increased, there is a reduction of nutrient losses on a per hectare basis of 4 kg N/ha/year and 0.1 kg P/ha/year meaning that nutrients losses are being spread over a larger area in the proposal as opposed to being more concentrated on one particular block of land (existing dairy platform) The existing dairy platform and expanded dairy platform (and remainder of the landholding) are located within the same groundwater and surface water	The increased modelled contaminant losses from the dairy platform are mitigated by the wider distribution of modelled contaminant losses across the remainder of the landholding. The existing dairy platform and the expanded dairy platform are located within the same catchments and physiographic zones meaning that there will be no modelled increase in contaminant losses to water bodies in

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	one particular block of land may result in concentrated nutrient accumulation in the soil profile and/or in localised drainage channels which can result in water quality degradation and ecological stressors on aquatic life and human health issues.		catchments which ensures that the modelled losses entering the receiving water bodies does not increase under the proposal. The existing dairy platform and expanded dairy platform (and remainder of the landholding) are located within the same physiographic zones which ensures that the modelled losses from these physiographic zones does not increase under the proposal. The mitigation measures to reduce modelled nutrient losses (contained throughout this table) are located across the entire landholding and therefore will mitigate against contaminant losses from activities located on both the existing platform and the expanded dairy platform.	accordance with the physiographic zone policies and Policy 16 of the PSWLP.
Discharge of liquid effluent to land via low rate application predominantly using pods and occasional discharge via travelling irrigator and slurry	The proposal sees an increase in the number of cows milked on farm from 775 to 850 which means more effluent will be generated which needs to be discharged to land. Potential for contaminant losses via all three pathways:	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 utilised by plants for pasture production. Effluent area receiving liquid FDE is sized to ensure nutrient loadings from the application of effluent are	No further mitigations are required over and above GMP level as liquid effluent management system is designed to meet best practice by utilising low rate application, deferred storage of effluent and application at a rate less than the soil moisture deficit as guided by the ES soil moisture monitoring sites on the website. The effluent discharge area at 56ha is large enough to cater for the additional effluent generated by the additional cows and maintain effluent N loadings at less than 150kg N/ha/year.	Adverse effects to the environment from the discharge of effluent should be no more than minor. Effluent application rates, GMPs and the resulting avoidance of effects supported by Policy 42 of the RWP. The discharge of effluent is governed by the consent conditions in the

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
tanker/umbillical to existing effluent discharge area (existing platform)	leaching (N), artificial drainage (N, P, microbials) and overland flow (N, P, microbials) when nutrients in effluent are applied to land. Potential for contaminant losses to cause excess nutrients in surface water and groundwater bodies in the vicinity of the property, particularly via tile drain pathways on the Braxton soils In general, excess nutrients result in water quality degradation causing ecological stress for plants and animals.	maintained at less than 150 kgN/ha/year to avoid excess nutrient loading. Utilizing low rate effluent application (<10mm/hr) on the Braxton soils which are poorly drained to ensure effluent is only applied when a soil moisture deficit occurs and to avoid losses via artificial drainage by applying effluent in a manner which keeps nutrients in the root zone. Use of deferred storage of effluent to allow effluent to be stored when it is unsafe to apply to land. Use of a travelling irrigator and slurry tanker to discharge larger volumes of effluent to low risk soils (Tuatapere) when soil moisture deficit levels are appropriate to lower storage volumes.		discharge permit giving certainty that the activity will be regulated.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
		Buffer zones created from effluent application areas to critical source areas and other sensitive receptors such as bores, property boundaries and dwellings.		
Activities on the Gladfield block - Intensive winter grazing	Potential for significant amounts of contaminants (N, P, sediment and microbials) to be lost to both surface and groundwater bodies as a result of the complete de-vegetation of pasture/crop, treading damage on soil structure and runoff following rainfall events. Nutrient losses from this activity occur via deep drainage through the soil profile into the underlying aquifer or via overland flow into adjacent waterways (Waimuatuku Stream) or artificial drainage channels.	Buffer zones maintained between crop cultivation and critical source areas to provide an area where runoff can be filtered and captured limiting risks of entering water. Grazing direction will be away from buffer zones/critical source areas leaving last bite to provide a buffer zone for nutrient capture through until the end of the fodder grazing period. Back fencing and portable water troughs to limit treading damage over already de-vegetated ground. Cultivation of paddocks timed to avoid paddocks sitting bare for long periods of time which reduces risks	The intensive winter grazing will continue to be located on the Gladfield block under this proposal because it is predominantly flat with no waterways or artificial drainage channels which avoids the risk of the direct runoff of nutrients to the Waimatuku Stream (particularly P, sediment and microbials). When this activity was modelled as occurring on the Tuatapere soils on the new block, modelled losses were significantly higher due to nutrient leaching risks and the siting of the activity on the new block was subsequently discounted. The activity is located on the Braxton soils which presents less risk of nutrient leaching to shallow groundwater and therefore significantly lower N loss results modelled in Overseer. However, the Braxton soils are known to be prone to cracking which is not a factor which is considered in the Overseer model. The applicant has seen little evidence of cracking on the Gladfield block and cracking does not generally occur in	Adverse effects potentially still exist from this activity due to the high level of contaminant losses which occur from intensive winter grazing despite the implementation of GMPs and mitigations. The overall nutrient budget has taken this high contaminant loss activity into account and provided mitigations and reductions in nutrient loss in other areas and activities across the landholding to offset adverse effects to ensure overall nutrient losses are kept to a practical minimum. The GMPs and the mitigations proposed will mitigate adverse effects to a certain extent, with the long term goal of the applicant to abolish

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	Excessive nutrient losses can cause nutrient accumulation in groundwater and excessive nutrient load in waterways causing water quality degradation and the resulting ecological stress on plants and animals when the life-supporting capacity of the water is compromised by excess nutrients. Groundwater and surface water flow from the Gladfield block is primarily in a south to south-easterly direction towards the Waimatuku Stream and away from the Bayswater Bog. The bog is recharged purely via rainfall and accordingly effects on the Bog are discounted because it is not a receiving environment.	of contaminant losses through leaching and overland flow. All other GMPs listed in rule 20 will be implemented by May 2019. Bare soils are cultivated using full cultivation and tide to avoid paddocks siting bare for long periods of time which reduces risks of losses of excess nutrients remaining from the grazing activity to the environment via overland flow and leaching.	the winter period because it is a condition impacted by drier temperatures and low soil moisture levels. To mitigate against the risk of contaminant losses via cracking, the applicant will cultivate intensive winter grazing paddocks in early spring to ensure pasture cover is established going into summer which can suck up nutrients for their growth and soil moisture is maintained and held in the profile as much as possible over the spring and summer. This will mitigate against risks to water quality in the underlying aquifer and the Waimatuku Stream	intensive winter grazing from the dairy platforms/Central Plains area. The effects of this activity will be limited to a five-year timeframe. Under phase 2, Gladfield block becomes a cut and carry block.
Increase in cow numbers to	The grazing of more cows on pasture during high risk	Use of selective grazing to avoid grazing very wet paddocks during	Stocking rate will reduce from 3.2 cows/ha to 2.1 cows/ha with the introduction of the additional land to the dairy	A reduction in stocking rate mitigates effects of the small increase in cow

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
consented discharge permit levels across the entire landholding	periods increases the risk of the leaching of nutrients (N,P and microbials) through the soil profile from urine and dung spots or transported via subsurface drainage. Pasture damage from cows grazing during adverse periods can result in increased sediment, microbial and P loss if erosion or soil loss occurs from paddocks Increased nutrient losses as total figures due to more cows, to groundwater and surface water bodies may potentially cause water quality degradation which can cause ecological stresses on aquatic plants and animals from algal growth, temperature increases and eutrophication. Human health concerns can also	adverse weather conditions to reduce risks of pugging and treading damage to soil structure which can accelerate contaminant losses. Increase the size of feed breaks during adverse conditions to give animals more of the paddock to graze than the volume of feed required. This is to reduce stocking rate on wet and vulnerable pasture to avoid pugging and treading damage of feed. Use nutrient budgeting to manage nutrient inputs and outputs to guide farm management decisions which can maintain overall nutrient losses at desired level.	platform with a comparatively smaller increase in cow numbers. A stocking rate reduction results in a reduction in nutrient losses on a per hectare basis as a result of an increase of cows producing urine and dung spots which are significant sources of contaminant losses to the root zone over a larger area of land, thereby reducing per hectare nutrient loadings. Fence off areas where stock camp if pasture damage is occurring to limit risks of further pasture damage. Use of in-shed feeding when feed deficits occur to ensure stock are well fed prior to entering the paddock break which can limit pugging and treading damage, particularly under adverse weather conditions.	numbers on total nutrient losses modelled by Overseer. Adverse effects on the environment adequately mitigated with combination of GMPs and mitigations which have a high level of effectiveness for mitigating risks of grazing cows on pasture throughout the milking season.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	arise from microbial contamination of waterways upon contact and risks of blue baby syndrome from nitrate accumulation in groundwater and potentially bowel cancer as discussed in section 8.1 above.			
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.	Time N, P, K and S fertiliser application to meet crop and pasture demand using split applications and avoid high risk times of the year i.e. when soil temperature is less than 7 degrees, during drought periods and during periods when soils are at field capacity. Reduce use of P fertiliser where Olsen P values are above agronomic optimum. Maintain Olsen P levels at around 30-40. Use nutrient budgeting and annual soil testing to manage nutrient inputs from fertiliser and outputs to	Urea applications on all blocks occur using a little and often approach with a reduction in the application rate compared to the baseline scenario. The effluent blocks also receive a reduced rate of N application across the various applications compared to the baseline. The total fertiliser nitrogen applied to the milking platform is reduced for non effluent blocks and for effluent blocks. An overall reduction in fertiliser rate across the entire farm compared to baseline. Total fertiliser use on the Gladfield block is maintained at baseline levels as it accurately meets crop demand and is applied under GMP	The proposed fertiliser regime under phase 1 has been improved given the ned for lower pastoral production (of 1 T DM/ha) with the stocking rate reduction. Less nitrogen is available from supplements and more is supplied by the additional effluent which equates to an overall reduction in fertiliser needed under the proposal. Adverse effects both avoided and mitigated with use of GMPs for fertiliser usage and further mitigations to reduce fertiliser across the dairy platform.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	Adverse effects of inappropriate fertiliser application or excess application include a loss of excess nutrients to water causing water quality degradation in both groundwater and surface water bodies. Water quality degradation can adversely impact aquatic plant and animal ecosystems and impact on human health.	guide farm management decisions which can maintain overall nutrient losses at desired level.		
Imported supplementary feed and feed made on-farm and fed during the season across existing platform and new block	Supplementary feed usage has an impact on the pasture production of the farm system and can change the quantity of N particularly in the farm system compared to an all-grass based diet. Low N supplementary feeds can reduce estimated N losses to the environment as less N needs to be supplied to fuel pasture production which in	N/A	Supplementary feed imported onto the property has reduced by 60 T of barley grain and brewers grain and 100 T of PKE. Supplementary feed made and fed during the season is unchanged.	The reduced stocking rate has necessitated the reduction in imported supplementary feed to reconcile pasture production between the two systems. Likely to have positive effects on the environment.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	turn can have beneficial effects on water quality by reducing nutrient load in groundwater and surface water bodies.			
Slurry effluent application across entire landholding	The nutrient concentration of slurry effluent is higher than liquid or FDE due to the lack of dilution from rainwater or washdown water. Due to the higher concentration of nutrients, application of slurry effluent 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 from effluent. This loading is achieved by ensuring the land area is large enough and the application depth is restricted to 2.5mm. If nutrient loadings exceed 150 kg N/ha/year or nutrients are applied in excess then there is	The maximum loading rate of nitrogen from the application of effluent (both slurry and liquid) to land is 150 kg N/ha/year. Slurry effluent is not discharged onto the same area any more frequently than once every two months. Slurry effluent is only discharged to land when soil temperature is greater than 5 degrees in winter and 7 degrees 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.	Slurry effluent is applied to non-effluent blocks in the Overseer model i.e. blocks where liquid FDE is not applied. The non-effluent blocks are the same in terms of FDE classification, soil type and physiographic zone to the approved effluent blocks so is considered equally as suitable for receiving slurry effluent. Slurry effluent applied to paddocks low in potash (K levels lower than 6-10) and with low Olsen P levels (P levels lower than 25)	Adverse effects to the environment from the discharge of slurry effluent should be no more than minor. Effluent application rates, GMPs and the resulting avoidance of effects supported by Policy 42 of the RWP. The discharge of effluent is governed by the consent conditions in the discharge permit giving certainty that the activity will be regulated. Application of slurry effluent to paddocks 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.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	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. Slurry effluent will be applied to areas outside of the liquid discharge area. Slurry effluent 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.	Effluent area receiving slurry FDE is sized to ensure nutrient loadings from the application of effluent are maintained at less than 150 kgN/ha/year to avoid excess nutrient loading. Utilising low depth effluent application (<2.5mm) on the Braxton soils which are poorly drained to ensure effluent is only applied when a soil moisture deficit occurs and to avoid losses via artificial drainage by applying effluent in a manner which keeps nutrients in the root zone. Use of deferred storage of effluent to allow effluent to be stored when it is unsafe to apply to land. Use of a slurry tanker to discharge larger volumes of effluent to low risk soils (Tuatapere) when soil moisture deficit levels are		

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
		appropriate to lower storage volumes. Buffer zones created from effluent application areas to critical source areas and other sensitive receptors such as bores, property boundaries and dwellings.		
Use of the existing effluent storage facilities on existing dairy platform	If a structure is leaking or not structurally sound these is a risk of contaminant losses directly to shallow groundwater. Contaminant accumulation in groundwater can lead to human health issues from blue baby syndrome or *E.coli* contamination if drinking water is abstracted nearby. Contaminants may also reach surface water bodies if there is a groundwater/surface water connection which can	Monthly/frequent effluent system checks will be undertaken in accordance with the farm's maintenance checklist. Leaks will be repaired immediately Fail safe systems will be kept in place and kept in good working order i.e. automatic alarm and shut off system All staff involved in the management of the effluent system are fully trained in its use	The main effluent storage pond which contains a clay liner has passed a drop down test in 2018 to confirm that it is not leaking beyond normal operating parameters. The pond also has had written confirmation from an engineer that the pond has no visible cracks or defects. Drop tests will be completed on the pump sump and solids bunker in July when milking stops for the season as these areas are first collection points for effluent and there is no mechanism by which to divert effluent during the 48hour drop test period.	Effluent storage facilities are fit for purpose and leaks are identified through regular testing and checking of the effluent storage structures. Adverse effects from leakage should be avoided or remedied immediately.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	cause water quality degradation effects such as algal blooms, smothering and eutrophication in surface water bodies.			
Groundwater abstraction on existing dairy platform	Groundwater abstractions must be at a rate which doesn't cause drawdown effects on adjacent bores which can compromise the availability and reliability of the resource for other users. Groundwater abstractions must be at a level which does not result in an over-allocation of the resource which can adversely impact on drinking water availability, water availability for commercial and industrial uses. Water use in the dairy shed should be managed to ensure there is little wastage because	Reduce water usage in the shed by re-using clean water whenever possible. Treating cows gently to avoid upset.	The yard is scraped to reduce fresh water use at the dairy shed.	No adverse effects on aquifer sustainability or the availability and reliability of water for other users. Groundwater usage is reasonable in terms on end use. Adverse effects should be less than minor.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	the more water used, the more effluent generated which needs to be discharged to land.			

9.4 AEE for the farming activity under phase 2 of the proposal

Phase 2 of the application involves the introduction of a wintering shed into the farm system as a major mitigation measure for reducing nutrient losses across the landholding. The transition to a farm system which includes a wintering shed enables the removal of high-risk activities for nutrient losses from high risk areas on the farm.

We also note that Environment Southland consent staff have advised the applicant that a nutrient budget for phase 2 is not considered a requirement for this application, however the applicant has chosen to provide one to strengthen their proposal and to show that nutrient losses can be reduced to baseline levels.

The intention of phase 2 is to introduce wintering sheds into the farm system which will significantly reduce nutrient losses on the landholding. The applicant proposes that the land use consent be issued requiring them to operate the farm system in phase 2 at a level equal to or less than the modelled nutrient losses (predicted by Overseer) submitted in the baseline models. Therefore, we are applying for phase 2 of the application to be governed by a land use consent based on an Overseer output figure to enable the applicant to operate an entirely flexible farm system under the resulting land use consent. Our proposal is that only input values relating to the scale of the activity derived from the example nutrient budget are inserted as consent conditions in the land use consent.

The assessment below attempts to show how the applicant has assessed the suitability of individual activities within the proposal against likely effects, available GMPs and mitigations and likely outcome in terms of whether effects are likely to be avoided, mitigated or both. The assessment lacks reference to specific input figures to show that an output-based land use consent is appropriate and still provides certainty of effects and effectiveness of mitigations.

Table 26: Assessment of effects at activity level for phase 2 on WW4

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
Decrease in nitrogen losses from the entire landholding	The proposal sees a modelled decrease in total N losses on the landholding. The N losses decrease from 11,298 kg N to approximately 11,142 kg N. An overall reduction in total nitrogen losses from the landholding reduces nitrate accumulation risks in groundwater and reduces nitrogen load in waterways. A reduction in overall nitrogen load can improve water quality and maintain and enhance the life-supporting capacity of water bodies.		The removal of the winter grazing activity from the farm system results in a significant reduction in modelled N losses at the Gladfield block from 1,542kg N down to 448kg N. The use of wintering sheds provides additional mitigation of nitrogen losses across the platform.	The reduction in modelled nitrogen losses from the landholding to the lowest practical level should correlate with a nutrient load reduction in the receiving water bodies and/or physiographic zones in accordance with the physiographic zone policies and Policy 16 of the RWPS.
Increase in phosphorus losses from the entire landholding	The proposal sees a modelled increase in P losses from the entire landholding	Avoid working CSAs and their margins	Removal of intensive winter grazing activity from the farm system results in a marginal decrease in modelled P losses from the Gladfield block.	Please see section 8.4 of this report for full assessment of expected P losses and full assessment of

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	of 30kg P compared to baseline.	All riparian margins to be fenced and left to establish with grasses to enable filtration of contaminants that may be transported via overland flow processes and erosion Reduce use of P fertiliser where Olsen P levels are above agronomic optimum. Reduce the risk of runoff from laneways and other sources by ensuring crossings are adequately maintained and maintain gradients to direct runoff to pasture. Please see section 8.4 of this report which discusses further P loss GMPs proposed by the applicant and discusses how P (and sediment and microbial) losses are likely to be misrepresented by Overseer modelling.	All new laneways will be located away from waterways and riparian margins implemented.	proposed mitigations and their effectiveness.
Increase in nutrient losses	The proposal sees a modelled increase in N and P	Use of selective grazing to avoid grazing very wet paddocks and	Although total modelled nitrogen and phosphorus losses from the WW4 dairy platform have increased,	The increased modelled contaminant losses from the dairy platform are

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
from the dairy platform	losses (potentially also sediment and microbial losses) on the dairy platform. The N losses on this particular block of land increase from 9,016 kg N in the baseline to 10,694 kg N in phase 2. The P losses increase from 270 kg P to 353 kg P. Excess losses from one particular block of land may result in concentrated nutrient accumulation in the soil profile and/or in localised drainage channels which can result in water quality degradation and ecological stressors on aquatic life and human health issues.	open the breaks up to avoid pugging and treading damage. Use nutrient budgeting to manage nutrient inputs and outputs Time N application in fertiliser and effluent to meet pasture demand and avoid high risk times of the year when soil temperature is low, soils are at field capacity or during drought periods.	there is a reduction of nitrogen losses on a per hectare basis of 1 kg N/ha/year compared to baseline meaning that nutrients inputs and outputs are being carefully managed, balanced, sited and spread over the entire landholding to ensure total nitrogen losses do not increase from the landholding as a whole and are kept at the practical minimum. The wintering shed is located on the dairy platform ensuring the presence of a large mitigation measure to reduce nutrient losses from activities on this block. P losses are not described well within Overseer. Therefore, the applicant has assessed their mitigation of P losses through a series of improvements and extension of laneway management as described in depth in section 8.4 of this report. The dairy platform and remainder of the landholding are located within the same groundwater and surface water catchments which ensures that the modelled losses entering the receiving water bodies does not increase under the proposal. The dairy platform and remainder of the landholding are located within the same physiographic zones which	mitigated careful consideration and distribution of nutrient inputs and outputs across the entire landholding. The dairy platform and the remainder of the landholding are located within the same catchments and physiographic zones meaning that there will be no modelled increase in contaminant losses, and contaminant losses are at the lowest practical level, in accordance with the physiographic zone policies and Policy 16 of the RWPS.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
			ensures that the modelled losses from these physiographic zones does not increase under the proposal. The mitigation measures to reduce modelled nutrient losses contained throughout this table are located across the entire landholding and therefore will mitigate against contaminant losses from activities located on the dairy platform.	
Use of wintering sheds	Nutrients in effluent generated by the cows during winter and in marginal periods is stored and applied to land in a manner which matches plant demand and mitigates against excessive leaching processes which can lead to the contamination of groundwater and surface water bodies. An overall reduction in nutrient losses from the landholding reduces nutrient accumulation risks in	Urine and dung deposition during high risk periods is redistributed to pasture using the effluent management system when soils are in a suitable state to receive and utilize applied nutrients. The wintering sheds are located in accordance with the setbacks listed in Rule 35 of the PSWLP.	The wintering sheds will be used to winter the majority of the milking herd from June through till calving dates. Two primary scenarios would exist under an output-based land use consent: - All mixed age cows and R2 replacements are wintered in the sheds for the winter period totalling 1030-1050 cows. - All mixed age cows are wintered in the sheds for the winter period totalling 770 and R2 replacements are grazed on fodder crop at WRO and return to the platform towards the end of July/beginning of August for calving. Intensive winter grazing will cease entirely on the Gladfield block under this proposal and will be used solely as a cut and carry block providing silage for the dairy platform and wintering shed.	Adverse effects from winter grazing on the Gladfield block are ceased. Wintering sheds significantly reduce nutrient losses to the environment and can offset adverse effects from activities on the remainder of the landholding by lowering the total quantity of nutrients lost to the environment.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	groundwater and reduces nutrient load in waterways. A reduction in nutrient load can improve water quality and maintain and enhance the life-supporting capacity of water bodies. Standing cows off pasture in late Autumn and early Spring reduces the risk of pugging to pastures which increases the infiltration ability of soils and reduces overland flow of nutrients.		The dry of date is extended to 15th June because cows are able to be kept indoors towards the end of the milking season. The wintering sheds can be used during the autumn and spring to remove cows from pasture during high drainage periods to protect soil structure, avoiding tramping of feed and avoid urine and dung deposition.	
Increase in cow numbers to 1000 across dairy platform	The grazing of more cows on pasture during high risk periods increases the risk of the leaching of nutrients (N,P and microbials) through the soil profile from urine and dung spots or transported via subsurface drainage.	Use of selective grazing to avoid grazing very wet paddocks during adverse weather conditions to reduce risks of pugging and treading damage to soil structure which can accelerate contaminant losses.	Stocking rate will increase from 2.1 cows/ha under phase 1 to to 3.2 cows/ha under phase 2 with the introduction of more cows onto the same land area as phase 1. Overall, there is a marginal stocking rate reduction of 0.1 cows/ha compared to the baseline scenario. Fence off areas where stock camp if pasture damage is occurring to limit risks of further pasture damage.	The marginal stocking rate reduction is unlikely to have a discernible impact on per hectare nutrient loadings which is why the introduction of the wintering shed forms the most significant mitigation measure alongside other minor mitigations.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	Pasture damage from cows grazing during adverse periods can result in increased sediment, microbial and P loss if erosion or soil loss occurs from paddocks Increased nutrient losses as total figures due to more cows, to groundwater and surface water bodies may potentially cause water quality degradation which can cause ecological stresses on aquatic plants and animals from algal growth, temperature increases and eutrophication. Human health concerns can also arise from microbial contamination of waterways upon contact and risks of blue baby syndrome from nitrate accumulation in groundwater.	Increase the size of feed breaks during adverse conditions to give animals more of the paddock to graze than the volume of feed required to reduce stocking rate on wet and vulnerable pasture to avoid pugging and treading damage of feed. Use nutrient budgeting to manage nutrient inputs and outputs to guide farm management decisions which can maintain overall nutrient losses at desired level.	Use of in-shed feeding when feed deficits occur to ensure stock are well fed prior to entering the paddock break which can limit pugging and treading damage, particularly under adverse weather conditions. Use of the wintering shed as a standoff area to offset additional nutrient losses that may occur with higher number of cows grazing during adverse weather conditions. Use of the wintering shed to winter the majority of the herd off the support block and the subsequent removal of intensive winter grazing from Gladfield block.	Adverse effects on the environment will be adequately mitigated with combination of GMPs and mitigations which have a high level of effectiveness for mitigating risks of grazing cows on pasture throughout the milking season.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
Discharge of liquid effluent to land via low rate application predominantly using pods, occasional discharge via travelling irrigator and slurry tanker/umbillical to existing effluent discharge area (existing platform)	The proposal sees an increase in the number of cows milked on farm from 850 to 1000, plus the introduction of a wintering shed as a generation area for effluent which means more effluent will be generated which needs to be discharged to land. Potential for contaminant losses via all three pathways: leaching (N), artificial drainage (N, P, microbials) and overland flow (N, P, microbials) when nutrients in effluent are applied to land. Potential for contaminant losses to cause excess nutrients in surface water and groundwater bodies in the vicinity of the property, particularly via tile drain	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 liquid FDE is sized to ensure nutrient loadings from the application of effluent are maintained at less than 150 kgN/ha/year to avoid excess nutrient loading. Utilising low rate effluent application on the Braxton soils which are poorly drained to ensure effluent is only applied when a soil moisture deficit occurs and to avoid losses via artificial drainage by applying effluent in a manner which keeps nutrients in the root zone. Use of deferred storage of effluent to allow effluent to be stored when	Liquid effluent discharge area increased to 78ha covering the same soil types and physiographic zones as the existing effluent discharge area. No further mitigations are required over and above GMP level as liquid effluent management system is designed to meet best practice by utilising low rate application, deferred storage of effluent and application at a rate less than the soil moisture deficit as guided by the ES soil moisture monitoring sites on the website. The effluent discharge area at 56ha is large enough to cater for the additional effluent generated by the additional cows and maintain effluent N loadings at less than 150kg N/ha/year.	Adverse effects to the environment from the discharge of effluent should be no more than minor. Effluent application rates, GMPs and the resulting avoidance of effects supported by Policy 42 of the RWP. The discharge of effluent is governed by the consent conditions in the discharge permit giving certainty that the activity will be regulated.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	pathways on the Braxton soils In general, excess nutrients result in water quality degradation causing ecological stress for plants and animals.	soil conditions are unsuitable to receive effluent Use of a travelling irrigator and slurry tanker to discharge larger volumes of effluent to low risk soils (Tuatapere) when soil moisture deficit levels are appropriate to lower storage volumes. Buffer zones created from effluent application areas to critical source areas and other sensitive receptors such as bores, property boundaries and dwellings.		
Imported supplementary feed and feed made on-farm and fed during the season across the entire landholding	Supplementary feed usage has an impact on the pasture production of the farm system and can change the quantity of N particularly in the farm system compared to an all-grass based diet. Low N supplementary feeds can reduce estimated N losses to the environment as less N	N/A	Supplementary feed imported onto the property is likely to increase under this scenario. The example Overseer budget modelled an increase in the vicinity of 150 T of barley grain, 150 T of distilled brewers grain, 33 T of molasses, 191 T PKE and allows for lactation to be extended. Supplementary feed made and fed during the season is increased to 1200 T DM silage.	The increased number of cows and longer lactation requires the need to increase supplementary feed to reconcile pasture production. Additional fertiliser and barn slurry also needed to reconcile pasture production. Increased supplementary feed can reduce overall N cycling in a system

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	needs to be supplied to fuel pasture production which in turn can have beneficial effects on water quality by reducing nutrient load in groundwater and surface water bodies.			which can result in less overall N losses to the environment and the mitigation of adverse effects on water quality.
Slurry effluent application across the entire landholding	The nutrient concentration of slurry effluent is higher than liquid or FDE due to the lack of dilution from rainwater or washdown water. Due to the higher concentration of nutrients, application of slurry 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 from effluent. This loading is achieved by ensuring the land area is large enough and the application depth is restricted to 2.5mm. If nutrient loadings exceed 150 kg	The maximum loading rate of nitrogen from the application of effluent (both slurry and liquid) to land is 150 kg N/ha/year. Slurry effluent is not discharged onto the same area any more frequently than once every two months. Slurry effluent is only discharged to land when soil temperature is greater than 5 degrees in winter and 7 degrees in spring.	Slurry effluent is applied to non-effluent blocks in the Overseer model i.e. blocks where FDE is not applied. The non-effluent blocks are the same in terms of FDE classification, soil type and physiographic zone to the approved effluent blocks so is considered equally as suitable for receiving slurry effluent. Slurry effluent generated in the wintering shed is exported to both the Gladfield block to return the nutrients to the cut and carry block and to the non-tiled non-effluent blocks. Slurry effluent applications occur twice per season in December and January which are low risk times of the year and are at rates less than 150 kg N/ha/year.	The application of slurry effluent to land will be undertaken under the conditions and provisions of the discharge permit and adverse effects from this activity are expected to be no more than minor.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	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. Slurry effluent will be applied to areas outside of the liquid discharge area. Slurry effluent is generally considered lower risk to apply to land because it doesn't have the same risks of leaching, overland flow/runoff that pure liquid effluent has. A significant amount of additional slurry effluent is			

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	generated from the wintering sheds which needs to be redistributed to land evenly and at a rate which matches pasture and crop demand to avoid direct losses of nutrients to the environment as described above.			
Use of the existing effluent storage facilities on dairy platform	If a structure is leaking or not structurally sound these is a risk of contaminant losses directly to shallow groundwater. Contaminant accumulation in groundwater can lead to human health issues from blue baby syndrome or *E.coli* contamination if drinking water is abstracted nearby. Contaminants may also reach surface water bodies if there is a groundwater/surface water connection which can cause water quality degradation effects such as algal blooms, smothering and	Monthly/frequent effluent system checks will be undertaken in accordance with the farm's maintenance checklist. Leaks will be repaired immediately. Fail safe systems will be kept in place and kept in good working order i.e. automatic alarm and shut off system All staff involved in the management of the effluent system are fully trained in its use	The applicant will be continuing to operate under the existing land use consents for the use and maintenance of these structures granted under phase 1.	Effluent storage facilities are fit for purpose and leaks are identified through regular testing and checking of the effluent storage structures. Adverse effects from leakage should be avoided or remedied immediately.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	eutrophication in surface water bodies.			
New effluent storage facilities on dairy platform	New effluent storage facilities are designed in accordance with current specifications and will include leak detection systems which ensures that any leakages can be quickly identified and remedied. Adverse effects from leakage are the same as described above for existing effluent storage facilities	Monthly/frequent effluent system checks will be undertaken in accordance with the farm's maintenance checklist. Leaks will be repaired immediately Fail safe systems will be kept in place and kept in good working order i.e. automatic alarm and shut off system All staff involved in the management of the effluent system are fully trained in its use	New effluent structures will contain leak detection systems and will be consented by way of land use consents applied for prior to the commencement of phase 2. A regular drop testing regime will be implemented in accordance with likely consent conditions.	Effluent storage facilities are fit for purpose and leaks are identified through regular testing and checking of the effluent storage structures. Adverse effects from leakage should be avoided or remedied immediately.
Groundwater abstraction on the dairy platform	Groundwater abstractions must be at a rate which doesn't cause drawdown effects on adjacent bores which can compromise the availability and reliability of the resource for other users.	Reduce water usage in the shed by re-using clean water whenever possible. Treating cows gently to avoid upset.	The yard is scraped to significantly reduce fresh water use at the dairy shed which considerably lowers effluent generation throughout the milking season. Effluent storage requirements are reduced.	No adverse effects on aquifer sustainability or the availability and reliability of water for other users. Groundwater usage is reasonable in terms on end use. Adverse effects should be less than minor.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	Groundwater abstractions must be at a level which does not result in an over-allocation of the resource which can adversely impact on drinking water availability, water availability for commercial and industrial uses. Water use in the dairy shed should be managed to ensure there is little wastage because the more water used, the more effluent generated which needs to be discharged to land.	Monitoring of the groundwater abstraction volumes on a monthly basis.		

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS FOR PROPOSAL ON WW5

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.

This assessment of environmental effects (AEE) is broken into two parts: a broad scale/cumulative effects assessment and an assessment of the individual activities within the individual management blocks for both phase 1 and phase 2 individually.

10.1 Broad scale/cumulative effects assessment

The AEE below concludes that the implementation of targeted mitigation measures on-farm should ensure that adverse effects on water quality from activities within the proposal are either avoided or mitigated as far as reasonably practical whilst still maintaining a viable, efficient and profitable farm system. The AEE below was written in a holistic way and did not solely refer and relate to Overseer outputs because Overseer only models nutrients leached below the root zone and does not model nutrient loss directly to either groundwater or surface water bodies. The amount of these nutrients which may end up in these water bodies depends on a variety of different factors including the extent of denitrification in the vadose zone referred to as the attenuation rate and the catchment hydrology and characteristics which impacts the resulting concentration of these nutrients in water bodies.[34]

This broad scale/cumulative effects assessment includes a catchment scale assessment in relation to attenuation and hydrology processes, characteristics of the catchment and consideration of the state of the receiving environment. This assessment also assesses the proposed activity in its entirety, i.e not using a permitted or consented baseline approach. The term "practical minimum" is used frequently and is used to portray the fact that any dairy farming activity results in nutrient losses to the environment of some scale and that the applicant has reduced nutrient losses as far as they are practically able to do so given available mitigations, innovations, technology whilst still maintaining an efficient and profitable farm system that meets their social and economic needs. The term "practical minimum" does <u>not</u> refer to an effect on the environment. The summary to this AEE concludes that effects on the environment should be less than minor given the proposed mitigations, the characteristics of the catchment and the predicted changes to water quality as a result of the proposed activity.

Attenuation

Section 3.4 included a map of the denitrification potential across the subject catchment. The map showed that the area of the subject landholding having low to very low dentification with pockets of the lower catchment having higher denitrification potential. Broadly, this means that risk of a greater proportion of the modelled N losses from below the root zone ending up in groundwater and eventually surface water bodies is high, especially on the free draining Tuatapere and Upukerora soils. The applicant has recognised this risk and sited high contaminant loss activities (particularly high N loss activities such as intensive winter grazing and discharge of slurry and liquid effluent) on the more poorly

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

drained Braxton soils which have less vulnerability to nitrogen leaching and therefore less risk of N loss below the root zone and through the soil profile. The siting of these activities on lower risk soils has been a conscious decision by the applicant for a number of years and has therefore reduced N leaching risk to a practical minimum. The Braxton soils are known to be prone to cracking however the attached report in Attachment I from Environment Southland Scientist, Michael Killick confirms that the Braxton soils in this specific location have not shown evidence of cracking thereby reducing potential risks of contaminant loss during dry periods from these soils.

The inclusion of a wintering shed within the end goal farm system is one of the most effective and significant mitigation measures available for NZ dairy farms for reducing N leaching beyond the root zone through to groundwater and surface water receiving bodies. The wintering shed allows the applicant to remove cows from pasture and hold them inside during high risk drainage periods. In doing so, N deposited via urine and dung patches is collected within the effluent system and can be redistributed to pasture evenly, at a lower rate and timed to avoid high risk drainage periods which significantly reduces the risk of N leaching through the soil profile as it is preferentially used in the root zone. As a result, the mitigation measures put forward by the applicant will avoid risks of N accumulation in groundwater within the Aparima GMZ to a practical minimum and effects on this water body should be less than minor.

Groundwater nitrate levels are of particular concern to human health. The link between groundwater nitrates and blue baby syndrome is a fairly widely accepted and is one of the origins of the NZ Drinking water standard. Other studies indicate that other contaminants, or dietary nitrate sources, may also play a role in the syndrome.[35] A recent Danish study suggested a link between groundwater nitrates and bowel cancer. The study found that those people exposed to nitrate levels in excess of 9.3 mg/L (NZ drinking water standard is 11.3 mg/L) had a 15% increased carcinogenic risk. In December 2018, Agriview NZ published an article attempting to correlate the Danish study within the New Zealand agricultural context. The article noted that "most of the international research conducted throughout the past four decades on this topic has found either a negligible or only slight correlation between nitrates in drinking water and colon/bowel cancer rates" and also that "the idea that colon cancer is heavily influenced by diet surfaces in many of the studies evaluating its link to the intake of nitrate through drinking water." The article further noted "Ian Shaw, professor of toxicology at the University of Canterbury, says it is this very factor that makes the associations between water nitrate and colon cancer unconvincing:

"In my opinion nitrate is associated with colon cancer because it can be converted to nitrite by gut bacteria and form nitrosamines with dietary amino compounds. Nitrosamines are profound carcinogens. Links with water nitrate would, therefore, not be definitive because other components of the diet would be necessary to facilitate carcinogenesis. If exposure to an appropriate dietary mixture, plus the right bacterial species in the microbiome do not coincide carcinogenesis will not occur. This is a complex scenario that cannot be attributed to a single exposure to a single chemical."

[35] https://en.wikipedia.org/wiki/Blue_baby_syndrome accessed 8 February 2019

In other words, attributing high colon cancer rates to nitrates in drinking water would be oversimplifying things to a considerable level. One must consider the variations of diet and lifestyle also considered potential factors for increasing colon cancer risk, and this is something the Danish study failed to do."[36]

Given the level of current science, effects on human health should be protected under the proposal which is likely to result in less than minor adverse effects on groundwater quality due to the imposition of mitigation measures to address nitrate accumulation.

Phosphorus, Sediment and Microbial losses

The loss of P, sediment and microbials via erosion of the main river banks and within the tributaries of the Aparima River is likely to primarily occur during flood events and will be partly mitigated by the presence of established vegetation along the river margins which stabilizes the adjoining land and the flat topography of the applicants property and the wider catchment which slows erosion and the surface runoff processes.

These contaminants may also enter artificial drainage channels if applied to land inappropriately via fertiliser application, intensive winter grazing activities, effluent application or by the inappropriate grazing of animals during high drainage periods (such as late autumn and mid-spring). The AEE below has correlated which GMPs and further mitigations are required to mitigate against losses of contaminants via artificial drainage pathways from these specific activities to a practical minimum.

Another factor to consider is the risk of P, sediment and microbial losses directly to surface water bodies within this catchment via overland flow – primarily occurring from runoff from laneways and via critical source areas. Overall losses of these contaminants directly to waterways is considered low risk in this catchment and on the applicants' property due to the flat topography. Overseer gives an estimate of what P may be lost directly to the environment from laneways, waterway crossings and critical source areas in the 'other sources' output within the model. The model does not consider sediment and microbial losses, however as all three contaminants typically enter surface water bodies via the same transport pathways then P loss modelled by Overseer can be used as a proxy for estimating sediment and microbial losses to the environment also.

The problem with the 'other sources' output estimated by Overseer is that it is not spatially explicit and does not account for site-specific mitigation measures which may be in place on a farm to mitigate losses directly to waterways from these laneways and critical source areas. The nutrient budgets provided with this application model an increase in total P loss of 8kg over the whole farm between the baseline and the winter barn example model. The key driver for this increase in P loss is from 'other sources' as classified in Overseer and equates for about 50% of total P losses. Overseer is known to assume 30% of P deposited on a lane is lost directly to water[37]. Therefore, when a dairy farm is expanded such as in the proposal, more lanes generally need to be constructed, and the model then assumes that additional phosphorus is lost from those lanes.

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[36] https://www.agriview.nz/forum/2018/12/11/investigating-the-nitrate-colon-cancer-link accessed 8 February 2019

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

GMPs and mitigation measures to reduce P, sediment and microbial losses

As part of the proposed dairy expansion, the applicant will be constructing new lanes and new culvert crossings to allow access from the current dairy platform to the new block. The applicant will be implementing specific critical source area GMPs that will seek to minimise potential P loss via overland flow from these new lanes and/or culvert crossings such as the fencing of waterways, establishing vegetated riparian margins, contouring lanes to direct runoff to pasture, installing bargeboards on culvert crossings and locating laneways away from waterways. The implementation of these GMPs by the applicant are not rewarded by Overseer as the model is not spatially explicit as explained above.

The following calculations have been adapted from workings by Mo Topham, Farmwise Consultant (CNMA) and seek to explain how actual P losses (and sediment and microbial losses by proxy) have been reduced to a practical minimum and are likely to be lower than those modelled by Overseer due to the implementation of these GMPs which are not rewarded in Overseer. According to a Massey University publication[38], a lactating cow consumes 0.4kg P per week or 16.6 kg P per milking season. Of this amount consumed 66% or 10.9kg is estimated to be deposited as dung. Assuming cows spend 2 hours per day (or 0.08% of their day) on the lanes then 0.8kg P of this dung deposited may be deposited on lanes within the platform. Overseer assumes that 30% of the P in this dung is then lost directly to waterways. Research indicates that there is opportunity to mitigate these losses as described above which are likely to be between 38% and 58% effective at reducing P beyond that modelled by Overseer[39].

In the examples below, the baseline has been assessed to be currently implementing laneway P loss management at GMP level at the lower end of effectiveness estimates (38% effectiveness). Under the winter barn example, laneway P loss GMP will be improved and extended by:

- The addition of 0.8km of vegetated buffer zones around riparian areas, including fences around waterways which will ensure that dung deposited on the laneway near where it crosses a waterway will be captured and filtered by the vegetation.
- new culverts crossings (constructed under permitted activity rules) with appropriate cutouts to direct runoff to pasture primarily. The secondary area of filtration and capture is the vegetated riparian buffer zone
- Contouring of the new lane along its entire length to direct runoff to pasture
- Locating the new lane perpendicular to the two waterways on the new block to maximise buffer distance between the new lane and surface water bodies

The implementation of these expanded and improved GMPs has been assessed to conservatively add a further 10% improvement (up to a total of 48% effectiveness).

[38] https://www.massey.ac.nz/~flrc/shortcourses/IntroNotes&MastTest.pdf accessed 24 January 2019

[39] https://www.mfe.govt.nz/sites/default/files/assessment-strategies-mitigate-impact-loss-contaminants-agricultural-land-freshwater_0.pdf accessed 24 January 2019

Under the baseline:

850 cows x 10.9kg P x 0.08 x 0.3 = 222kg P

222 kg P x 38% effectiveness = 84.36 kg P mitigation with current laneway mitigations.

Under the winter barn example:

930 cows x 10.9kg P x 0.08 x 0.3 = 243 kg P

243 x 48% effectiveness = 116 kg P mitigation with current, improved and extended laneway mitigations.

The baseline P losses estimated at 237kg P - 84.36 kg P of mitigations = 153 kg P revised Overseer P loss to water.

The phase 2 P losses estimated at 245 kg P – 116 kg P of mitigations = 129 kg P revised Overseer P loss to water.

Therefore, P losses are likely to be less than those predicted by Overseer under both the baseline and phase 2 of the proposal. P losses are likely to be 24 kg P less under phase 2 than the baseline accounting for the lack of reward in Overseer for laneway mitigations which will be implemented under both scenarios to differing degrees of effectiveness. P losses have therefore been reduced to the practical minimum under the proposal. The implementation of targeted GMPs and mitigation measures should result in effects on the environment which are less than minor.

Hydrology of the catchment

Section 4.4 described the high level of connectivity of the Upper Aparima GMZ with surface water bodies. This connectivity provides for a large and steady discharge of groundwater to surface water bodies with a high correlation between rainfall, stream flow, soil moisture and groundwater levels. The local hydrology of the area indicates that significant amounts of groundwater, recharged via rainfall, discharges into surface water bodies which will provide for considerable mixing and dilution of nutrients from either source (groundwater or surface water). The dilution of nutrients can reduce the concentration of these nutrients in these water bodies which can lead to less prevalence of the adverse effects of water quality degradation and can partly mitigate against the low denitrification potential of the soils in the area.

Catchment Characteristics

The WW5 farm sits within the Aparima River catchment. The Aparima River is a braided gravel bed river and for the majority of its reach, drains farmland of the Southland plains and discharges to the Jacobs

River Estuary. According to a 2014 Aqualinc Report, the Aparima River catchment is 156,474ha comprised of 102 dairy farms, 10 forestry blocks and 233 sheep and beef farms.

Nutrient Load

We have used some of the workings in this Aqualinc report to illustrate how nutrient load can be reduced within a water body. The calculations below are purely an illustration to demonstrate nutrient load reductions and are based on various assumptions and generalized workings and should not be treated as absolute figures in the context of this application.

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

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

The table estimates the total source load within the catchment at 2133 T N/year undergoing attenuation to result in an estimated 1300 T N/year as a nutrient load within the receiving waters at the Jacobs River Estuary.

Table 27: Estimated loads of nitrogen and phosphorus in the eight study catchments[40]

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

Aqualinc further estimates that in the Jacobs River Estuary catchment, dairy farming contributes 50% of nitrogen load and 64% of phosphorus load. In the context of WW5, the entire farm is within this catchment and therefore may contribute 9,689 kg N to receiving waters based on our Overseer modelling including attenuation at 39%. Realised loads for P are not estimated, so using our Overseer modelling, WW5 may contribute 94 kg P to receiving waters in this catchment using an attenuation rate of 39%.

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

The report then estimated how much these loads may reduce if mitigation scenarios are imposed on only dairy farms within the catchment. For the Jacobs River Estuary catchment, N could be reduced by 18% and P reduced by 31% under the full suite of mitigations (M3).

Table 28: Estimated reductions in the agricultural source loads under three levels of mitigation for all dairy farms in the catchment[41]

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

The full suite of mitigations assessed by Aqualinc includes:

Table 29: Description of mitigations assumed to apply under each mitigation level[42]

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

In the context of WW5, the farm is currently operating at what could be considered M3 level. Therefore, Aqualinc suggests that WW5 operating at M3 may have resulted in a historic reduction of their contribution to the receiving water load. The mitigations proposed in the application are more specific, comprehensive and likely to be more effective at reducing N, P, sediment and microbial contaminant losses as described in detail in the AEE. Our Overseer modelling for the proposal showed approximately a 1.5% reduction in overall N losses with the implementation of the improved GMPs and mitigation measures and an estimated 15% reduction in overall P losses using calculations of GMP effectiveness

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

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

outside of Overseer. This could result in a further reduction of 145 kg N and 14kg P to nutrient load given attenuation.

As the figures above show, the applicant's operation represents a small proportion of the total Aparima River catchment and therefore contributes a small proportionate amount of total nutrient load to the Aparima River (approximately 0.4%). Currently the applicant is operating their dairy farms under restrictions on the discharge activity only and there is no capping or restriction on the amount of nutrients "lost" to the environment contributing to the nutrient load in the receiving waters. Under the proposal, the applicant volunteers both an ongoing restriction on the level of nitrogen outputs modelled by Overseer and the ongoing implementation of specific GMPs and mitigation measures. The result of long term restrictions on the applicant as an operator is that they will be unable to further increase their contribution to contaminant load within any of the receiving water catchments. The Aqualinc report discussed above concluded that if mitigations were implemented on all farms within the catchment, not just dairy farms, then both N and P loads would decrease even more significantly to the tune of 30% for N and 39% for P. Therefore, in time, as other operators in the catchment are restricted in the same manner then there is an expectation that overall nutrient loads will reduce which is likely to improve water quality.

Nutrient Concentration

As described above, the proposal may see a 1.5% and 15% reduction in the applicant's contribution to nitrogen and phosphorus load to the Aparima River catchment. A concurrent reduction in the concentration of these nutrients in these waterways is possible. Section 4.1 of this report detailed the median concentration of nutrients within the Aparaima River between 2009 and 2017. These concentrations would include the implementation of M3 level mitigations on WW5, but will not show the expected improvement in nutrient load under the proposal. For example, WW5 contributes in the vicinity of 0.4% of the nutrient load to the Aparima catchment and the proposal is likely to result in a further 1.5% improvement to nutrient load. Nutrient concentrations are then likely to follow suit and result in a similar and concurrent improvement to median nutrient concentrations in the Aparima River catchment. The median concentrations would then reduce by such a miniscule amount that the reduction in nutrient concentration would be unlikely to show in water quality testing or show a reduction in water quality effects within this catchment on a year end basis. The Aparima River is showing signs of water quality degradation and therefore the proposal is likely to, at a minimum, maintain water quality, and at best, marginally enhance water quality on a long-term basis.

This illustration shows that the applicants operation contributes a small proportion of the total nutrients to the receiving waters. Improvements made under the proposal are likely to reduce total nutrient load and nutrient concentration but will only have a negligible measured impact on water quality on a year end basis. This highlights the importance of catchment wide implementation of water quality mitigation measures and the ongoing restriction on the applicants operation in accordance with nutrient output limits to give certainty that water quality will not be further degraded in the long term.

Summary

The proposal will result in a reduction in P, N, sediment and faecal indicator organisms lost to the environment and a concurrent reduction in the resulting concentration of these 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 the existing trends of improving water quality.

10.2 Overseer Modelling for WW5

Overseer models have been included to support this application at the request of Environment Southland as it is their current preference to have Overseer models to guide an assessment of the overall proposal. Overseer nutrient budgets for the proposed landholding need to be provided by May 2019 according to Appendix N of the PSWLP.

The baseline Overseer model is an accurate description of the operation of the applicant's existing dairy platform averaged over the preceding three years since it was converted. All inputs into the model have been taken from three years of farm records and/or accounts and are actual figures and therefore fairly represent the scale of the farm system as it has been operating since 2015. As discussed in Section 3.2, WW5 was granted land use consent AUTH-20157537-04 in 2015 which granted the establishment of a dairy farm on the property under a proposal which detailed that the majority of the proposed dairy platform was to be converted in 2015 and the remaining 45ha Collies block would be purchased by the applicant in 2019 and converted into dairy platform at the time of purchase. The land use consent and the conditions it contained were worded as such to allow for this the two phased conversion of this property. At the time, both Environment Southland and Fonterra were encouraging consent holders who were converting farms under these consents to "establish a dairy farm" to get the consents signed off as complete once the farm was converted, the consent given effect to and all conditions were met in order to enable supply to Fonterra to commence. Accordingly, the applicants surrendered the consent with Environment Southland in April 2016. The issue now arises that a consent was surrendered, either mistakenly or unwillingly by both the applicant and Environment Southland which had ongoing conditions and ongoing obligations for the conversion of Collies block.

In order to resolve this situation, this application seeks land use consent under Rule 20 for the conversion of Collies block to dairy land in recognition of the fact that the land use consent which has previously approved the conversion of this land to dairy land has been surrendered. In order to give credit for the fact that the conversion of Collies block has already been assessed under proper process in 2015, and that the land use consent was surrendered in error, the applicant has agreed in writing with Environment Southland that this block can be modelled in the baseline models as already being dairy land.

The proposed phase 1 model is a predictive model which estimates inputs based on what is planned to happen for the next five years.

The example phase 2 model is also a predictive model which estimates inputs based on what is planned to happen at least five years in the future. This example model uses more assumptions and typical industry-wide input values due to the inherent uncertainties which exist modelling a farm system so much further into the future. This example model must only be viewed as an example, not representing the exact and absolute farm system the applicant proposes to implement in the future. We also note that Environment Southland consent staff have advised the applicant that a nutrient budget for phase 2 is not considered a requirement for this application, however the applicant has chosen to provide one

to strengthen their proposal and to show that nutrient losses can be reduced to baseline levels under phase 2.

In recent months, 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[43] and Overseer Ltd's review contracted to Enfocus titled Using Overseer in Water Management Planning.[44] 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 N 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 improvement in N 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 in light of the fact that the Resource Management Act is an effects based piece of legislation.

The applicant requests that the land use consents include a restriction on the nitrogen output from the baseline Overseer model. An example condition would be:

X	(a) The subject land shall only be used in a manner such that when modelled with the current version of OVERSEER, the OVERSEER estimated losses of N to water shall not exceed the Nitrogen Baseline. The determination of compliance with this condition will be made using the modelled N loss from the most recent reporting year. (b) The Nitrogen Baseline means the OVERSEER estimated N loss to water using the current version of OVERSEER using (as far as possible) the original OVERSEER input file information provided with the application for consent *dated February 2019* to demonstrate the long-term baseline N loss to water from the consented activity.	This condition essentially provides a compliance limit, which is assessed based on the baseline file provided in the application. The condition ensures that version changes in Overseer are accounted for.

This application proposes that there are no P output loss figure limits imposed as a consent condition. The reason being is that Overseer models farm system P losses at block scale based on topography, land use, soil type and climate. The calibrations within Overseer for phosphorus are not spatially explicit and although assume good management practice around critical source areas, do not reward spatially specific mitigations. It is therefore difficult for users of Overseer/consent holders to lower P output figures by implementing specific mitigation measures because the modelled P loss output would not be able to accurately reflect these initiatives. The GMPs detailed in the FEMP relate in detail to mitigating P, sediment and microbial losses and the application details further mitigation measures

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

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

which will be implemented under the proposal. Imposing a requirement to implement these GMPs and mitigations measures is a meaningful and effective way of managing the risk of P loss to water.

The applicant accepts that the resulting land use consents will need some restrictions on inputs to ensure there is certainty over the scale of the activity and of the implementation of the mitigations which are crucial to the proposal. The applicant suggests inputs from the nutrient budget be inserted into the consent conditions for the following matters:

- Land area to be used as WW5 milking platform
- Liquid effluent discharge area
- Slurry effluent discharge area
- Peak cow numbers milked
- Minimum and maximum number of cows housed in wintering barns (this restriction in effect controls the number of cows wintered off site)

Overseer is an incredibly useful tool to be able to understand the nutrient interactions of a farm system based on soil properties, rainfall, drainage and feed requirements. The output from the model gives an indication of how much nutrient may be lost beyond the root zone. The model does not tell us what the environmental impact of these losses is likely to be. 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. The assessment in Sections 9.3 and 9.4 attempts to show how the applicant has assessed the suitability of individual activities within the proposal against likely effects, available mitigations and likely outcome in terms of whether effects are likely to be avoided, mitigated or both.

10.3 AEE for the farming activity under phase 1 of the proposal on WW5

Section 3.2 of this report described the existing environment on the area of the proposed WW5 landholding . These activities are currently occurring as either permitted activities or consented activities under current and enduring resource consents. Policy 39 of the PSWLP directs an assessment of the adverse effects from the activity as a whole, where the permitted baseline cannot be used to justify an existing level of effects or used to justify the effects of a proposal.

The assessment below assesses the farming activity in its entirety and doesn't use a permitted baseline approach to the assessment. This assessment within Section 9.1 is restricted to the proposed activity under phase 1 of the proposal.

Table 30: Assessment of effects at activity level for phase 1 on WW5

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
Capital fertiliser applications during conversion of 70ha of sheep land (Cochrans) and 45ha of sheep land (Collies) to dairy farming land	The phase 1 Overseer model does not include capital fertiliser applications because it is based on a long term average farm system operating in equilibrium therefore N and P losses as result of capital fertiliser applications over the conversion period may be higher than modelled by Overseer. Capital fertiliser applications will apply larger quantities of N, P, K and S to land in order to increase fertility. These applications of larger quantities of nutrients have the potential to result in losses to the environment if applied at rates which exceed the plants ability to utilize these applied nutrients. Excess applied N likely to be lost to water bodies via nutrient leaching and artificial drainage	Capital fertiliser application timings avoid high drainage periods such as late autumn and winter and periods when soil temperature is less than 7 degrees to mitigate against excess N leaching through the soil profile. All other fertiliser applications will use a little and often approach to avoid the application of excess nutrients which cannot be utilized. Regular soil testing to guide capital fertiliser requirements to avoid the application of excess N and P which cannot be used for plant uptake to mitigate against losses via artificial drainage.	Capital fertiliser applications will only be done as required by the latest annual soil test results from the Cochrans and Collies blocks where P, K or S levels are below agronomical optimum levels. P = 20-40 K = 6-10 S= 10-12 Capital P fertiliser applications will be applied at a maximum of 100kg P/ha which may require P fertiliser applications to be split.	Capital fertiliser applications are only undertaken where there is a nutrient deficit and are done at a rate which meets this deficit and avoids the application of excess nutrients. There is a low risk of adverse effects eventuating as application will meet pasture demand. The fertiliser regime described in the nutrient budgets will be the default fertiliser regime and capital fertiliser applications will only be done during the early phase of the land conversion and completed using GMP principles and in according to mitigation measures which should adequately mitigate adverse effects.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	channels on the Braxton, Upukerora and Tuatapere soils. Excess applied P likely to be lost to water bodies via overland flow on Braxton soils only. Excess N and P in water bodies may lead to water quality degradation resulting in ecological stresses on aquatic life and human health consequences such as blue baby syndrome.			
Cultivation of new pastures on new 70ha Cochrans block and 45ha Collies block	Short term increase in potential sediment, microbial and phosphorus losses to the environment which can cause ecological stresses on plants and animals due to sedimentation, algae blooms and water temperature increases in waterways and estuaries	Re-sow bare paddocks as soon as possible Use buffer zones around critical source areas and use direct drilling if possible. Cultivation will be undertaken to meet permitted activity criteria in Rule 25(a) of the PSWLP maintaining a 5 meter buffer zone.	Further mitigations not required as land is flat which reduces the risk of overland flow of sediment and phosphorus when cultivating land. The block contains one waterway (on Collies block) which has riparian buffer zone margins which significantly reduces risks of contaminants entering water bodies directly from cultivation activity.	Adverse effects should be adequately avoided as this is a low risk activity in this location. GMPs provide adequate mitigation of effects.
Construction of new lanes on new 70ha block and new 45ha block	New laneways create high risk areas for sediment, microbial and P losses.	No stockpiling of earthworks material near waterways.	The paddock and lane layout have been designed to ensure new lanes are perpendicular to waterways. Where the lane crosses a waterway, an appropriately	Overseer assumes 30% of dung deposited on lanes is lost directly to waterways, regardless of where the waterways are located in relation to

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	Short term increase in potential sediment, microbial and phosphorus losses to the environment which can cause ecological stresses on plants and animals due to sedimentation, algae blooms and water temperature increases in waterways and estuaries	Laneways include camber and contouring to direct runoff to pasture and away from waterways Buffer zones will be created in riparian margins to waterways.	sized culvert will be used (within permitted activity rules) with runoff directed to adjacent pasture.	the laneways. Overseer may have overestimated P losses (and sediment losses) in phase 1 proposal model because it doesn't recognise that the applicant will be implementing these GMPs and also siting of the lanes away from waterways as a mitigation measure.
Increase of nutrient losses from the 70ha new block and 45ha new block	The land use change on the two blocks from sheep farming to dairy platform results in an increase of modelled nutrient loss on these specific blocks of land. The N losses from the 70ha sheep block have been modelled to increase by 1,730 kg N and by 25 kg N/ha/year. Under the agreed modelling method, Collies block is not modelled in the baseline as sheep land. It can be assumed that nutrient losses will increase at a proportional rate to the Cochrans block.		The modelled nutrient losses from the WW5 dairy platform have increased under the proposal by a small total of 55 kg N which means that losses on the existing dairy platform have been reduced in general to counteract the increase in contaminant losses from the 73ha sheep block. This concurrent reduction of losses on the platform ensures that overall, nutrient losses do not increase under the proposal on a per hectare basis. The 73ha existing sheep block and 45ha Collies block are both located within the same groundwater and surface water catchments as the remainder of the dairy platform which ensures that the modelled losses entering the receiving water bodies does not increase under the proposal in its entirety. The 73ha existing sheep block and 45ha Collies block are located within the same physiographic zones as the remainder of the dairy platform which ensures that the	The increased modelled contaminant losses from the new blocks are mitigated by the concurrent reduction in modelled contaminant losses across the remainder of the dairy platform. The new blocks and the existing dairy platform are located within the same catchments and physiographic zones meaning that there will be no modelled increase in contaminant losses to water bodies in accordance with the physiographic zone policies and Policy 16 of the RWPS.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	Excess nutrients lost from one specific area of land may result in water quality degradation in the receiving waters causing ecological stress for plants and animals.		modelled losses from these physiographic zones does not increase under the proposal in its entirety. The mitigation measures to reduce modelled nutrient losses (contained throughout this table) are located across the entire dairy platform and therefore will mitigate against contaminant losses from activities located on both of the new blocks and the existing platform.	
Increase in nutrient losses from the existing self-contained dairy platform	The proposal sees a modelled increase in N losses on the self-contained dairy platform. The N losses on this block of land increase by 55 kg N which represents a 0.3% increase. The P losses decrease by 6 kg P and therefore it is expected that sediment and microbial losses also will decrease. Excess nutrients lost from one specific area of land may result in localised water quality degradation in the receiving waters causing ecological stress for plants and animals.		Although modelled N losses from the WW5 platform have increased, there is no change in the per hectare N losses meaning that nutrient losses are being spread over a larger area in the proposal as opposed to being more concentrated on a smaller block of land. The existing dairy platform and the expanded dairy platform are located within the same groundwater and surface water catchments which ensures that the modelled losses entering the receiving water bodies increases by only 0.3% under the proposal. The existing dairy platform and expanded dairy platform are located within the same physiographic zones which ensures that the modelled losses from these physiographic zones increases by only 0.3% under the proposal. The mitigation measures to reduce modelled nutrient losses (contained throughout this table) are located	The increased modelled contaminant losses from the dairy platform are mitigated by the wider distribution of modelled contaminant losses across the remainder of the landholding. The existing dairy platform and expanded dairy platform are located within the same catchments and physiographic zones meaning that there will be a negligible modelled increase in contaminant losses to water.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
			across the entire dairy platform and therefore will mitigate against contaminant losses from activities located on both the existing platform and expanded platform.	
Discharge of liquid effluent to land via low rate application predominantly using pods and slurry tanker with umbillical	The proposal sees an increase in the number of cows milked on farm from 665 (theoretical) to 800 which means more effluent will be generated which needs to be discharged to land. Potential for contaminant losses via all three pathways: leaching (N), artificial drainage (N, P, microbials) and overland flow (N, P, microbials) when nutrients in effluent are applied to land. Potential for contaminant losses to cause excess nutrients in surface water and groundwater bodies in the vicinity of the property, particularly via tile drain pathways on the Braxton soils	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 liquid FDE is sized to ensure nutrient loadings from the application of effluent are maintained at less than 150 kgN/ha/year to avoid excess nutrient loading. Utilizing low rate effluent application on the Braxton soils which are poorly drained to ensure effluent is only applied when a soil moisture deficit occurs and to avoid losses via artificial drainage by applying effluent in a manner which keeps nutrients in the root zone.	No liquid effluent is applied to the Upukerora soils due to their high risk of nutrient leaching/ deep drainage. No further mitigations are required over and above GMP level as liquid effluent management system is designed to meet best practice by utilizing low rate application, deferred storage of effluent and application at a rate less than the soil moisture deficit as guided by the ES soil moisture monitoring sites on the website. The effluent discharge area at 133ha is large enough to cater for the additional effluent generated by the additional cows and maintain effluent N loadings at less than 150kg N/ha/year.	Adverse effects to the environment from the discharge of effluent should be no more than minor. Effluent application rates, GMPs and the resulting avoidance of effects supported by Policy 42 of the RWP. The discharge of effluent is governed by the consent conditions in the discharge permit giving certainty that the activity will be regulated.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	In general, excess nutrients result in water quality degradation causing ecological stress for plants and animals.	Use of deferred storage of effluent to allow effluent to be stored when it is unsafe to apply to land. Use of a slurry tanker to discharge larger volumes of effluent to low risk soils (Tuatapere) when soil moisture deficit levels are appropriate to lower storage volumes. Buffer zones created from effluent application areas to critical source areas and other sensitive receptors such as bores, property boundaries and dwellings.		
Intensive winter grazing on the WW5 platform	Potential for significant amounts of contaminants (N, P, sediment and microbials) to be lost to both surface and groundwater bodies as a result of the complete de-vegetation of pasture/crop, treading damage on soil structure and runoff following rainfall events.	Buffer zones maintained between crop cultivation and critical source areas to provide an area where runoff can be filtered and captured limiting risks of entering water. Grazing direction will be away from buffer zones/critical source areas leaving last bite to provide a buffer zone for nutrient capture through until the end of the fodder grazing period.	The intensive winter grazing will continue to be located on the milking platform under this proposal because it is predominantly flat with no waterways or artificial drainage channels which avoids the risk of the direct runoff of nutrients to surface water bodies. Cropping is ceased on the Upukerora soils and cropping is now located on the Braxton and Tuatapere soils which have lower N leaching risk compared to Upukerora. However, the Braxton soils are known to be prone to cracking which is not a factor which is considered in the Overseer model. The applicant has	Adverse effects potentially still exist from this activity due to the high level of contaminant losses which occur from intensive winter grazing despite the implementation of GMPs and mitigations. The overall nutrient budget has taken this high contaminant loss activity into account and provided mitigations and reductions in nutrient loss in other areas and activities across the dairy platform to offset adverse effects.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	Nutrient losses from this activity occur via deep drainage through the soil profile into the underlying aquifer or via overland flow into adjacent waterways or artificial drainage channels. Excessive nutrient losses can cause nutrient accumulation in groundwater and excessive nutrient load in waterways causing water quality degradation and the resulting ecological stress on plants and animals when the life-supporting capacity of the water is compromised by excess nutrients. In the current scenario, cropping on the existing dairy platform represents 26% of the N losses within the farm system on 12% of the land area due to the higher concentration of stock in a small area and thus greater urine deposition. On the	Back fencing and portable water troughs to limit treading damage over already de-vegetated ground. Cultivation of paddocks timed to avoid paddocks sitting bare for long periods of time which reduces risks of contaminant losses through leaching and overland flow. All other GMPs listed in rule 20 will be implemented by May 2019. Bare soils are cultivated using full cultivation and timed to avoid paddocks siting bare for long periods of time which reduces risks of losses of excess nutrients remaining from the grazing activity to the environment via overland flow and leaching.	seen little evidence of cracking on the Gladfield block and cracking does not generally occur in the winter period because it is a condition impacted by drier temperatures and low soil moisture levels. To mitigate against the risk of contaminant losses via cracking, the applicant will cultivate intensive winter grazing paddocks in early spring to ensure pasture cover is established going into summer which can suck up nutrients for their growth and soil moisture is maintained and held in the profile as much as possible over the spring and summer. This will mitigate against risks to water quality in the underlying aquifer and surface water receiving bodies. Crop area is reduced by 4ha. The additional dairy replacements from other Woldwide dairy farms previously grazed on crop on WW5 have been removed.	The GMPs and the mitigations proposed will mitigate adverse effects to a certain extent, with the long term goal of the applicant to abolish intensive winter grazing from the Central Plains/Heddon Bush area. The effects of this activity will be limited to a five-year timeframe.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	existing Cochrans block, cropping contributes 33% of total losses from 6% of the total land area. Nutrient losses from the crop block reduce under the proposal to 15% of total losses over 11% of the land area.			
Increase in cow numbers to consented discharge permit levels.	The grazing of more cows on pasture during high risk periods increases the risk of the leaching of nutrients (N,P and microbials) through the soil profile from urine and dung spots or transported via subsurface drainage. Pasture damage from cows grazing during adverse periods can result in increased sediment, microbial and P loss if erosion or soil loss occurs from paddocks Increased nutrient losses as total figures due to more cows, to groundwater and surface water bodies may potentially cause water	Use of selective grazing to avoid grazing very wet paddocks during adverse weather conditions to reduce risks of pugging and treading damage to soil structure which can accelerate contaminant losses. Increase the size of feed breaks during adverse conditions to give animals more of the paddock to graze than the volume of feed required to reduce stocking rate on wet and vulnerable pasture to avoid pugging and treading damage of feed. Use nutrient budgeting to manage nutrient inputs and outputs to guide farm management decisions which	Stocking rate will reduce from 3.2 cows/ha to 2.1 cows/ha with the introduction of the additional land to the dairy platform with a comparatively smaller increase in cow numbers. A stocking rate reduction results in a reduction in nutrient losses on a per hectare basis as a result of an increase of cows producing urine and dung spots which are significant sources of contaminant losses to the root zone over a larger area of land, thereby reducing per hectare nutrient loadings. Fence off areas where stock camp if pasture damage is occurring to limit risks of further pasture damage. Use of in-shed feeding when feed deficits occur to ensure stock enter paddock break having already eaten some food which can limit pugging and treading damage, particularly under adverse weather conditions.	A reduction in stocking rate mitigates effects of the small increase in cow numbers on total nutrient losses modelled by Overseer. Adverse effects on the environment adequately mitigated with combination of GMPs and mitigations which have a high level of effectiveness for mitigating risks of grazing cows on pasture throughout the milking season.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	quality degradation which can cause ecological stresses on aquatic plants and animals from algal growth, temperature increases and eutrophication. Human health concerns can also arise from microbial contamination of waterways upon contact and risks of blue baby syndrome from nitrate accumulation in groundwater and potentially bowel cancer as discussed in section 9.1 above.	can maintain overall nutrient losses at desired level.		
Fertiliser application regime across the 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 utilized for pasture/crop production. Nitrogen losses from fertiliser application most likely to occur via deep drainage. Phosphorus losses from	Time N, P, K and S fertiliser application to meet crop and pasture demand using split applications and avoid high risk times of the year i.e. when soil temperature is less than 7 degrees, during drought periods and during periods when soils are at field capacity. Reduce use of P fertiliser where Olsen P values are above agronomic optimum. Maintain Olsen P levels at around 30-40.	Urea applications on all blocks occur using a little and often approach. Applied N in fertiliser has reduced across the whole property. N fertiliser has reduced on non-effluent blocks and on effluent blocks. These changes have been enabled due to the increase in land area, decrease in urea applied and increase in the spread of effluent. January fertiliser application on the Upukerora blocks has been ceased.	The proposed fertiliser regime under phase 1 has been improved given the need for lower pastoral production (of 1 T DM/ha) with the stocking rate reduction. Less nitrogen is available from supplements and more is supplied by the additional effluent which equates to an overall reduction in fertiliser needed under the proposal. Adverse effects both avoided and mitigated with use of GMPs for fertiliser usage and further mitigations

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	fertiliser most likely to occur via soil loss and/or direct loss through runoff or erosion. Adverse effects of inappropriate fertiliser application or excess application include a loss of excess nutrients to water causing water quality degradation in both groundwater and surface water bodies. Water quality degradation can adversely impact aquatic plant and animal ecosystems and impact on human health.	Use nutrient budgeting and annual soil testing to manage nutrient inputs from fertiliser and outputs to guide farm management decisions which can maintain overall nutrient losses at desired level.		to reduce fertiliser across the dairy platform.
Imported supplementary feed and feed made on-farm and fed during the season	Supplementary feed usage has an impact on the pasture production of the farm system and can change the quantity of N particularly in the farm system compared to an all-grass based diet. Low N supplementary feeds can reduce estimated N losses to the environment as less N needs to be supplied to fuel pasture production which in		Supplementary feed imported onto the property has reduced by 39 T of barley grain and brewers grain. Supplementary feed made and fed during the season is unchanged.	The reduced stocking rate has necessitated the reduction in imported supplementary feed to reconcile pasture production between the two systems. Likely to have positive effects on the environment.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	turn can have beneficial effects on water quality by reducing nutrient load in groundwater and surface water bodies.			
Slurry effluent application across the entire landholding	The nutrient concentration of slurry effluent is higher than liquid or FDE due to the lack of dilution from rainwater or washdown water. Due to the higher concentration of nutrients, application of slurry effluent 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 from effluent. This loading is achieved by ensuring the land area is large enough and the application depth is restricted. 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	The maximum loading rate of nitrogen from the application of effluent (both slurry and liquid) to land is 150 kg N/ha/year. Slurry effluent is not discharged onto the same area any more frequently than once every two months. Slurry effluent is only discharged to land when soil temperature is greater than 5 degrees in winter and 7 degrees 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.	Slurry effluent is applied to non-effluent blocks in the Overseer model i.e. blocks where FDE is not applied. The non-effluent blocks are the same in terms of FDE classification, soil type and physiographic zone to the approved effluent blocks so is considered equally as suitable for receiving slurry effluent. Slurry effluent applied to paddocks low in potash (K levels lower than 6-10) and with low Olsen P levels (P levels lower than 25) . Slurry effluent from neighbouring Woldwide Three is approved under an existing discharge permit to be exported to WW5 and is therefore included in the baseline and phase 1 models.	Adverse effects to the environment from the discharge of slurry effluent should be no more than minor. Effluent application rates, GMPs and the resulting avoidance of effects is supported by Policy 42 of the RWPS. The discharge of effluent is governed by the consent conditions in the discharge permit giving certainty that the activity will be regulated. The application of slurry effluent to paddocks 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.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	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. Slurry effluent will be applied to areas outside of the liquid discharge area approved under the discharge permit. Slurry effluent is generally considered lower risk to apply to land because it doesn't have the same risks of leaching, overland flow/runoff that liquid effluent has.			
Use of three small standoff pads on the dairy platform	Standing cows off pasture in marginal periods especially during late Autumn and early Spring reduces the risk of pugging to pastures which reduces the infiltration ability of soils and reduces overland flow of nutrients.	Urine and dung deposition during high risk periods is redistributed to pasture when soils are in a suitable state to receive and utilize applied nutrients. The standoff pad is located in accordance with the setbacks listed in Rule 35 of the PSWLP and is constructed, used and maintained	The standoff pads will be used occasionally to stand between 100 and 120 cows each off pasture during the milking season (modelled as during April, May, August and September).	Standoff pads are used as an effective and simple environmental mitigation tool to reduce nutrient losses to the environment which can occur primarily during high risk and high drainage periods. Soil degradation is protected as a result which increases pasture productivity and nutrient utilization.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	Nutrients in effluent generated by the cows during these periods spent on standoff structures coincides with high drainage periods which ensures that these nutrient can be stored in situ and applied to land in a manner which matches plant demand and mitigates against excessive leaching processes which can lead to the contamination of groundwater and surface water bodies. An overall reduction in nutrient losses from the landholding reduces nutrient accumulation risks in groundwater and reduces nutrient load in waterways. A reduction in nutrient load can improve water quality and maintain and enhance the life-supporting capacity of water bodies.	under the permitted activity criteria meaning that the pads themselves do not require resource consent. The solid effluent is applied to land in accordance with permitted activity criteria in Rule 38 of PSWLP.		

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
Use of the existing effluent storage facilities on the dairy platform	If a structure is leaking or not structurally sound there is a risk of contaminant losses directly to shallow groundwater. Contaminant accumulation in groundwater can lead to human health issues from blue baby syndrome or E.coli contamination if drinking water is abstracted nearby. Contaminants may also reach surface water bodies if there is a groundwater/surface water connection which can cause water quality degradation effects such as algal blooms, smothering and eutrophication in surface water bodies.	Monthly effluent system checks will be undertaken in accordance with the farm's maintenance checklist. Leaks will be repaired immediately. Fail safe systems will be kept in place and kept in good working order i.e automatic alarms and shut off system. All staff involved in the management of the effluent system are fully trained in its use.	Drop tests will be completed on the slurry bunker in July when milking stops for the season as these areas are first collection points for effluent there is no mechanism by which to divert effluent during the 48hr drop test period.	Effluent storage facilities are fit for purpose and leaks are identified through regular testing and checking of the effluent storage structures. Adverse effects from leakage should be avoided and remedied immediately.
Groundwater abstraction	Groundwater abstractions must be at a rate which doesn't cause drawdown effects on adjacent bores which can compromise the availability and reliability of the resource for other users.	Reduce water usage in the shed by re-using clean water whenever possible. Treating cows gently to avoid upset.	The yard is scraped to significantly reduce fresh water use at the dairy shed.	No adverse effects on aquifer sustainability or the availability and reliability of water for other users. Groundwater usage is reasonable in terms on end use. Adverse effects should be less than minor.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	Groundwater abstractions must be at a level which does not result in an over-allocation of the resource which can adversely impact on drinking water availability, water availability for commercial and industrial uses. Water use in the dairy shed should be managed to ensure there is little wastage because the more water used, the more effluent generated which needs to be discharged to land.			

10.4 AEE for the farming activity under phase 2 of the proposal

Phase 2 of the application involves the introduction of a wintering shed into the farm system as a major mitigation measure for reducing nutrient losses across the dairy platform. The transition to a farm system which includes a wintering shed enables the removal of high-risk activities for nutrient losses from high risk areas on the farm.

We also note that Environment Southland consent staff have advised the applicant that a nutrient budget for phase 2 is not considered a requirement for this application, however the applicant has chosen to provide one to strengthen their proposal and to show that nutrient losses can be reduced to baseline levels.

The intention of phase 2 is to introduce wintering sheds into the farm system which will reduce nutrient losses on the dairy platform. The applicant proposes that the land use consent be issued requiring them to operate the farm system in phase 2 at a level equal to or less than the modelled nutrient losses (predicted by Overseer) submitted in the baseline models. Therefore, we are applying for phase 2 of the application to be governed by a land use consent based on an Overseer output figure to enable the applicant to operate an entirely flexible farm system under the resulting land use consent. Our proposal is that only input values relating to the scale of the activity derived from the example nutrient budget are inserted as consent conditions in the land use consent.

The assessment below attempts to show how the applicant has assessed the suitability of individual activities within the proposal against likely effects, available GMPs and mitigations and likely outcome in terms of whether effects are likely to be avoided, mitigated or both. The assessment lacks reference to specific input figures to show that an output-based land use consent is appropriate and still provides certainty of effects and effectiveness of mitigations.

Table 31: Assessment of effects at activity level for phase 2 on WW5

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
Decrease in nitrogen losses from the entire dairy platform	The proposal sees a modelled decrease in total N losses on the landholding. The N losses decrease from 15,882 kg N in the baseline to approximately 15,639 kg N. An overall reduction in total nitrogen losses from the dairy platform reduces nitrate accumulation risks in groundwater and reduces nitrogen load in waterways. A reduction in overall nitrogen load can improve water quality and maintain and enhance the life-supporting capacity of water bodies.		The removal of the winter grazing activity from the dairy platform results in a significant reduction in modelled N losses from the dairy platform. The intensive winter grazing activity is removed from the central plains area and either relocated to WRO or reduced in intensity by utilizing the wintering sheds. The use of wintering sheds provides additional mitigation of nitrogen losses across the platform.	The reduction in modelled nitrogen losses from the landholding to the lowest practicable level should correlate with a nutrient load reduction in the receiving water bodies and/or physiographic zones in accordance with the physiographic zone policies and Policy 16 of the RWPS.
Modelled Increase in phosphorus losses from the entire landholding	The proposal sees a modelled increase in P losses from the entire landholding of 8kg P compared to baseline, however this increase is not expected to occur in reality.	Avoid working CSAs and their margins All riparian margins to be fenced and left to establish with grasses to enable filtration of contaminants that	All new laneways will be located away from waterways and riparian margins implemented.	Please see section 8.4 of this report for full assessment of expected P losses and full assessment of proposed mitigations and their effectiveness.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
		may be transported via overland flow processes and erosion Reduce use of P fertiliser where Olsen P levels are above agronomic optimum. Reduce the risk of runoff from laneways and other sources by ensuring crossings are adequately maintained and maintain gradients to direct runoff to pasture. Please see section 8.4 of this report which discusses further P loss GMPs proposed by the applicant and discusses how P (and sediment and microbial) losses are likely to be misrepresented by Overseer modelling.		
Use of wintering sheds	Nutrients in effluent generated by the cows during winter and in marginal periods is stored and applied to land in a manner which matches plant demand and mitigates against excessive leaching processes which can	Urine and dung deposition during high risk periods is redistributed to pasture using the effluent management system when soils are in a suitable state to receive and utilize applied nutrients.	The wintering sheds will be used to winter the majority of the milking herd from June through till calving dates. Two primary scenarios would exist under an output based land use consent: - All mixed age cows and R2 replacements are wintered in the sheds for the winter period totalling 1030-1050 cows.	Adverse effects from winter grazing on the high risk soils on the dairy platform are ceased. Wintering sheds significantly reduce nutrient losses to the environment and can offset adverse effects from activities on the remainder of the

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	lead to the contamination of groundwater and surface water bodies. An overall reduction in nutrient losses from the landholding reduces nutrient accumulation risks in groundwater and reduces nutrient load in waterways. A reduction in nutrient load can improve water quality and maintain and enhance the life-supporting capacity of water bodies. Standing cows off pasture in late Autumn and early Spring reduces the risk of pugging to pastures which reduces the increases the infiltration ability of soils and reduces overland flow of nutrients.	The wintering sheds are located in accordance with the setbacks listed in Rule 35 of the PSWLP.	- All mixed age cows are wintered in the sheds for the winter period totalling 770 and R2 replacements are grazed on fodder crop at WRO and return to the platform towards the end of July/beginning of August for calving. Intensive winter grazing will cease entirely on the dairy platform under this proposal and the land will be used as dairy platform. The dry of date is extended to 15th June because cows are able to be kept indoors towards the end of the milking season. The wintering sheds can be used during the autumn and spring to remove cows from pasture during high drainage periods to protect soil structure, avoiding tramping of feed and avoid urine and dung deposition.	landholding by lowering the total quantity of nutrients lost to the environment.
Increase in cow numbers to 930 across dairy platform	The grazing of more cows on pasture during high risk periods increases the risk of the leaching of nutrients (N,P	Use of selective grazing to avoid grazing very wet paddocks during adverse weather conditions to reduce risks of pugging and treading	Stocking rate will increase from 2.1 cows/ha under phase 1 to to 3.2 cows/ha under phase 2 with the introduction of more cows onto the same land area as phase 1.	The marginal stocking rate reduction is unlikely to have a discernible impact on per hectare nutrient loadings which is why the introduction of the

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	and microbials) through the soil profile from urine and dung spots or transported via subsurface drainage. Pasture damage from cows grazing during adverse periods can result in increased sediment, microbial and P loss if erosion or soil loss occurs from paddocks Increased nutrient losses as total figures due to more cows, to groundwater and surface water bodies may potentially cause water quality degradation which can cause ecological stresses on aquatic plants and animals from algal growth, temperature increases and eutrophication. Human health concerns can also arise from microbial contamination of waterways upon contact and risks of blue baby syndrome from nitrate	damage to soil structure which can accelerate contaminant losses. Increase the size of feed breaks during adverse conditions to give animals more of the paddock to graze than the volume of feed required to reduce stocking rate on wet and vulnerable pasture to avoid pugging and treading damage of feed. Use nutrient budgeting to manage nutrient inputs and outputs to guide farm management decisions which can maintain overall nutrient losses at desired level.	Overall, there is a marginal stocking rate reduction of 0.1 cows/ha compared to the baseline scenario. Fence off areas where stock camp if pasture damage is occurring to limit risks of further pasture damage. Use of in-shed feeding when feed deficits occur to ensure stock enter paddock break having already eaten some food which can limit pugging and treading damage, particularly under adverse weather conditions. Use of the wintering shed as a standoff area to offset additional nutrient losses that may occur with higher number of cows grazing during adverse weather conditions. Use of the wintering shed to winter the majority of the herd off the support block and the subsequent removal of intensive winter grazing from the dairy platform	wintering shed forms the most significant mitigation measure alongside other minor mitigations. Adverse effects on the environment will be adequately mitigated with combination of GMPs and mitigations which have a high level of effectiveness for mitigating risks of grazing cows on pasture throughout the milking season.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	accumulation in groundwater.			
Discharge of liquid effluent to land via low rate application predominantly using pods, and slurry tanker will umbillical to existing effluent discharge area (existing platform)	The proposal sees an increase in the number of cows milked on farm from 850 to 930, plus the introduction of a wintering shed as a generation area for effluent which means more effluent will be generated which needs to be discharged to land. Potential for contaminant losses via all three pathways: leaching (N), artificial drainage (N, P, microbials) and overland flow (N, P, microbials) when nutrients in effluent are applied to land. Potential for contaminant losses to cause excess nutrients in surface water and groundwater bodies in the vicinity of the property, particularly via tile drain pathways on the Braxton soils	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 liquid FDE is sized to ensure nutrient loadings from the application of effluent are maintained at less than 150 kgN/ha/year to avoid excess nutrient loading. Utilizing low rate effluent application on the Braxton soils which are poorly drained to ensure effluent is only applied when a soil moisture deficit occurs and to avoid losses via artificial drainage by applying effluent in a manner which keeps nutrients in the root zone. Use of deferred storage of effluent to allow effluent to be stored when it is unsafe to apply to land.	No further mitigations are required over and above GMP level as liquid effluent management system is designed to meet best practice by utilizing low rate application, deferred storage of effluent and application at a rate less than the soil moisture deficit as guided by the ES soil moisture monitoring sites on the website. The effluent discharge area is large enough to cater for the additional effluent generated by the additional cows and maintain effluent N loadings at less than 150kg N/ha/year.	Adverse effects to the environment from the discharge of effluent should be no more than minor. Effluent application rates, GMPs and the resulting avoidance of effects supported by Policy 42 of the RWP. The discharge of effluent is governed by the consent conditions in the discharge permit giving certainty that the activity will be regulated.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	In general, excess nutrients result in water quality degradation causing ecological stress for plants and animals.	Use of a slurry tanker to discharge larger volumes of effluent to low risk soils (Tuatapere) when soil moisture deficit levels are appropriate to lower storage volumes. Buffer zones created from effluent application areas to critical source areas and other sensitive receptors such as bores, property boundaries and dwellings.		
Imported supplementary feed and feed made and fed during the season across the entire landholding	Supplementary feed usage has an impact on the pasture production of the farm system and can change the quantity of N particularly in the farm system compared to an all-grass based diet. Low N supplementary feeds can reduce estimated N losses to the environment as less N needs to be supplied to fuel pasture production which in turn can have beneficial effects on water quality by reducing nutrient load in groundwater and surface water bodies.		Supplementary feed imported onto the property is likely to increase under this scenario. The example Overseer budget modelled an increase in the vicinity of 135 T of barley grain, 35 T of distilled brewers grain, 300 T PKE and allows for lactation to be extended. Supplementary feed made and fed during the season is increased to 1250 T DM silage.	The increased number of cows and longer lactation requires the need to increase supplementary feed to reconcile pasture production. Additional fertiliser and barn slurry also needed to reconcile pasture production. Increased supplementary feed can reduce overall N cycling in a system which can result in less overall N losses to the environment and the mitigation of adverse effects on water quality.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
Slurry effluent application across the entire landholding	The nutrient concentration of slurry effluent is higher than liquid or FDE due to the lack of dilution from rainwater or washdown water. Due to the higher concentration of nutrients, application o fslurry 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 from effluent. This loading is achieved by ensuring the land area is large enough and the application depth is restricted. 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	The maximum loading rate of nitrogen from the application of effluent (both slurry and liquid) to land is 150 kg N/ha/year. Slurry effluent is not discharged onto the same area any more frequently than once every two months. Slurry effluent is only discharged to land when soil temperature is greater than 5 degrees in winter and 7 degrees in spring.	Slurry effluent is applied to non-effluent blocks in the Overseer model i.e blocks where FDE is not applied. The non-effluent blocks are the same in terms of FDE classification, soil type and physiographic zone to the approved effluent blocks so is considered equally as suitable for receiving slurry effluent. Slurry effluent is applied at a depth of no more than 2.5mm to maintain effluent loadings. Effluent from WW3 is applied evenly to the approved discharge area.	The application of slurry effluent to land will be undertaken under the conditions and provisions of the discharge permit and adverse effects from this activity are expected to be no more than minor.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	ecosystems and the overall health of water bodies. Slurry effluent will be applied to areas outside of the liquid discharge area. Slurry effluent is generally considered lower risk to apply to land because it doesn't have the same risks of leaching, overland flow/runoff that pure liquid effluent has. A significant amount of additional slurry effluent is generated from the wintering sheds which needs to redistributed to land evenly and at a rate which matches pasture and crop demand to avoid direct losses of nutrients to the environment as described above.			
Use of the existing effluent storage facilities on dairy platform	If a structure is leaking or not structurally sound these is a risk of contaminant losses directly to shallow groundwater. Contaminant	Monthly/frequent effluent system checks will be undertaken in accordance with the farm's maintenance checklist.	The applicant will be continuing to operate under the existing land use consents for the use and maintenance of these structures granted under phase 1.	Effluent storage facilities are fit for purpose and leaks are identified through regular testing and checking of the effluent storage structures.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	accumulation in groundwater can lead to human health issues from blue baby syndrome or E.coli contamination if drinking water is abstracted nearby. Contaminants may also reach surface water bodies if there is a groundwater/surface water connection which can cause water quality degradation effects such as algal blooms, smothering and eutrophication in surface water bodies.	Leaks will be repaired immediately Fail safe systems will be kept in place and kept in good working order i.e. automatic alarm and shut off system All staff involved in the management of the effluent system are fully trained in its use		Adverse effects from leakage should be avoided or remedied immediately.
New effluent storage facilities on dairy platform	New effluent storage facilities are designed in accordance with current specifications and will include leak detection systems which ensures that any leakages can be quickly identified and remedied. Adverse effects from leakage are the same as described above for existing effluent storage facilities	Monthly/frequent effluent system checks will be undertaken in accordance with the farm's maintenance checklist. Leaks will be repaired immediately Fail safe systems will be kept in place and kept in good working order i.e. automatic alarm and shut off system All staff involved in the management of the effluent system are fully trained in its use	New effluent structures will contain leak detection systems and will be consented by way of land use consents applied for prior to the commencement of phase 2. A regular drop testing regime will be implemented in accordance with likely consent conditions.	Effluent storage facilities are fit for purpose and leaks are identified through regular testing and checking of the effluent storage structures. Adverse effects from leakage should be avoided or remedied immediately.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
Groundwater abstraction on the dairy platform	Groundwater abstractions must be at a rate which doesn't cause drawdown effects on adjacent bores which can compromise the availability and reliability of the resource for other users. Groundwater abstractions must be at a level which does not result in an over-allocation of the resource which can adversely impact on drinking water availability, water availability for commercial and industrial uses. Water use in the dairy shed should be managed to ensure there is little wastage because the more water used, the more effluent generated which needs to be discharged to land.	Reduce water usage in the shed by re-using clean water whenever possible. Treating cows gently to avoid upset. Monitoring of the groundwater abstraction volumes on a monthly basis.	The yard is scraped to significantly reduce fresh water use at the dairy shed which considerably lowers effluent generation throughout the milking season. Effluent storage requirements are reduced.	No adverse effects on aquifer sustainability or the availability and reliability of water for other users. Groundwater usage is reasonable in terms on end use. Adverse effects should be less than minor.

11. ASSESSMENT OF ENVIRONMENTAL EFFECTS FOR PROPOSAL ON WRO

Please see attached document in Appendix F named "Woldwide Runoff – Proposal and AEE" for a full assessment of environmental effects on WRO.

12. NOTIFICATION AND CONSULATION

The applicant requests that the consent authority publicly notify this application in accordance with s95A of the Resource Management Act.

13. 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.

13.1 Part 2 of the RMA

Part 2 of the RMA states the general purpose to the Act which is to promote the sustainable management of natural and physical resources. Sustainable management is explained to mean managing the use, development, and protection of natural and physical resources in a way which enables people and their communities to provide for their economic social and cultural wellbeing while sustaining the reasonably foreseeable needs of future generations, or on the life-supporting capacity of the environment and any ecosystems associated with it and avoiding remedying and mitigating adverse effects on the environment.

The proposal is for a farming activity which utilizes natural resources. The continuation of the activity as proposed will enable the applicant to provide for their economic and social wellbeing, and that of the immediate small Southland community and the wider regional economy in which it operates. The applicant has described that potential adverse effects of the proposal may exist, however they consider that these adverse effects have been adequately identified and assessed as able to be avoided, remedied and mitigated under their proposal.

Section 6 of the RMA requires consideration of several matters of natural importance. The matters specifically relevant to this proposal include:

- The preservation of the natural character of the coastal environment, wetlands, and lakes and rivers and their margins and the protection of them from inappropriate subdivision, use and development

- The relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu and other taonga

The proposed activities will not impact directly on the coastal environment, wetlands, lake and rivers however there is the potential for water quality effects on the wider receiving environment which includes these features. The applicants assessment of environmental effects identifies potential effects on these receiving water bodies and provides appropriate and adequate mitigation measures to avoid adverse effects. The applicant acknowledges Maori have a long history and relationship with the area and consider that their proposal will not compromise or have an adverse impact on Maori culture, traditions or taonga.

Section 7 lists matters which all persons shall have regard to. This application has given particular regard to the efficient use and development of natural resources, intrinsic values of ecosystems and the maintenance and enhancement of the quality of the environment. The proposed activity is not inconsistent with the principles of the Treaty of Waitangi as required by Section 8.

Overall, the activity is considered to be consistent with Part 2 of the RMA, given the incorporation of proposed mitigations for the activity.

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

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

- National Policy Statement for Freshwater Management, 2014
- Te Tangi a Tauira - The Cry of the People, Ngai Tahu Ki Murihiku, Natural Resource and Environmental Iwi Management Plan, 2008
- Regional Policy Statement for Southland, 2017 (SRPS)
- Regional Water Plan for Southland, 2010 (RWPS)
- Proposed Southland Water and Land Plan, 2018 (PSWLP)

For ease, policies from these documents have been grouped together under subjects relevant to this application. The most relevant objectives and policies to this application have been selected, with particular weighting and consideration given to the policies contained with the Proposed Southland Water and Land Plan 2018 (PSWLP). We appreciate that the PSWLP is currently under appeal and is therefore still a moving entity, however we consider that the background to this plan including the policies it contains has considered all of the other planning documents in its development and therefore a higher level of assessment is provided for the policies it contains.

13.2.1 *Water Quantity*

Regulatory Document	Particularly relevant Sections
National Policy Statement for Freshwater Management	Objective B5 Policies B1, B2, B4, B8
Southland Regional Policy Statement	Policy WQUAN.3, WQUAN.6, WQUAN.7
Regional Water Plan for Southland	Policy 21, 28
Proposed Southland Water and Land Plan	Policy 20, 21
Te Tangi a Tauira	Section 3.5.14 Policies 4, 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 sheds. This notion 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 applicant. 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 which will be installed.

13.2.2 *Land use change*

Regulatory Document	Particularly relevant Sections
Southland Regional Policy Statement	Objectives RURAL.1, RURAL.2 Policies RURAL.1, RURAL.2,
Proposed Southland Water and Land Plan	Policy 15A, 16 Policies 5, 10, 12
Te Tangi a Tauira	Section 3.5.7, 3,5,13

The applicants have made a commitment to abolish intensive winter grazing from their farm systems within the high risk Central Plains area and introduce wintering sheds to house all cows inside over high risk drainage periods. The proposal is a cumulation of the applicants wanting to farm in an environmentally sustainable manner whilst still enhancing the productive capacity of their farms and providing for their economic and social well-being. The proposal is therefore consistent with the objectives and policies in the SRPS that reiterate the notion of supporting the sustainable use and development of rural land resources, both environmentally and economically, if undertaken in an appropriate manner.

Policy 16 of the PSWLP holds some of the greatest weight in regards to this application. The policy includes a number of different issues and factors, so only the parts of relevance to this application have been extracted and assessed and emphasis has been added. Policy 16.1 (a) only refers to new dairy farming of cows in close proximity to regionally significant waterways which this application is not for as the application is for the expansion of an existing dairy operation.

Policy 16.1 requires the minimisation of adverse environmental effects from farming activities as a priority. Part (b) of the policy states that this can be done by generally not granting consents for expanded dairying or intensive winter grazing activities where adverse effects on water quality cannot be avoided or mitigated. Our assessment of effects has assessed the expanded dairy farming activity in its entirety in the absence of a permitted baseline or consented baseline approach which has allowed us to show how nutrient losses from the activity have been minimised as far as practicable whilst still maintaining a viable farm system. Nutrient budgeting has been used extensively to model the applicant's operations in the decision making process for this proposal. In the course of deciding on a final proposal, numerous farm systems were investigated and run through nutrient budget software which sited different activities on different parts of the landholding under various forms of management. The resulting proposal provides for the greatest minimisation of nutrient losses that could be sustained by the applicant. Our cumulative effects assessment concluded that this minimisation of nutrient losses and the subsequent reduction in nutrient losses under the proposal will result in adverse effects on water quality which are less than minor considering the scale of the applicants operation within the receiving environments.

The policy provides for a method by which adverse effects can be minimised which is by the avoidance or mitigation of these effects. The policy specifically uses the term "or" suggesting that methods which either avoid or mitigate are acceptable. Our proposal adopts a variety of measures which either avoid or mitigate against adverse effects on water quality which are described in detail in Sections 8.3, 8.4, 9.3 and 9.4. For example, the use of a wintering shed avoids direct deposition of nutrients in dung and

urine to land during the winter period. The removal of intensive winter grazing from the Central Plains area avoids soil damage and direct losses of nutrients via all three transport pathways during the winter period from soils present on the Gladfield block and on the WW5 platform which are susceptible to nutrient leaching and nitrate accumulation. The implementation of a fertiliser regime that uses partial substitution of fertiliser with effluent and a little and often approach mitigates against nutrient losses particularly through deep drainage processes. GMPs in relation to riparian management, laneway runoff and CSA management mitigates against nutrient losses directly to surface water bodies. The cumulative effects assessment in Section 8.1 and 9.1 and in the WRO AEE brought all of the proposed activities with their corresponding mitigation measures and GMPs together and assessed the effect that this might have on the receiving environments. Our assessment concluded that the proposal will result in a long-term reduction in the nutrient load it will contribute to receiving waters in terms of N, P, sediment and microbials given the mitigations proposed and the imposition of nutrient limits. In turn, a reduction in total nutrient load in the receiving waters combined with the attenuation processes and hydrological processes at work in the catchment should reduce the concentration of nutrients in the receiving waters. A reduction in both nutrient load and concentration should result in the maintenance and possible enhancement of water quality in receiving waters and therefore the avoidance or mitigation of adverse effects on aquatic ecosystems and the life-supporting capacity of freshwater in accordance with both Policy 16 and 15A.

Policy 16.2 is met in its entirety by the Farm Environmental Management Plan submitted with the application. This plan 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.

Policies 5, 10 and 12 relate to the physiographic zones on the two landholdings. All three policies require the avoidance, remedying or mitigation of adverse effects on water quality within these zones by the implementation of GMPs, consideration of the key contaminant pathways and generally not granting consent for expanded dairying or intensive winter grazing where contaminant losses will increase as a result of the proposal. The application is explicit and comprehensive in the implementation of a wide range of GMPs across both landholdings and the consideration of key contaminant pathways which guide which GMPs are adopted and which further mitigations are necessary. Our AEE concludes that the range of mitigations will be successful in avoiding or mitigating contaminant loss to the environment. Part 3 of these physiographic policies appears to direct decision makers to generally not grant consent where contaminant losses increase within these physiographic zones. The nutrient budgeting attached to this application has not blocked the farm systems in accordance with physiographic zoning as it is not considered the most representative method of blocking the farm because these zones contain different soil types and management.

The existing WW4 landholding is located on the Central Plains physiographic zones. The new sheep block being brought into the WW4 dairy platform is located on the Central Plains and Oxidizing physiographic zones. As described in the AEE, contaminant losses may increase under the proposal on the dairy platform, but that will be offset with concurrent reductions in other parts of the landholding due to mitigation measures spread over the entire landholding. As such, the Oxidizing physiographic zone may see an increase in contaminant loss under the proposal because of the land use change on the 63ha part of Cochrans block. The portion of the landholding within the Oxidizing zone is 24ha which represents 5% of the total area of the WW4 landholding. This equates to approximately 27kg N increase

in total N losses within the Oxidizing Zone and 2kg P increase in total P losses within the Oxidizing Zone. We submit that increases in losses of this magnitude over the entire Oxidizing Zone in this catchment would create de minimis effects within the receiving water bodies. A similar correlation can be made to the potential increase in intensive winter grazing at WRO where an increase in losses would create a de minimis effect within the surrounding low risk receiving environment. As the RMA is an effects-based piece of legislation, we assert that the application is consistent with Policy 10.3 due to the de minimis effects and accordingly there is no reason why consent should not be granted.

The new block on WW5 is located within the same three physiographic zones as the existing WW5 landholding and therefore no parts of the landholding within specific physiographic zones will see an increase in contaminant losses because all increases are offset within the same physiographic zone, thereby being consistent with Policies 5.3, 10.3 and 12.3.

13.2.3 *Water Quality*

Regulatory Document	Particularly relevant Sections
Southland Regional Policy Statement	Objectives WQUAL.1, WQUAL.2 Policies WQUAL, 1, 2, 5, 7, 8
Proposed Southland Water and Land Plan	Policy A4 of NPS Policies 15A, 15B
Te Tangi a Tauira	Section 3.5.13

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. This 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 2014
- And freshwater quality is managed to meet the reasonably foreseeable social, economic and cultural needs of future generations.

The concurrent policies expand and re-iterate on the functions of this overarching principle. The PSWLP adds a couple of policies in the form of Policy 15A and 15B which are of vital importance to this application. These policies apply the same notion of maintaining and improving water quality in water bodies which meet or do not meet relevant water quality standards respectively.

Our application has discussed these issues in depth, particularly in the three cumulative effects assessments where we have illustrated the likely effect that this proposal will have on total nutrient load and nutrient concentration in the end receiving environments. Our illustration showed that the proposal represents a very miniscule proportion of the total nutrient load to receiving waters and the proposal will have a de minimis effect on water quality which will ensure water quality is at least maintained, and at best, enhanced. We can confidently say that the proposal is consistent with these objectives and policies listed above.

13.2.4 *Effluent discharge*

Regulatory Document	Particularly relevant Sections

Southland Regional Policy Statement	Objectives WQUAL.1, Policies WQUAL.8, WQUAL.10
Proposed Southland Water and Land Plan	Policy 17 Policies 13, 14
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 product and protects cultural values as described in Te Tangi a Tauira. The management of effluent in the proposal meets best practice and is designed to completely avoid any surface runoff, overland flow, ponding, contamination of water via subsurface drainage channels from the application of effluent to land. The land which will be receiving effluent has been considered suitable and the discharge areas are sized appropriately to lower overall nutrient loads from the application of effluent.

The effluent discharge activities will continue for the duration of the consents in the manner in which they have been described in the application. However, there is scope within the system to ensure new technologies and innovations can be incorporated in the future if need be which will only but improve the effluent discharge activity.

13.2.5 *Tangata Whenua*

Regulatory Document	Particularly relevant Sections
Southland Regional Policy Statement	Policies TW.3, TW.4
Proposed Southland Water and Land Plan	Policy 1, 2, 3
Te Tangi a Tauira	Entire document

The Southland Regional Policy Statement describes the resource management issues important to Ngai Tahu in the Southland region 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 Ngāi 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 primarily contained within the applicants property boundary and should not materially impact on tangata whenua values or compromise sites of special significance or food gathering sites. The cumulative effects assessment concludes that any effects felt outside the boundary of the property will negligible and not impact on cultural values.

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 of effluent is to land rather than water;
- The applicant already adopts best practice for land application of managing farm effluent;
- The existing riparian margins are protected;
- Deferred application of FDE 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 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.

14. CONSENT DURATION, REVIEW AND LAPSE

With regard to consent duration, special consideration has been given to Policy 16 and 40 of the PSWLP, which have been grouped below for ease of assessment.

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

Potential effects of the proposed activities are understood reasonably well and these are to be managed as far as reasonably practicable. Council's level of knowledge regarding the underlying aquifer, the receiving soils and surface water management zone is improving on a continuing basis, with ongoing knowledge and research of Southland and the site being achieved in the form of the proposed physiographic units and future catchment specific studies.

Potential adverse effects have been mitigated by appropriate management techniques on farm which are detailed within this application and in the FEMP for each farm. Whilst the potential effects are reasonably well understood, the advances in research and development suggest that there is still a lot to be understood. It is because of this that a 35-year term is not proposed.

Matching consent duration to the level of risk of adverse effects

The assessment of effects concludes adverse effects should be no more than minor. As the risk of adverse effects is low, this suggests that the consent duration should provide for a balance of ensuring these adverse effects are maintained as low and providing for the applicants economic and social wellbeing.

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 is seeking a 5 year consent for each consent granted under phase 1 of the application. This will ensure that this phase of the proposal is restricted to the term assessed in the application.

The applicant is then seeking a 15 year consent for each consent granted under phase 2 of the application. This term is slightly longer than the typical 10 year consents granted by Environment Southland for similar activities to give credit for the construction of wintering sheds on both farms which is considered to be one of the most effective and desirable mitigation measures for managing contaminant losses from dairy farms available.

The applicant wishes that the consent terms for WW4 and WW5 are aligned.

The permanence and economic life of any investment

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

Commodity market influence is always a factor in the permanence of individual dairying units, hence why these activities are often considered to have semi-permanent economic life. The economic life of

the farm is firstly dependent on the granting of the relevant consents. Should consents be granted, the permanence of the dairying operation and associated activities should be inter-generational. Furthermore, the permanence of the economic life of the activity requires resource consents be granted from the Council for a reasonable duration. Wintering sheds and their associated infrastructure is a significant investment for the applicant to the tune of $1.2million on each farm. This level of investment needs to be recognised with the granting of a longer term consent to give the applicant certainty of the permanence of their activity.

Common expiry date for permits that affect the same resource

A common expiration date for all the permits applied for is considered appropriate as discussed above.

Applicant's compliance history

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

Timing and development of FMUs

The granting of a 15 year consent duration may better enable implementation of the impending limit setting process.

Review and Lapse

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

Some draft consent conditions are discussed in the application.

15. CONCLUSION

Overall, the proposal will result in the maintenance of water quality in the receiving environment.

The proposal enables opportunities for the applicant to sustainably, efficiently and profitably run their dairy farms whilst still maintaining environmental outcomes desired in the Southland region. The adherence to the proposed conditions, the full implementation of good management practices and the proposed mitigation measures will mean that that potential adverse effects will be avoided, remedied and mitigated in a manner that is consistent with all relevant RMA requirements and all policies of the relevant planning documents.

Granting of consent, conversely enables the consent authority a pathway to pre-emptively restrict nutrient losses from two large dairy farms via a resource consent process. The modelled nutrient budgets have been completed by an experienced and qualified professional, and the integrity of the nutrient budgets combined with the above (and attached) assessments, we believe will give the consent authority sufficient certainty that the proposal meets the sustainable management purpose of Part 2 of the RMA.

WOLDWIDE RUNOFF – PROPOSAL AND AEE

1. Executive summary

Woldwide Runoff (WRO) is a dry stock support block which currently supports all of the five Woldwide dairy farms by providing grazing for dry stock associated with the farms.

This document supports the concurrent resource consent applications for Woldwide 1&2(WW1&2) and Woldwide 4 (WW4) and Woldwide 5 (WW5) which seek various resource consents under the PSWLP for farming activities. This document details the activities currently occurring at WRO and how these activities are proposed to change if the proposals for the abovementioned four dairy farms are approved and enacted. An assessment of effects is provided in this document to enable the Council to be able to fully understand all effects associated with the proposal on WRO.

2. Existing use of WRO

WRO is a dry stock grazing block which also contains a commercial forestry operation, native bush block, commercial gravel extraction operation and land for supplement production. WRO is considered by Environment Southland to form both an individual landholding as well as being part of the landholdings for WW1&2, WW4 and WW5.

In summary, the existing use of the WRO landholding includes:

- The use of land (732ha) for dry stock farming
- The use of land (160ha) for commercial pine plantation and native bush
- The grazing of R1 and R2 heifers plus mating bulls and carry over cows from WW1&2, WW3, WW4 and WW5
- The use of land for intensive winter grazing of dry stock (52 hectares in 2018)

Status of activities at WRO

The land use consent applications for the farming activities for WW1&2, WW4 and WW5 seek consent for all activities located on the landholding which are directly associated with the operation of the respective dairy farms for 365 days of the year.

The proposed farming activity for WW1&2, WW4 and WW5 includes the grazing of dry stock all year round at WRO. Dry stock includes R1 and R2 grazing, mating bull grazing and carry over cow grazing. In this respect, WRO is considered to be part of the landholding for WW1&2, WW4 and WW5 and the grazing of dry stock at WRO has been included in the respective land use consent applications.

When considering WRO as an individual landholding, the use of land at WRO for the current and proposed activities in their entirety would otherwise be a **permitted activity** under Rule 20(a) of the PSWLP:

- There is no dairy platform on the landholding
- There is no associated discharge permit which specifies a maximum number of cows

- A FEMP in accordance with Appendix N of the PSWLP has been prepared for the landholding and implemented (see attached).
- The landholding contains no more than 100ha of intensive winter grazing
- The good management practices for intensive winter grazing specified in Rule 20(a)(iii)(3) have been implemented and detailed in the FEMP.
- A vegetated strip including stock inclusion will be in place adjacent to any water bodies in accordance with the setbacks in Rule 20(a)(iii)(4-6)

The applicant accepts that the activities at WRO which form part of the farming activity on WW1&2, WW4 and WW5 require land use consent as detailed above. However, it is important to note that when viewing WRO as an individual landholding then the current and proposed activities would otherwise be a permitted activity under the PSWLP and would remain so at any point in the future so long as they comply with any requirements, conditions and permissions specified in the RMA, detailed in Rule 20(a) and any applicable regional plans.

The applicant has included WRO in the respective land use consent applications as part of the farming activity and landholding at the request of Environment Southland staff, however the matter of whether it should technically be included in the respective farming activity and the landholdings for WW1&2, WW4 and WW5 lies in the interpretation of the term "landholding" in the PSWLP and in the conclusions from an Environment Southland legal opinion. This is a matter that will be raised and discussed in the upcoming hearing process.

3. Property description

Woldwide Runoff is located 20km to the west of Otautau, on the western side of the Longwood Ranges. WRO is comprised of two separate blocks. The Merrivale Block is owned by Woldwide Runoff Limited and the Merriburn block is leased. The Merriburn lease block is under a 5-year lease agreement, with Woldwide Runoff Limited having first right of renewal.

Property Details – WRO	
Property address	20 Gill Road – Merrivale block 1711 Otautau Tuatapere Road – Merriburn block
Property owner(s)	Woldwide Runoff Ltd
Legal Description	Merrivale Block: Part Section 7 Block XII Waiau SD Part Section 7 Block XII Waiau SD Part Section 7 Block XII Waiau SD Lot 1 DP 3537 Merriburn Lease Block: Lot 1 DP 302409 Sec 26 Merrivale Settlement No. 1 Sec 27 Merrivale Settlement No. 1
Property area (ha)	507 ha total, 321 ha effective – Merrivale 385ha total, 338 ha effective – Merriburn
Location	NZTM 1201022, 4893762 – Merrivale NZTM 1200812, 4890495 – Merriburn
Proposed land use	Both blocks are run as a single operating unit. Grazing of R1 and R2 heifers, grazing of carry over cows and grazing of mating bulls all year round (includes intensive winter grazing)

	Production of baleage 100ha of commercial pine plantation 60ha beech forest under sustainable management
Dry stock in 2017/2018 season	1265 R1 1265 R2 37 carry over cows 70 mating bulls

Figure 1: Current/Proposed farm boundary for WRO. [1]

[1] Beacon mapping service, Environment Southland website, accessed 13 February 2019.

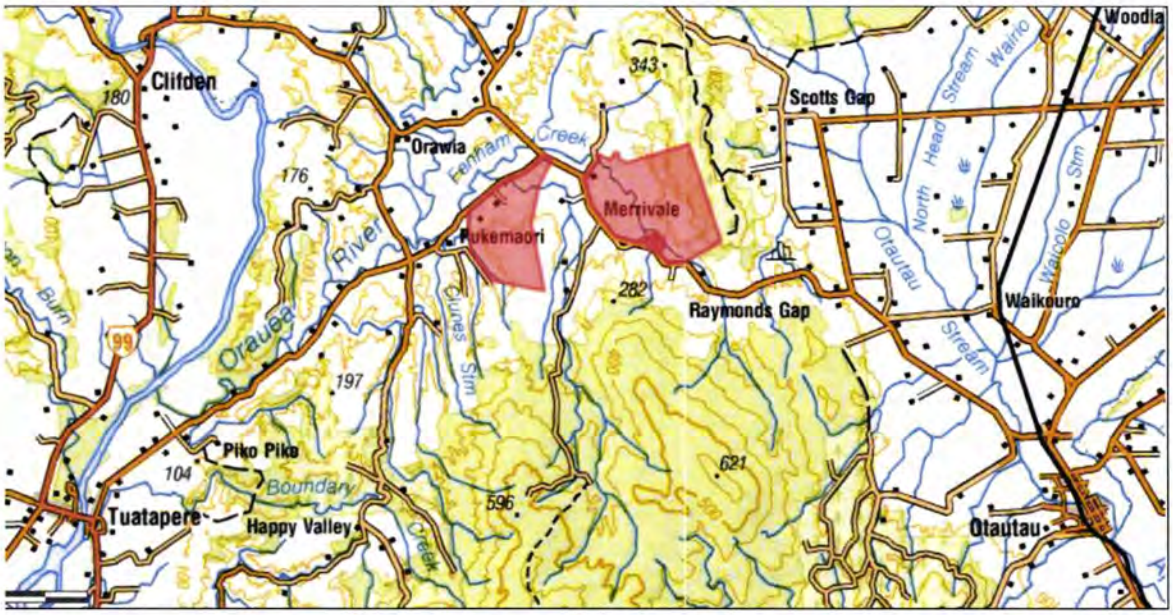


Figure 2: General location of WRO[2]

Figures 3 and 4 show the mapped farm boundaries and features of interest on the original part of the runoff block and the leased part of the runoff block respectively.

[2] Beacon mapping service, Environment Southland website, accessed 13 February 2019.

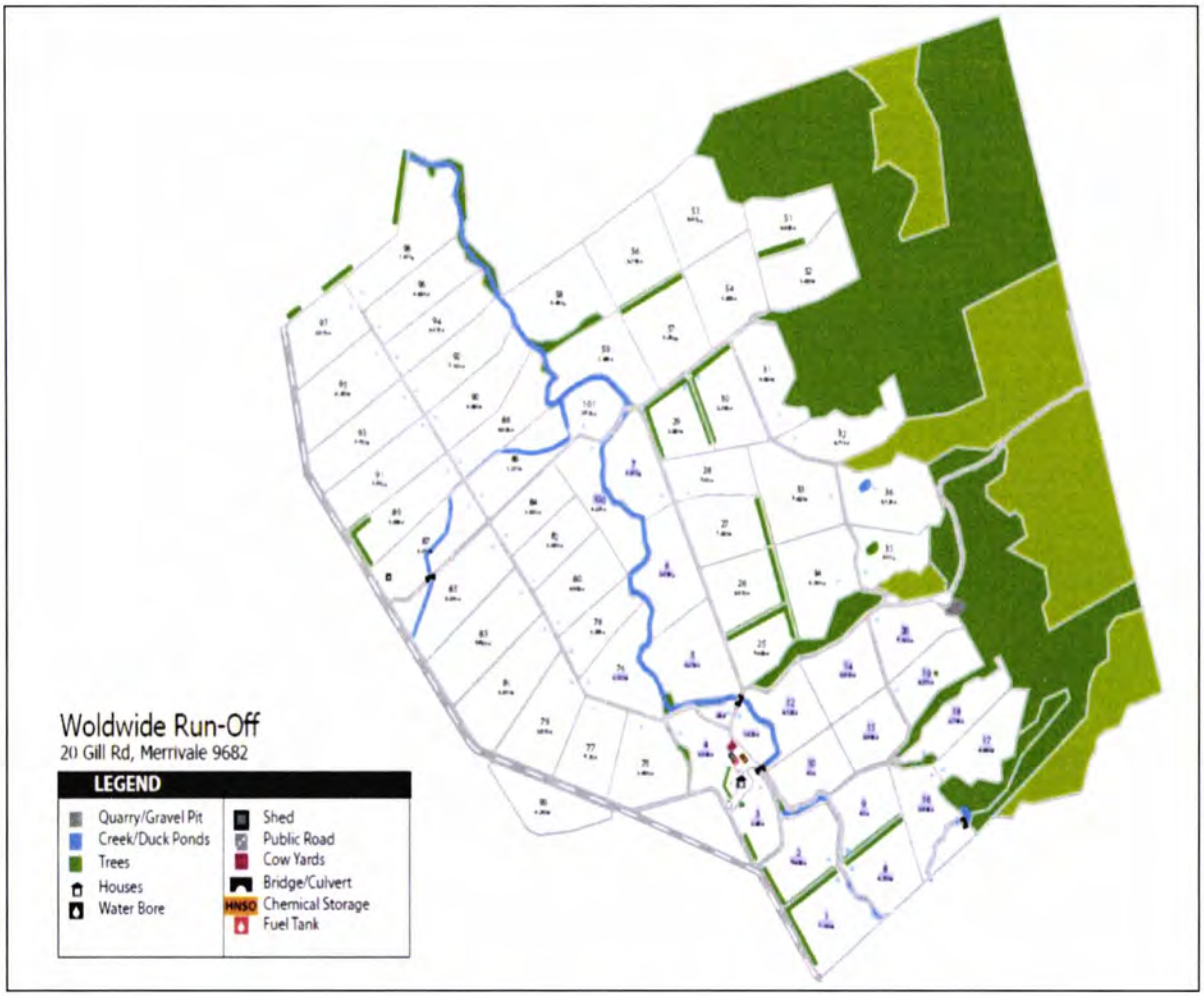


Figure 3: Farm map for Merrivale block

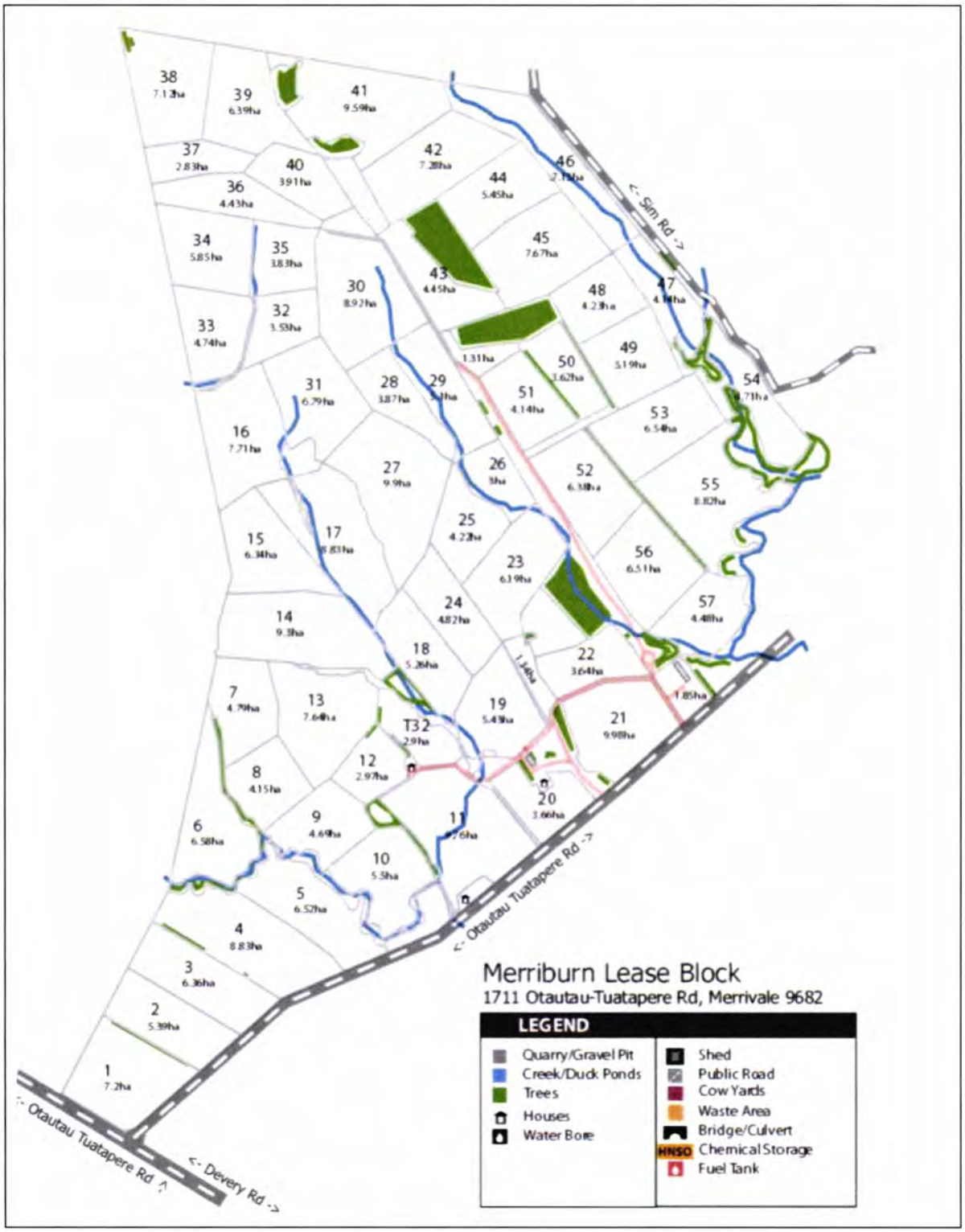


Figure 4: Farm map for Merriburn block (leased)

4. Soils and Physiographic Zones

The Merrivale block contains Malakoff, Waimatuku and Makarewa soils and the Merriburn lease block contains Aparima, Orawia and Makarewa soils. These soils are a mixture of heavier wetter soils and free draining soils.

Figure 5: Soil map[3]

The Merrivale block is classified as Hill Country, Oxidizing and Gleyed physiographic zones. The Merriburn lease block is classified as Hill Country, Oxidizing, Gleyed, Marine terraces and Peat physiographic zones.

[3] Beacon mapping service, Environment Southland website, accessed 13 February 2019.

Figure 6: Physiographic zones[4]

5. Surface water receiving environment

WRO is located within both the Fenham and Merry Creek catchments. Both creeks are tributaries of the Orauea River which flows south-westerly towards Tuatapere township and joins the Waiau River. There is a SOE monitoring site on the Orauea River at Orawia Pukemaori Road which is used to measure water quality information data. The Land and Water website (www.lawa.org.nz) collates this water quality data and provides the most recent water quality data and trends available. **Table 1** below gives a summary of the state and trend measured at this site for key river water quality indicators.

Table 1: Summary of Measurement and State of Orauea River at Orawia[5]

	State	Quality	NOF Band Annual Median	Trend
E. coli	In the worst 25% of all lowland rural sites	315 n/100ml (median 5 year)	E	Likely improving
Clarity	In the worst 25% of all lowland rural sites	1.13 metres (median 5 year)	N/A	Indeterminate
Total Oxidised N	In the worst 25% of all lowland rural sites	0.415 g/m^3 (median)	A - median	Meaningful improvement
Total N	In the worst 50% of all lowland rural sites	0.73 g/m^3 (median)	N/A	Indeterminate
Ammoniacal N	In the best 25% of all lowland rural sites	0.0005 g/m^3 (median)	A – 99% species protection level.	N/A
Dissolved Reactive P	In the worst 50% of all lowland rural sites	0.011 g/m^3 (median)	N/A	Indeterminate

[4] Beacon mapping service, Environment Southland website, accessed 13 February 2019.

[5] https://www.lawa.org.nz/explore-data/southland-region/river-quality/waiau-river/orauea-river-at-orawia-pukemaori-road/

The water quality medians indicate that the Orauea catchment is degraded in regards *E. coli*, however there is a definite trend of improvement. High *E. Coli* levels are a concern for overall water quality within a waterway due to human health risks. Typically, *E. coli* contamination of waterways is caused by stock contact with surface water, point source discharges from septic tanks, wastewater treatment at upstream towns and effluent discharges to land reaching surface water. A high proportion of land within the Orauea catchment is both intensive and extensive sheep farms which is likely to contribute to the high *E. coli* levels because stock on sheep farms are not excluded from waterways in the same manner in which it is compulsory on dairy farms. The other activities listed above may also be contributing factors. *E. coli* is rated as E band in the National Objectives Framework (NOF) of the National Policy Statement for Freshwater Management. An E band rating equates to an average infection risk of greater than 7%.

Conversely, total oxidised nitrogen concentration has improved and is rated as A band under the NOF which means that water quality is considered suitable for the designated use and associated with a high conservation values ecosystem where there is unlikely to be effects even on sensitive species. The national bottom line value is 6.9 mg/L which far exceeds the 0.415 mg/L median at this site.

The median dissolved reactive phosphorus (DRP) is below ANZECC guideline levels and is not showing an evident trend. The raw data shows that DRP is low on the majority of the sampling dates, with spikes most likely occurring during rainfall events where phosphorus can be transported to surface water bodies via runoff and erosion.

The overall impact of the trends in nutrient concentrations is not clear at this stage, however the receiving water is considered low in relation to nitrogen and phosphorus concentrations overall. There is very limited published information on periphyton extent or macroinvetebrate community status in the Orauea River, so it is difficult to assess the current status or trend in biological quality of the stream. However, it is accepted that any increase in nutrient concentrations is likely to create the potential for an increase in periphyton and/or other plant biomass in the stream.

Ecological indicators are measured at the lower catchment *Waiau River at Tuatapere* SOE site with 5-year medians for MCI score, taxonomic richness score and %EPT available. The median MCI score is good at 103 with an indeterminate trend. The median Taxonomic Richness score is 15 and the median %EPT is 47%. One NOF water quality indicator for the *Waiau River at Tuatapere* site shows evidence of land use impacts (periphyton) and three indicators show minimal evidence of land use impacts (*E.coli*, macroinvertebrates and nitrate toxicity). The periphyton parameter indicates moderate nutrient levels and/or natural flow or habitat disruption. In this case the nuisance periphyton levels are likely to be primarily due to natural flow disruption due to the diversion of c.95% of the flow of the Waiau River to Doubtful Sound for hydroelectricity generation.

Over the summer period in 18/19, Environment Southland monitoring of the Waiau River at Tuatapere has confirmed the presence of toxic algae benthic cyanobacteria in the lower Waiau. Given the relatively low level of nutrients N and P in the lower Waiau, it likely that natural flow disruption is a major factor contributing to the growth of algae, including toxic algae in the lower Waiau.

The lower Waiau River also has a significant issue with the invasive stalked diatom *Didymosphenia geminate*, commonly known as didymo or "rock snot." Didymo blooms smother river beds with nuisance mats of algae and typically occur in rivers with low nutrient concentrations, i.e. low levels of N and P. Didymo blooms can lead to changes in communities of invertebrates and other algae on the river bed.

The available physical/chemical data show the Waiau River catchment to be in relatively good health. Nitrate, DRP and *E.coli* levels are relatively low and water clarity is moderately good. Some biological indicators such as the MCI index indicate good water quality with minimal land use effects whereas others such as periphyton levels are elevated at times. The toxic benthic algal bloom seen in the 18/19 summer period is indicative of land use effects, such as natural flow disruption and possibly nutrient losses to an extent although this complex issue is poorly understood.

Surface water is the primary receiving environment for contaminants lost from WRO due to the nature of the soils, topography and drainage channels.

Figure 7: Topomap showing both WRO blocks (marked with X) and SOE site *Orauea River at Orawia Pukemaori*.[6]

6. Groundwater receiving environment

WRO is located in an area of unclassified groundwater management zone. Groundwater nitrate levels in the vicinity of WRO are in the range 0.01 – 1.0 g/m^3, regarded as pristine to modern day background levels. Due to a combination of the topography, depth of groundwater and drainage channels there is a low risk of nitrate accumulation in groundwater in this area. This is supported by the very low mapped nitrate levels.

[6] Beacon mapping service, Environment Southland website, accessed 13 February 2019.

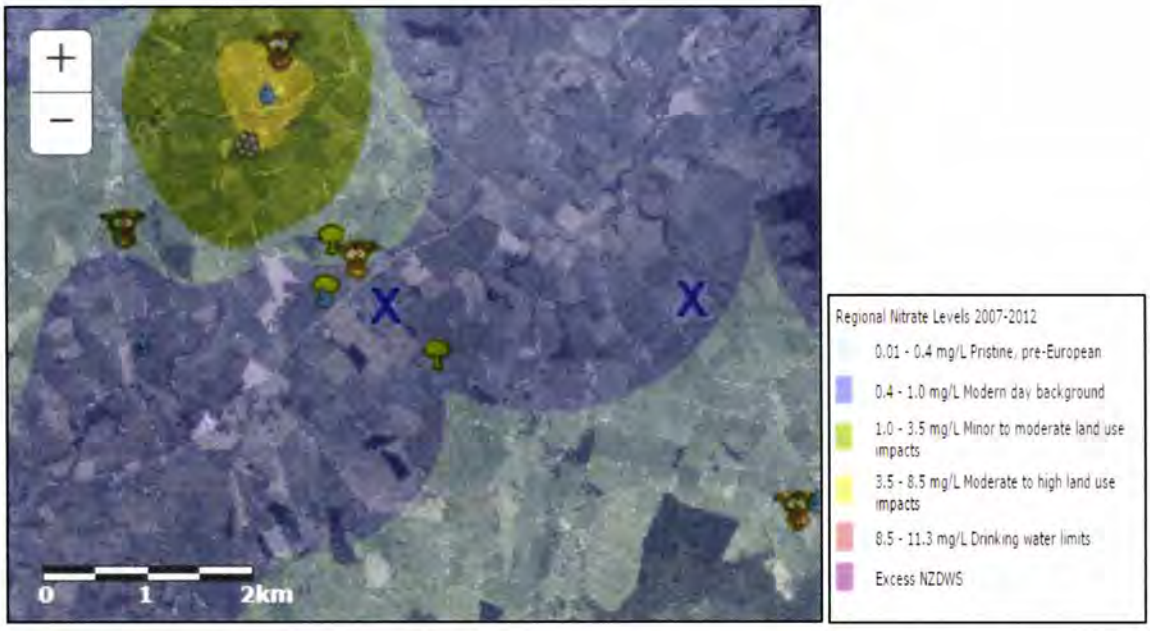


Figure 8: Groundwater nitrate in the vicinity of WRO (approximate location of WRO blocks marked with X)[7]

7. Contaminant Pathways

The production of grass for stock grazing and supplements requires the input of nutrients into the farming system. On a stock grazing block, excess nutrients are primarily lost to the environment from the deposition of dung and urine spots on pasture. For this property the main contaminant pathways are identified as overland flow, deep drainage and artificial drainage due to the variety of different soil types and physiographic zones on the farm. Woldwide Runoff predominantly grazes young dry stock (R1 and R2 heifers), which cause less soil damage and related effects due to their smaller size and lighter weight than mature cows, in addition the lease arrangement for Merriburn Block prohibits the wintering of adult cows.

Contaminant Pathways – Overland Flow and Artificial drainage

Loss of nutrients via overland flow and artificial drainage presents the highest risk to the environment on the wetter, poorly drained soils on this property primarily in the Gleyed physiographic zone. These areas have high vulnerability to waterlogging, and in some areas require subsurface artificial drainage, which can become a mechanism for the rapid transfer of contaminants to the water bodies they drain to. The applicant will avoid and mitigate the risk of contaminant loss via overland flow and artificial drainage by:

- Ensuring critical source areas are left as buffer zones for cropping and fenced off to exclude stock;
- Re-sowing bare soils as soon as possible;
- Avoid grazing very wet soils by opening the breaks up to reduce tramping damage;
- Using good management practice for intensive winter grazing on either grass or forage crop – back fencing, CSA management, last bite grazing, portable troughs etc.; (See FEMP)
- Ensure water ways are fenced off to exclude stock and existing riparian vegetation is maintained;

[7] Beacon mapping service, Environment Southland website, accessed 13 February 2019.

- Time fertilizer application to meet pasture demand and apply in a little and often manner;
- Protecting steeper, erosion prone land with trees.

Contaminant Pathways – Deep drainage

Loss of nutrients via deep drainage presents the highest risk to the environment on the free draining soils mainly within the Oxidizing physiographic zone. These areas have high vulnerability for nutrients, particularly N, leaching through the soil profile which has the potential to reach groundwater and surface water receiving environments. The applicant will avoid and mitigate the risk of contaminant loss via deep drainage using the same measures as above, with the primary goal to avoid the accumulation of excess N in the soil profile prior to high drainage periods.

- Maintaining stocking rates at sustainable levels;
- Avoiding the over-application of fertilizer by matching application to pasture demand and undertaking in a little and often manner;
- Utilizing pasture species which result in less N loss;
- Utilizing soil testing to guide fertilizer usage;
- Time fertilizer application to meet pasture demand and apply in a little and often manner.

8. Good Management Practices (GMPs)

GMP adopted on WRO are detailed in the attached FEMP.

9. Description of activities

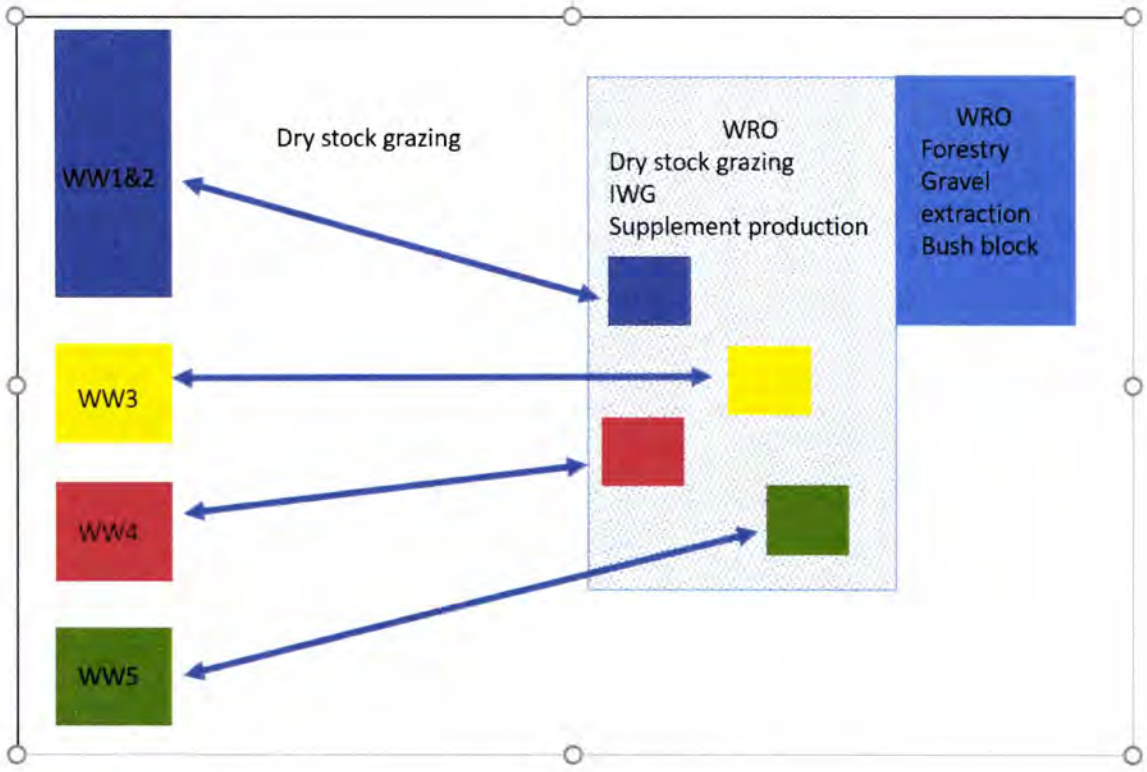
A year end nutrient budget has been completed by Cain Duncan CNMA for the 2017/2018 season to give an indication of the nature and scale of the activities which occurred at WRO during this one reporting year. The nutrient budget and accompanying report are appended to this application and should be referred to for a full description of the farm system at WRO during the 2017/18 year.

The applicant has now had WRO in its entirety (with the combination of the two separate blocks) for two and a half seasons. When the Merriburn block was initially leased it was heavily pugged and pasture productivity and fertility was low. Over the last two and a half seasons, the applicants have focussed on pasture renewal and increasing fertility. The 2018/19 season has seen the benefit of pasture and soil development with a big lift in pasture production. The applicants have found that they may need to alter the activities on this block in light of the increased productivity in order to farm it sustainably and economically making use of the quantities of feed available.

10. Proposed Activities

The diagram below presents a schematic impression of the relationship between the applicants five dairy farms and WRO. The diagram shows the individual dairy platforms sending dry stock grazing to the grazing block part of WRO (hatched box). The dry stock grazing, IWG and supplement production for the five dairy farms rotates through this grazing block of WRO every year. The legal descriptions of the land within the hatched box area is included in the separate land use consents for WW1&2, WW4 and WW5. The number of dry stock sent from each dairy farm is represented by the corresponding coloured boxes within the blue hatched area. A proposed condition of consent would specify the maximum number and class of stock grazed on WRO from each farm.

The solid blue WRO box contains activities which are not part of the respective farming activities (forestry, gravel extraction and bush block) and the legal descriptions of the land within this area will not be included on the respective land use consents.



The activities on WRO which will be covered under the land use consent applications for the farming activities on WW1&2, WW4 and WW5 include the grazing of dry stock (R1, R2, mating bulls and carry over cows) all year round:

- All R1 heifers currently grazed all year round at WRO continues unchanged.
- R2 heifers currently grazed from the time of transitioning from R1s and May of the following season on WRO continues unchanged.
- For future seasons during June and July, R2s from WW1&2 will be intensively winter grazed on WRO or housed in existing wintering barns at WW1&2 dairy platform (approximately 125 R2s).
- R2 heifers from WW4 and WW5 may spend the winter period in the wintering barns on WW4 and WW5 dairy platforms in some seasons.
- R2 heifers from WW4 and WW5 may be intensively winter grazed at WRO in some seasons.
- Mating bulls required for all five dairy farms will be on WRO all year round. Mating bull numbers may fluctuate marginally in future seasons.
- Carry over cows from all five dairy farms will be on WRO all year round. Carry over cow numbers may fluctuate marginally in future seasons.

The applicant has not provided an Overseer nutrient budget which models the proposed farm system due to concerns with providing a model which is representative of a long-term scenario farm system at WRO. The reasons behind this include:

- The increasing fertility levels on WRO combined with the large size of the block make it very difficult for the applicant to predict exactly what the block is capable of in terms of stocking rate, crop growth and pasture production much further into the future than the upcoming season.
- The siting of non-farming activities on the block which will not be covered under the land use consent applications.
- The large impact climatic conditions have on the management of a large support block which is more dramatic, variable and pronounced than a dairy farm system.
- The need and desire for flexibility (within reason) in the management of the farm system based on the above factors.

The applicant recognises that the Consent Authority needs certainty around the scale and nature of the activities proposed at WRO and the likely effects of these activities which have been detailed in the AEE. The applicant proposes the following input restrictions as consent conditions for the proposed land use consents applicable to activities at WRO. These input consent conditions are requested in place of any consent conditions referring to a nutrient output restriction based on an Overseer nutrient budget model:

For WW1&2

- A maximum of 417 R1 heifers grazed all year round at WRO from WW1&2
- A maximum of 417 R2 heifers grazed all year round at WRO from WW1&2, or
  A maximum of 417 R2 heifers grazed between August and May at WRO and during June and July in the WW1&2 wintering barns

For WW4

- A maximum of 286 R1 heifers grazed all year round at WRO from WW4
- A maximum of 286 R2 heifers grazed all year round at WRO from WW4 or
  A maximum of 286 R2 heifers grazed between August and May at WRO and during June and July in the WW4 and WW5 wintering barns

For WW5

- A maximum of 270 R1 heifers grazed all year round at WRO from WW5
- A maximum of 270 R2 heifers grazed all year round at WRO from WW5 or
  A maximum of 270 R2 heifers grazed between August and May at WRO and during June and July in the WW4 and WW5 wintering barns

On all land use consents

- A maximum of 100 hectares of winter fodder crop for intensive winter grazing at WRO

This recommendation to impose these input restrictions as consent conditions as opposed to an Overseer nutrient output restriction consent condition has been carefully considered by the applicant and recognises the inherent complications in including WRO on the resulting individual land use consents for WW1&2, WW4 and WW5. The primary complication that arises is that compliance and the enactment of individual consents must be able to stand alone and must not be reliant on third parties or third party actions. For example, if the land use consent granted for WW4 farming activities on WRO

are restricted with a consent condition requiring an overall WRO Overseer nutrient output limit be complied with, then compliance with the land use consent relies on the actions of several third parties: WW1&2 Ltd, WW3 Ltd and WW5 Ltd. This would inadvertently link all of the dairy farm systems together and create a scenario of reliance on compliance by third parties which may deem the land use consents unenforceable. This notion has been widely considered in case law. Common law derived from the House of Lords decision in *Newbury DC v Secretary of State for the Environment* determined that any resource consent condition needs to satisfy a range of criteria in order to be valid. This created what is known as the *Newbury* validity tests, of which (b) is particularly relevant to this application:

> (a) The condition must be imposed for a [resource management] purpose and not an ulterior purpose;
>
> (b) The condition must fairly and reasonably relate to the activities authorised by the consent to which the condition is attached; (emphasis added) and
>
> (c) The condition must not be so unreasonable that a reasonable planning authority, duly appreciating its statutory duties, could not have approved such a condition.

The individual applications for WW1&2 and WW4 and WW5 do not seek the authorisation of activities on any of the other landholdings. Since *Newbury*, the validity tests above have been modified by New Zealand courts and a review of case law strongly indicates that consent conditions relying on the actions or compliance by third parties are not valid.

The imposition of the 100-hectare winter fodder crop restriction is linked back to the permitted activity threshold in Rule 20 (a) of the PSWLP, which WRO would otherwise be able to operate under as an individual landholding in its own right.

11. Assessment of Environmental Effects

The table below describes the proposed activities occurring on WRO under the proposal.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
Capital fertilizer applications to lift Olsen P levels	The 2017/18 year end Overseer model included capital phosporus fertilizer applications to lift Olsen P levels. In future, capital fertilizer applications may be undertaken for K and S also. Capital fertilizer applications will apply larger quantities of N, P, K and S to land in order to increase fertility. These applications of larger quantities of nutrients have the potential to result in losses to the environment if applied at rates which exceed the plants ability to utilize these applied nutrients. Excess applied N likely to be lost to water bodies via nutrient leaching and artificial drainage channels. Excess applied P	Capital fertilizer application timings avoid high drainage periods such as late autumn and winter and periods when soil temperature is less than 7 degrees to mitigate against excess N leaching through the soil profile. All other fertilizer applications will use a little and often approach to avoid the application of excess nutrients which cannot be utilized. Regular soil testing to guide capital fertilizer requirements to avoid the application of excess N and P which cannot be used for plant uptake to mitigate against losses via artificial drainage.	Capital fertilizer applications will only be done as required by the latest soil test results and will be undertaken where P, K or S levels are below agronomical optimum levels. P = 20-30 K = 6-10 S= 10-12 The target Olsen P level on this block is 25. Capital P fertilizer applications will be applied at a maximum of 100kg P/ha which may require P fertilizer applications to be split.	Capital fertilizer applications are only undertaken where there is a nutrient deficit and are done at a rate which meets this deficit and avoids the application of excess nutrients. There is a low risks of adverse effects eventuating as application will meet pasture demand. The fertilizer regime described in the nutrient budget will be the default fertilizer regime and capital fertilizer applications will only be done according to soil test results and completed using GMP principles which should adequately mitigate adverse effects on water quality.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	likely to be lost to water bodies via overland flow, particularly on the sloping land. Excess N and P in water bodies may lead to water quality degradation resulting in ecological stresses on aquatic life and human health consequences such as blue baby syndrome.			
Cultivation of new pastures	Short term increase in potential sediment, microbial and phosphorus losses to the environment which can cause ecological stresses on plants and animals due to sedimentation, algae blooms and water temperature increases in waterways and estuaries	Re-sow bare paddocks as soon as possible Use buffer zones around critical source areas and use direct drilling if possible. Cultivation will be undertaken to meet permitted activity criteria in Rule 25(a) of the PSWLP maintaining a 5 meter buffer zone	Further mitigations not required as the imposition of buffer zones reduces the risk of overland flow of sediment and phosphorus when cultivating land. Riparian buffer zones will be installed with stock fencing and vegetated filter areas.	Adverse effects should be adequately avoided as this is a low risk activity in this location. GMPs provide adequate mitigation of effects.
Intensive winter grazing	Potential for significant amounts of contaminants	Buffer zones maintained between crop cultivation and	The intensive winter grazing of R1 calves will occur on a similar scale as the 2017/18 year. Mitigation	Adverse effects potentially still exist from this activity due to the

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
Potential future increase in the scale of the activity	(N, P, sediment and microbials) to be lost to both surface and groundwater bodies as a result of the complete de-vegetation of pasture/crop, treading damage on soil structure and runoff following rainfall events. Nutrient losses from this activity occur via deep drainage through the soil profile into the underlying aquifer or via overland flow into adjacent waterways or artificial drainage channels. Excessive nutrient losses can cause nutrient accumulation in groundwater and excessive nutrient load in waterways causing water quality degradation and	critical source areas to provide an area where runoff can be filtered and captured limiting risks of entering water. Grazing direction will be away from buffer zones/critical source areas leaving last bite to provide a buffer zone for nutrient capture through until the end of the fodder grazing period. Back fencing and portable water troughs to limit treading damage over already de-vegetated ground. Cultivation of paddocks timed to avoid paddocks sitting bare for long periods of time which reduces risks of contaminant losses through leaching and overland flow. All other GMPs listed in rule 20 will be implemented by May 2019.	measures include choosing suitable fodder crop paddocks which are predominantly flat with no waterways, away from critical source areas and on paddocks which may require additional fertility. Paddock selection is important to avoid and mitigate the risk of the direct runoff of nutrients to water bodies (particularly P, sediment and microbials). The intensive winter grazing of R2 heifers will be a new activity on this block in the future and would require the cultivation of an additional approximately 48ha of fodder crop. Currently this activity is located on the WW5 dairy platform and Gladfield block. It has been located on the WW1&2 platform (Marcel/SH96) in recent years. The current location of this intensive winter grazing activity within the highly sensitive Heddon Bush/Central Plains area results in significantly higher contaminant losses due to the nutrient leaching risks of the soils in this location. Suitable fodder crop paddocks will be chosen which are predominantly flat with no waterways or artificial drainage channels, away from critical source areas and on paddocks which may require additional fertility and concurrently, fertilizer usage	high level of contaminant losses which occur from intensive winter grazing despite the implementation of GMPs and mitigations. The GMPs and the mitigations proposed will mitigate adverse effects to a certain extent, with the long-term goal of the applicant to abolish intensive winter grazing from the dairy platforms/Central Plains area and overall to reduce the frequency and scale of intensive winter grazing at WRO by utilizing the wintering sheds in preference to fodder crop over winter.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	the resulting ecological stress on plants and animals when the life-supporting capacity of the water is compromised by excess nutrients.	Bare soils are cultivated using full cultivation and timed to avoid paddocks siting bare for long periods of time which reduces risks of losses of excess nutrients remaining from the grazing activity to the environment via overland flow and leaching.	may be able to be reduced given the soil nutrient levels following cropping. The siting of this activity on WRO in the future on heavier soils presents a lower risk of nitrate accumulation in groundwater and therefore a lower risk of water quality effects. The area surrounding WRO is currently low in groundwater nitrate levels and is low risk of nutrient leaching and is considered a more appropriate choice to site intensive winter grazing than the Central Plains area. Approximately 125 R2 heifers will be wintered in existing barns at the WW1&2 dairy platform. In some years, R2 heifers will be wintered in respective wintering sheds on the dairy platforms at WW4 and WW5. The final decision on whether stock will be in the sheds or at WRO rests in the feed available and overall pasture management of WRO in the preceding season – often heavily dictated by climatic conditions.	

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
Fertilizer application regime across entire block	The application of nutrients in fertilizer has the potential to result in direct nutrient losses to the environment if fertilizer is applied either in excess to plant requirements or at a time when it cannot be utilized for pasture/crop production. Nitrogen losses from fertilizer application most likely to occur via deep drainage. Phosphorus losses from fertilizer most likely to occur via soil loss and/or direct loss through runoff or erosion. Adverse effects of inappropriate fertilizer application or excess application include a loss	Time N, P, K and S fertilizer application to meet crop and pasture demand using split applications and avoid high risk times of the year i.e when soil temperature is less than 7 degrees, during drought periods and during periods when soils are at field capacity. Reduce use of P fertilizer where Olsen P values are above agronomic optimum. Maintain Olsen P levels at around 20-30. Use nutrient budgeting and annual soil testing to manage nutrient inputs from fertilizer and outputs to guide farm management decisions which can maintain overall nutrient losses at desired level.	Fertilizer applications occur in August, September, November, December and January on different blocks avoiding high drainage and high-risk periods that occur in late summer, late autumn, mid spring and during the winter. Fertilizer on crop blocks is applied in December which is considered a low risk month due to lower rainfall and higher soil temperatures. The fertilizer regime will remain flexible and will be undertaken to match pasture and crop requirements.	Adverse effects both avoided and mitigated with use of GMPs for fertilizer usage

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	of excess nutrients to water causing water quality degradation in both groundwater and surface water bodies. Water quality degradation can adversely impact aquatic plant and animal ecosystems and impact on human health.			
Potential increase in contaminant losses in the future	The future use of WRO is highly likely to involve an increase in the scale of intensive winter grazing which is likely to increase contaminant losses. Higher contaminant loss activities increase the risk of the leaching of nutrients (N, P and microbials) through the soil profile from urine and dung spots or transported via subsurface drainage.	Use of selective grazing to avoid grazing very wet paddocks during adverse weather conditions to reduce risks of pugging and treading damage to soil structure which can accelerate contaminant losses. Increase the size of feed breaks during adverse conditions to give animals more of the paddock to graze than the volume of feed required to reduce stocking rate on wet and vulnerable pasture to avoid pugging and treading damage of feed.	Overall stocking rate of cows grazing from August to May is kept to a level similar with an extensive operation and with its current level. Areas of native forest and commercial forest are maintained to balance out areas of dairy support land and non-grazed areas. Intensive winter grazing is sited on this block to shift it away from the higher risk Central Plains/Heddon Bush area which is classified as higher risk for water quality degradation.	Adverse effects both avoided and mitigated with use of GMPs and mitigation measures which site activities in the appropriate location where receiving environments are less susceptible to water quality degradation.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	Increased nutrient losses as total figures to groundwater and surface water bodies may potentially cause water quality degradation which can cause ecological stresses on aquatic plants and animals from algal growth, temperature increases and eutrophication. Human health concerns can also arise from microbial contamination of waterways upon contact and risks of blue baby syndrome from nitrate accumulation in groundwater	Use nutrient budgeting to manage nutrient inputs and outputs to guide farm management decisions which can maintain overall nutrient losses at desired level.		

12. Broad scale/cumulative effects assessment

The AEE above concludes that the implementation of targeted mitigation measures on-farm will ensure that adverse effects on water quality from activities within the proposal are either avoided or mitigated to levels that are consistent with the relevant regional plan water quality objectives whilst still maintaining a viable, efficient and profitable farm system. The amount of nutrients lost from the farm system which may end up in the receiving water bodies depends on a wide range of different factors often collectively referred to as attenuation rates. Similarly, the catchment hydrology and characteristics are critical in affecting the resultant concentration and/or mass loadings of nutrients and other contaminants in water bodies.[8]

This broad scale/cumulative effects assessment includes a catchment scale assessment in relation to attenuation and hydrology processes, characteristics of the catchment and consideration of the state of the receiving environment. This assessment also assesses the proposed activity in its entirety against the actual existing environment, i.e. not using a permitted or consented baseline approach. The term "practicable minimum" is used frequently and is used to portray the fact that any farming activity results in nutrient losses to the environment of some scale and that the applicant has reduced nutrient losses as far as they are practically able to do so given available mitigations, innovations and technology whilst still maintaining an efficient and profitable farm system that meets their social and economic needs. The term "practicable minimum" does not refer to an effect on the environment. The summary to this AEE concludes that water quality will be maintained in the receiving environments given the proposed mitigations, the characteristics of the catchment and the predicted changes to water quality as a result of the proposed activity.

Attenuation

A 2011 report by Clint Rissmann undertook regional groundwater denitrification potential and aquifer sensitivity analysis throughout the Southland region. Unfortunately, the area surrounding WRO and the Orauea catchment was not analysed in this report and therefore the denitrification potential in this area remains largely unknown.

However, we can surmise that the risks of nitrogen losses from below the root zone ending up in groundwater and eventually surface water bodies is low in the vicinity of WRO due to the low mapped groundwater nitrate levels, the presence of heavy soils, the depth of groundwater and the general topography of the site. The applicant has recognised that this catchment is low risk for groundwater contamination and decided it is more environmentally beneficial to site higher contaminant loss activities (particularly high N loss activities such as intensive winter grazing) on WRO in the future in preference to the siting of these activities within the higher risk Central Plains area which is where these activities are currently occurring. The proposed activities located on WRO would otherwise be a permitted activity which strongly suggests that the proposed scale and nature of the activities is likely to result in less than minor adverse effects on the environment.

Groundwater nitrate concentrations are of particular concern to human health. The risk of bottlefed infants getting 'blue baby syndrome' from consuming high nitrate nitrogen water is widely accepted and is the primary driver for the current NZ Drinking water standard for nitrate nitrogen. Other studies

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

indicate that other contaminants, or dietary nitrate sources, may also play a role in the syndrome.[9] A recent Danish study suggested a link between groundwater nitrates and bowel cancer. The study found that those people exposed to nitrate levels in excess of 9.3 mg/L (NZ drinking water standard is 11.3 mg/L) had a 15% increased carcinogenic risk. In December 2018, Agriview NZ published an article attempting to correlate the Danish study within the New Zealand agricultural context. The article noted that "most of the international research conducted throughout the past four decades on this topic has found either a negligible or only slight correlation between nitrates in drinking water and colon/bowel cancer rates" and also that "the idea that colon cancer is heavily influenced by diet surfaces in many of the studies evaluating its link to the intake of nitrate through drinking water." The article further noted "Ian Shaw, professor of toxicology at the University of Canterbury, says it is this very factor that makes the associations between water nitrate and colon cancer unconvincing:

"In my opinion nitrate is associated with colon cancer because it can be converted to nitrite by gut bacteria and form nitrosamines with dietary amino compounds. Nitrosamines are profound carcinogens. Links with water nitrate would, therefore, not be definitive because other components of the diet would be necessary to facilitate carcinogenesis. If exposure to an appropriate dietary mixture, plus the right bacterial species in the microbiome do not coincide carcinogenesis will not occur. This is a complex scenario that cannot be attributed to a single exposure to a single chemical."

In other words, attributing high colon cancer rates to nitrates in drinking water would be oversimplifying things to a considerable level. One must consider the variations of diet and lifestyle also considered potential factors for increasing colon cancer risk, and this is something the Danish study failed to do."[10]

Given the level of current science, effects on human health should be protected under the proposal which is likely to result in less than minor adverse effects on groundwater quality due to the imposition of mitigation measures to address nitrate accumulation and the siting of intensive winter grazing within a catchment which is low risk for nitrate accumulation, has deep groundwater and heavy soils.

Phosphorus, Sediment and Microbial losses

The loss of P, sediment and microbials via erosion, overland flow and artificial drainage presents the highest risk on this property. Loss of contaminants via erosion and will be partly mitigated by the presence of established vegetation along the riparian margins, fencing to exclude stock and the low stocking rate.

These contaminants may also enter artificial drainage channels if applied to land inappropriately via fertilizer application, intensive winter grazing activities or by the inappropriate grazing of animals during high drainage periods (such as late autumn and mid-spring). The low stocking rate will partly mitigate potential losses via artificial drainage channels as less urine and dung deposition per hectare will occur.

Another factor to consider is the risk of P, sediment and microbial losses directly to surface water bodies within this catchment via overland flow – primarily occurring from runoff from laneways and via critical source areas. Overall losses of these contaminants directly to waterways is considered low risk on this property due to the low stocking rate. Overseer gives an estimate of what P may be lost directly to the

[9] https://en.wikipedia.org/wiki/Blue_baby_syndrome accessed 8 February 2019

[10] https://www.agriview.nz/forum/2018/12/11/investigating-the-nitrate-colon-cancer-link accessed 8 February 2019

environment from laneways, waterway crossings and critical source areas in the 'other sources' output within the model. The model does not consider sediment and microbial losses, however as all three contaminants typically enter surface water bodies via the same transport pathways then P loss modelled by Overseer can be used as a proxy for estimating sediment and microbial losses to the environment also.

The problem with the 'other sources' output estimated by Overseer is that it is not spatially explicit and does not account for site-specific mitigation measures which may be in place on a farm to mitigate losses directly to waterways from these laneways and critical source areas. The GMPs implemented on WRO specifically address and seek to minimise contaminant losses from these areas.

GMPs and mitigation measures to reduce P, sediment and microbial losses

The applicant will be implementing specific critical source area GMPs that will seek to minimise potential P loss via overland flow from these new lanes and/or culvert crossings such as the fencing of waterways, establishing vegetated riparian margins, contouring lanes to direct runoff to pasture, installing bargeboards on culvert crossings and locating laneways away from waterways.

P losses have therefore been reduced to the practicable minimum. The implementation of targeted GMPs and mitigation measures should result in effects on the environment which are less than minor.

Hydrology of the catchment

The property is located in an area of unclassified groundwater management zone. This means that little information is available on groundwater and surface water connectivity, recharge and groundwater levels. Local anecdotal evidence strongly suggests that groundwater is very deep on the western side of the Longwoods ranges in the location of WRO as neighbours have had extreme difficulty drilling for groundwater. Despite the lack of knowledge and deep groundwater, there is expected to be some level of steady discharge of groundwater to surface water bodies. The discharge of groundwater to surface water bodies provides for mixing and dilution of nutrients from either source (groundwater or surface water). The dilution of nutrients can reduce the concentration of these nutrients in these water bodies which can lead to less prevalence of the adverse effects of water quality degradation.

Catchment Characteristics

The WRO farm sits within the wider Orauea catchment. The Orauea River is a cobble/gravel bedded river which drains pastoral land from near the town of Nightcaps to its confluence with the Waiau River near Tuatapere. According to a 2014 Aqualinc Report, the wider Waiau River catchment is large at 827,299 ha and is comprised of 33 dairy farms, 3 forestry blocks and 311 sheep and beef farms. Approximately 23% of the catchment is pastoral farmland. [11]

Nutrient Load

We have used some of the workings in this Aqualinc report to illustrate how nutrient load from a particular farm impacts on the resulting concentration of nutrient within the end receiving environment.

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

Total nutrient load within the Waiau River catchment have been estimated in the Aqualinc report.

The table estimates the total source load within the catchment at 4970 T N/year undergoing attenuation to result in an estimated 1864 T N/year as a nutrient load within the receiving waters at the Te Waewae Lagoon at the base of the catchment. Attenuation is estimated to be 62% which is the highest rate of attenuation seen across the subject catchments.

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

Figure 9: Estimated loads of nitrogen and phosphorus in the eight study catchments[12]

The report then estimated how much these loads may reduce if mitigation scenarios are imposed on all farms within the catchment. For the Waiau River catchment, N could be reduced by 29% and P reduced by 39% and an overall improvement to water quality of 16% under the full suite of mitigations (M3).

The full suite of mitigations assessed by Aqualinc includes:

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

Figure 10: Description of mitigations assumed to apply under each mitigation level[13]

The referenced Aqualinc report classified off-site grazing blocks which support dairy farms as sheep and beef farms. We have used the same classification and consider that WRO is currently operating at what could be considered M3 level for sheep and beef farms. WRO contains forested areas in swales and

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

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

duckponds which are act in a similar manner to wetlands. WRO does not contain a feed pad due to its low stocking rate and nature of the major stock class it grazes; i.e. young dairy stock.

The Overseer model predicts that 19,868 kg N was lost below the root zone from the entire farm at WRO in 2017/18. Based on the N load data from figure 10, WRO contributes in the vicinity of 0.4% of the nitrogen load to the Waiau River catchment. This equates to 22 kg N/hectare across WRO annually. Overseer predicts that 4,721 kg N was lost to below the root zone from the 52ha fodder crop block. If the area of the fodder crop block is increased to the maximum of 100ha then an additional 3,552 kg N would be lost to below the root zone (using a subsequent reduction in pastoral block losses for the lowest per hectare N loss pastoral block). Combining both figures, then a change to the farm system to increase to 100ha of fodder cropping may result in total farm losses below the root zone predicted by Overseer to be 23,420 kg N. Assuming the Waiau catchment's attenuation rate of 62%, this represents 0.47% of the estimated realised catchment N load detailed in the Aqualinc report for the Waiau catchment.

The Overseer model predicts that 23 kg P is lost below the root zone from the 52ha fodder crop block. If the area of the fodder crop block is increased to the maximum of 100ha then Overseer predicts that no additional P would be lost to below the root zone due to the fact that pastoral blocks are modelled to lose more P than the fodder crop block. The overall farm system P losses at 529 kg P represents 1.5% of the catchment P load detailed in the Aqualinc report for the Waiau catchment.

The figures above show that the nutrient load from the applicant's operation represents a small proportion of the total Waiau River catchment nutrient load.

Nutrient Concentration

As described above, the proposal may see an increase in the contribution to N source contaminant load of 0.07% if intensive winter grazing is increased on WRO to 100ha. The proposal would see a decrease in the contribution to P contaminant load if intensive winter grazing is increased. Sediment and microbial contaminant losses are likely to decrease at a similar scale given they are lost to the environment under the same contaminant pathway processes as phosphorus.

A concurrent increase in the concentration of nitrogen in these waterways is possible. The median concentration of nutrients in the Orauea River between 2009 and 2017 are described above. These concentrations would include the implementation of M3 level mitigations on WRO but will not show the expected increase in nutrient load under the proposal. For example, WRO contributes in the vicinity of 0.4% of the nitrogen load to the Waiau River catchment and the proposal is likely to result in an increase of 0.07% to nitrogen load. Nitrogen concentrations are then likely to follow suit and result in a 0.028% increase to median nitrogen concentrations in the catchment. This increase represents such a miniscule amount that it is unlikely to show an increase in water quality degradation effects within this catchment. The water quality parameters measuring nitrogen in the receiving environments in this catchment are rated A band under the NOF standards and therefore the proposal is unlikely to result in adverse effects on water quality.

If we use phosphorus as a proxy for *E.coli* then the proposal is likely to result in a decrease in E. coli load to the receiving water bodies and therefore result in no adverse effects on water quality.

Both receiving waters are showing some signs of water quality degradation, but not at a level witnessed in many of the other lowland water bodies in other areas of Southland. The Orauea River has high *E.coli* levels but these are showing a meaningful improvement trend. Total oxidised nitrogen is also showing improvement and total phosphorus is not showing any trends. The Waiau River on the whole has good water quality. *E.coli* levels are improving, total oxidised nitrogen is rated A band with no evident trends and total phosphorus levels are low and not showing any trend. The applicant recognises that their proposal introduces more intensive winter grazing (of young dairy stock) into this catchment. However, as can be seen from the calculations above and the existing water quality medians, this catchment has the capacity for a negligible increase in N contaminants.

Summary

The proposal results in an expected negligible increase in total N lost to the environment and a predicted reduction in total P, sediment and microbial losses to the environment. Water quality will be maintained in the receiving environment.

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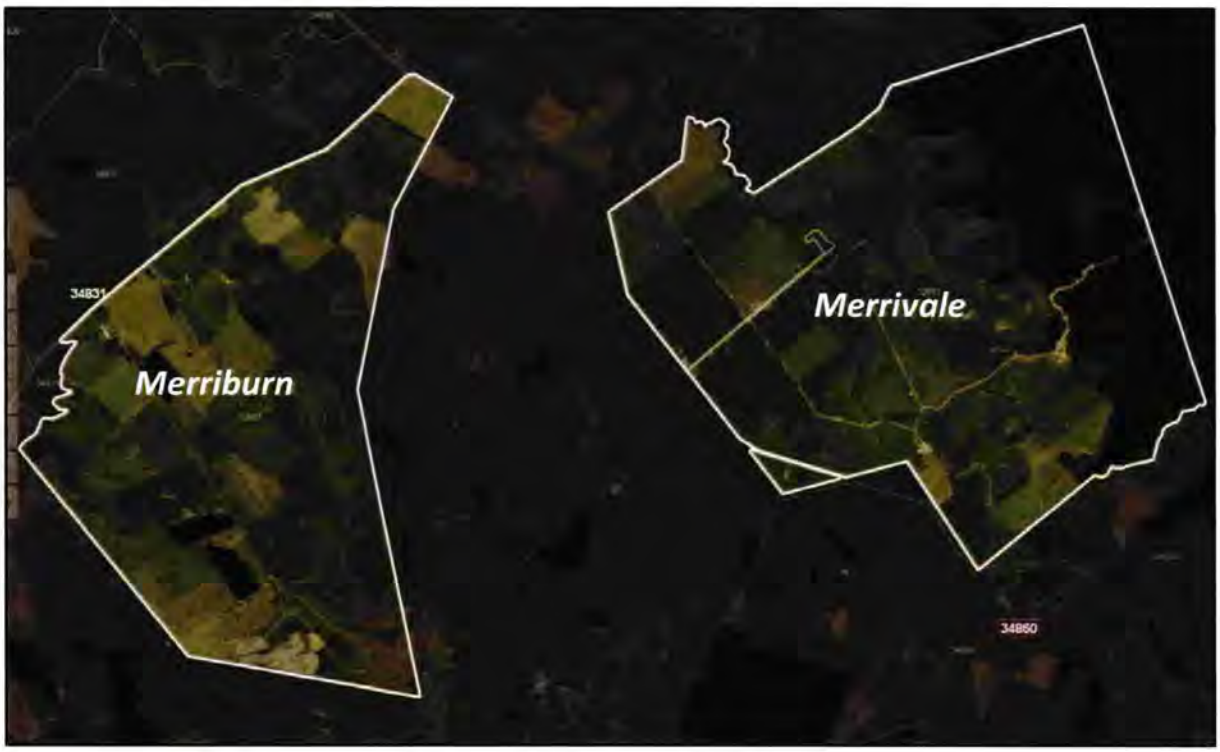
1.0 Overview

This report provides details and commentary on the nutrient budgeting that has been undertaken for Woldwide Runoff (WR) and forms part of two wider resource consent applications for expanded dairying at Woldwide 1, 2, 4 & 5. Background information and details of the nutrient budgeting for Woldwide 1, 2, 4, 5 and Horner Block can be found in the associated nutrient budget analysis dated the 2nd August 2018.

WR is comprised of two separate blocks being the 385ha (~338ha effective) Merriburn Block and the 507ha (~321ha effective) Merrivale Block. The Merrivale Block is owned by the De Wolde's with the Merriburn Block being leased; however they are both run as a single farm. The two properties are located in Western Southland to the north east of Tuatapere.

WR is used to graze young stock from five dairy farms with baleage being made during periods of surplus grass production. Baleage is used to supplement the winter grazing of young stock at WR and is also sold to Woldwide Farms, Woldwide 4 and Woldwide 5. In addition to the raising of young stock and baleage production, WR also has approximately 100ha of commercial pine plantation and 60ha of Beech forest under a sustainable management plan.



In 2017/18 there were 1265 rising 1 year olds (R1's) at WR and 1265 rising 2 year olds (R2's). R2 numbers were trimmed to approximately 1150 in March due to a cull of empty cows (not in calve). In addition to the R1's and R2's there were 37 empty carry over cows and 70 mating bulls (1st November to 10th January) grazing on WR

In 2017/18 there was 52ha of Kale grown on the property (36.5ha on Merriburn and 15.5ha on Merrivale) to facilitate the wintering of the 1265 R1's between the 20th May and the 10th August. In addition to Kale, R1's were also feed approximately 1188 bales of baleage (240kg/DM).

Fertiliser inputs into the nutrient budget are based on purchase records from Ravensdown for the 2017-18 season, with soil test results entered as an Olsen P level of 25, which is the long term objective for WR. On certain areas of the Merrivale Block capital applications of phosphorus were applied in 17/18 to lift Olsen P levels.

	Total 17/18	**Per/ha 17/18**
Nitrogen Loss (kg/N)	19868	22
Phosphorus Loss (Kg/P)	529	0.6
Pasture Production (kg/DM)		10928

2.0 Modelling Inputs

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

2.1 Blocks

WR has been split into the following blocks:

Block Name	**Soil Type**	**Size (ha)**
Merriburn	Ihak_23a.1	140
Merriburn	Apar_6a.1	27.5
Merriburn Lower Fert	Ihak_23a.1	139.7
Merriburn Lower Fert	Apar_6a.1	21.1
Merriburn No Fert	Ihak_23a.1	9.5
Merrivale	Waiki_36a.1	176.5
Merrivale	Makar_3b.1	31.9
Merrivale Lower Fert	Waiki_36a.1	42.7
Merrivale Lower Fert	Malok_3a.1	27.7
Merrivale No Fert	Malok_3a.1	28.1
Merrivale No Fert	Waiki_36a.1	14.3
Kale	Rotating	Rotating (52ha)
Effective Farm Area		**659**
Plantation Forest		100
Beech Forest		60
Non-Productive		73
Total Farm Area		**892**

- Soil areas were obtained from Smap/Environment Southland.
- Soil settings were obtained from SMap for all soil types.

2.2 Climate Data

- Location setting = Southland
- Climate station tool used for block climate data
  - 1147 - 1185mm of rainfall
  - 9.9 - 10°C mean annual temperature
  - 731-1450mm daily rainfall pattern. Low variation.
  - 737 - 743mm mean annual PET

2.3 Farm System Inputs

Description	**17/18 Season**			
Stock on Farm	<u>R1's – Friesian</u> July – 0 Aug – 0 Sep – 0 Oct – 0 Nov – 1265 Dec – 1265 Jan – 1265 Feb – 1265 Mar – 1265 Apr – 1265 May – 1265 June – 1265	<u>R2's – Friesian</u> July – 1265 Aug – 1265 Sep – 1265 Oct – 1265 Nov – 1265 Dec – 1265 Jan – 1265 Feb – 1265 Mar – 1150 Apr – 1150 May – 1150 June – 0	<u>Carry Overs</u> July – 37 Aug – 37 Sep – 37 Oct – 37 Nov – 37 Dec – 37 Jan – 37 Feb – 37 Mar – 37 Apr – 37 May – 37 June – 37	<u>Mating Bulls</u> July – 0 Aug – 0 Sep – 0 Oct – 0 Nov – 70 Dec – 70 Jan – 23 Feb – 0 Mar – 0 Apr – 0 May – 0 June – 0
Crop Area & Inputs	<u>52ha Kale (15.5ha Merrivale & 36.5ha Merriburn)</u> - 12T/DM/ha - Direct Drilled November - 46kg/ha/N; 49kg/ha/P; 48kg/ha/K applied in December - Grazed 24hrs a day 20th May to 10th August by R1's (entered as June, July August in Overseer as can't use part months) - Re-sown to grass in October			
Supplements	<u>Made on Farm</u> - 1188 (240kg/DM) bales of baleage = 285T/DM → Feed on Kale Crop - 2854 (240kg/DM) bales of baleage = 685T/DM → Exported off WR			
Fertiliser	<u>Merriburn</u> 136kg/N/ha (Sep, Dec, Feb) 20kg/P/ha (Dec) 26kg/K/ha (Dec)	<u>Merriburn Lower Fert</u> 36kg/N/ha (Sep, Dec, Feb) 25kg/P/ha (Dec) 16kg/K/ha (Dec)	<u>Merrivale</u> 165kg/N/ha (Aug, Nov, Sep, Feb) 59kg/P/ha (Nov & Jan) 99kg/K/ha (Nov & Jan)	<u>Merrivale Lower Fert</u> 57kg/N/ha (Sep & Nov) 22kg/P/ha (Nov) 25kg/K/ha (Nov)

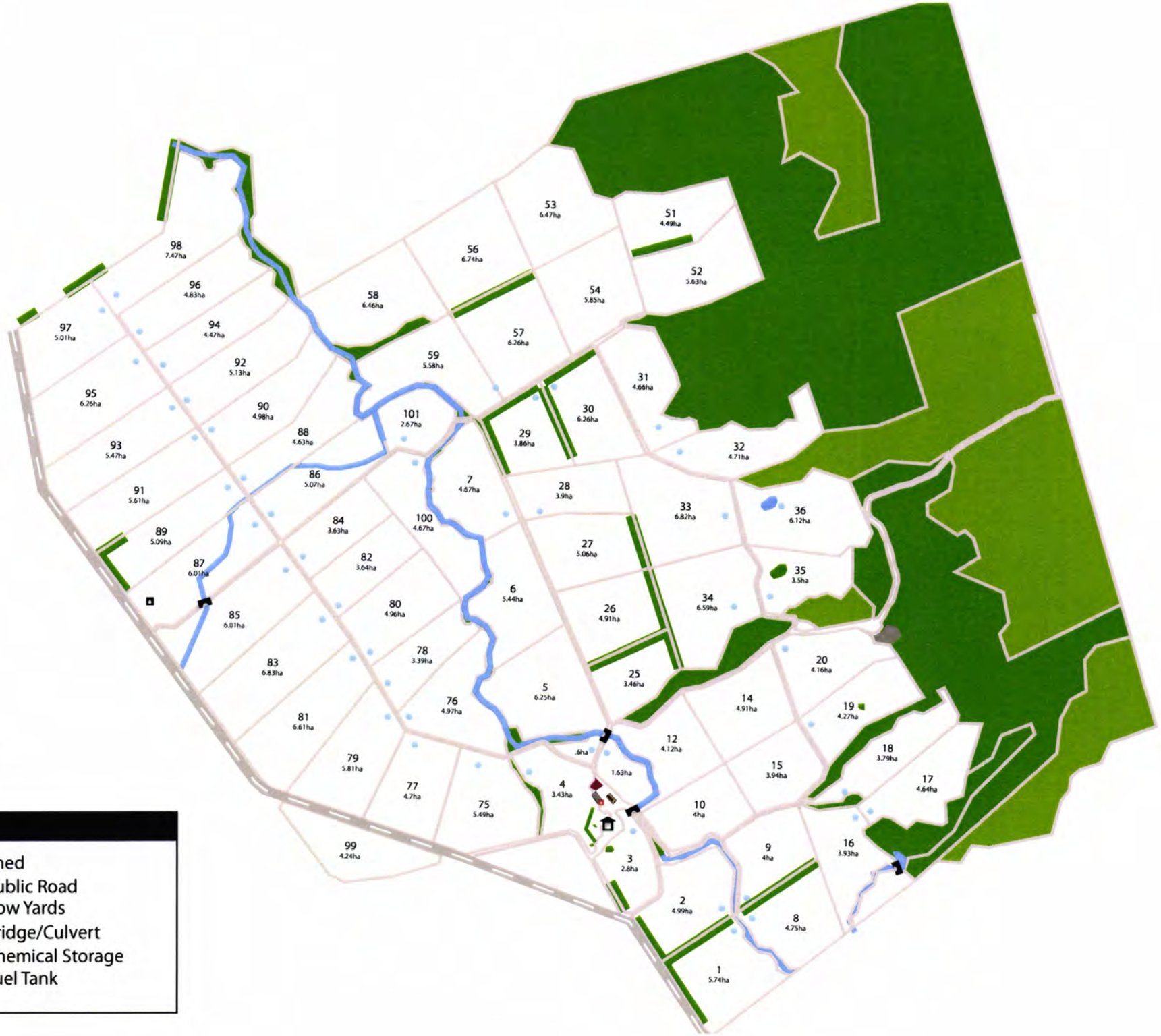
3.0 Modelling Results

	Total 17/18	Per/ha 17/18
Nitrogen Loss (kg/N)	19868	22
Phosphorus Loss (Kg/P)	529	0.6
Pasture Production (kg/DM)		10928

4.0 Proposed Scenario

No proposed scenario has been modelled as the operation of WR is planned to continue within the nutrient loss parameters outlined in Section 3.0. On this basis the proposed nutrient budget is identical to that produced for the 17/18 season.

Appendix 1 – Block & Farm Maps

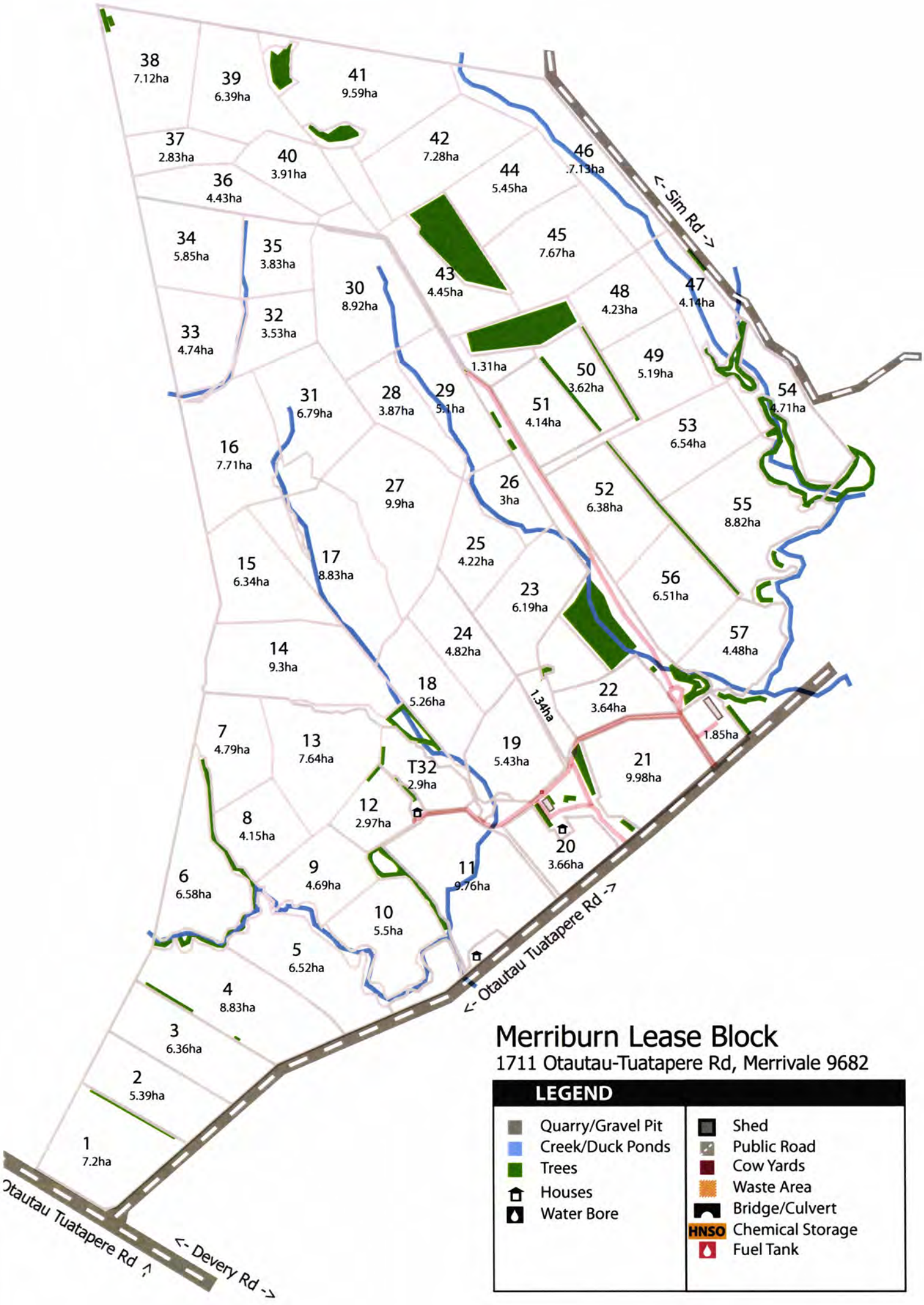


Woldwide Run-Off

20 Gill Rd, Merrivale 9682

LEGEND

- Quarry/Gravel Pit
- Creek/Duck Ponds
- Trees
- Houses
- Water Bore
- Shed
- Public Road
- Cow Yards
- Bridge/Culvert
- HNSO Chemical Storage
- Fuel Tank


38
7.12ha
39
6.39ha
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9.59ha
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7.28ha
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36
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<- Sim Rd ->
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5.85ha
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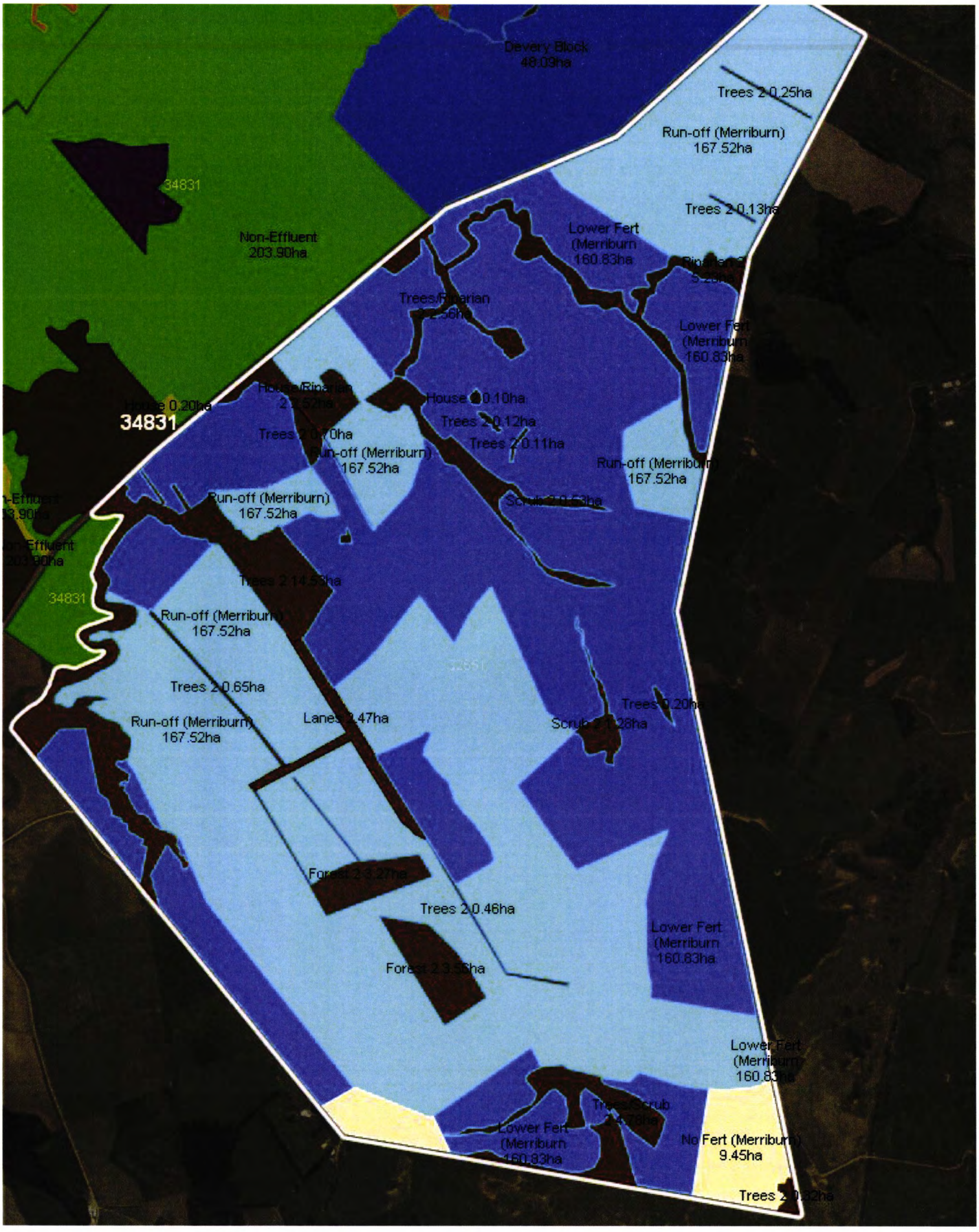
57
4.48ha
14
9.3ha
18
5.26ha
1.34ha
22
3.64ha
1.85ha
7
4.79ha
13
7.64ha
19
5.43ha
21
9.98ha
T32
2.9ha
12
2.97ha
8
4.15ha
20
3.66ha
6
6.58ha
9
4.69ha
11
9.76ha
10
5.5ha
<- Otautau Tuatapere Rd ->
5
6.52ha
4
8.83ha
3
6.36ha
2
5.39ha
1
7.2ha
Otautau Tuatapere Rd ->
<- Devery Rd ->
Merriburn Lease Block
1711 Otautau-Tuatapere Rd, Merrivale 9682
LEGEND
Quarry/Gravel Pit
Creek/Duck Ponds
Trees
Houses
Water Bore
Shed
Public Road
Cow Yards
Waste Area
Bridge/Culvert
HNSO Chemical Storage
Fuel Tank

Run- off No
Fert (Merri
42.49ha
Trees 0.48ha
Riparian 0.19ha
Run-off (Merrivale)
208.40ha
Trees 1.69ha
32651
Pond 0.18ha
Trees/Sheds
0.06ha
Trees 0.37ha
Trees 1.34ha
Run-off Lower
Fert (Merrivale)
70.40ha
Trees 0.58ha


Devery Block
48.09ha
Trees 2 0.25ha
Run-off (Merriburn)
167.52ha
34831
Trees 2 0.13ha
Non-Effluent
203.90ha
Lower Fert
(Merriburn
160.83ha
Trees/Riparian
House 0.20ha
34831
House 0.10ha
Trees 2 0.12ha
Trees 2 0.11ha
Run-off (Merriburn)
167.52ha
Run-off (Merriburn)
167.52ha
34831
Run-off (Merriburn)
167.52ha
Trees 2 0.65ha
Run-off (Merriburn)
167.52ha
Lanes 2.47ha
Trees 2 0.20ha
Scrub 2 1.26ha
Forest 2 8.27ha
Trees 2 0.46ha
Lower Fert
(Merriburn
160.83ha
Forest 2 3.55ha
Lower Fert
(Merriburn
160.83ha
Lower Fert
(Merriburn
160.83ha
No Fert (Merriburn)
9.45ha

Appendix 2 – Nutrient Budgets & Block Reports

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Version 6.3.0, on 2018-10-31 02:42:51

Abe De Wolde
Woldwide Runoff
Client reference:

Cain Duncan
Fonterra

Farm name: Woldwide Runoff (Merrivale & Merriburn) (17/18)

Farm Nutrient Budget - Whole farm

	N	P	K	S	Ca	Mg	Na
	(kg/ha/yr)						
Nutrients added							
Fertiliser, lime & other	79	25	33	31	0	0	0
Rain/clover N fixation	41	0	2	5	3	7	31
Irrigation	0	0	0	0	0	0	0
Supplements imported	0	0	0	0	0	0	0
Nutrients removed							
As products	14	4	1	2	7	0	0
Exported effluent	0	0	0	0	0	0	0
As supplements	14	2	15	1	3	1	1
To atmospheric	28	0	0	0	0	0	0
To water	22	0.6	8	36	24	6	25
Change in internal pools							
Plant material	1	0	-7	2	0	0	0
Organic pool	38	7	1	-5	0	0	0
Inorganic mineral	0	2	-15	0	-2	-3	-3
Inorganic soil pool	3	9	34	0	-31	3	7

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Version 6.3.0, on 2018-10-31 02:44:59

Abe De Wolde
Woldwide Runoff
Client reference:
Farm name: Woldwide Runoff (Merrivale & Merriburn) (17/18)

Cain Duncan
Fonterra

Block Nitrogen

Block name	Total N lost (kg N/yr)	N lost to water (kg N/ha/yr)	N in drainage * (ppm)	N surplus (kg N/ha/yr)	Added N ** (kg N/ha/yr)
Merriburn (Ihak_23a.1) ##	2646	21	4.5	132	136
Merriburn (Apar_6a.1) ##	445	18	3.9	132	136
Merriburn Lower Fert (Ihak_23a.1) ##	2486	20	4.2	100	72
Merriburn Lower Fert (Apar_6a.1) ##	332	17	3.8	100	72
Merriburn No Fert (Ihak_23a.1)	204	21	4.6	86	0
Merrivale (Waiki_36a.1) ##	5015	31	6.1	139	165
Merrivale (Makar_3b.1) ##	603	21	4.2	140	165
Merrivale Lower Fert (Waiki_36a.1)	882	21	N/A	95	57
Merrivale Lower Fert (Malok_3a.1)	683	25	N/A	97	57
Merrivale No Fert (Malok_3a.1)	769	27	N/A	88	0
Merrivale No Fert (Waiki_36a.1)	327	23	N/A	86	0
Kale	4721	91	**15.3**	150	82
Plantation Forest	250	2	N/A		
Beech Forest	180	3	N/A		
Other farm sources	325				
Whole farm	19868	22			
Less N removed in wetlands	0				
Farm output	19868	22			

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

** Sum of fertiliser and external factory effluent inputs.

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

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Version 6.3.0, on 2018-10-31 02:51:48

Abe De Wolde
Woldwide Runoff
Client reference:
Farm name: Woldwide Runoff (Merrivale & Merriburn) (17/18)

Cain Duncan
Fonterra

Block Phosphorus

Block name	Total P lost (kg P/yr)	P lost (kg P/ha/yr)	P loss categories		
			Soil	Fertiliser	Effluent
Merriburn (Ihak_23a.1) ##	72	0.6	Low	Low	n/a
Merriburn (Apar_6a.1) ##	14	0.6	Low	Low	n/a
Merriburn Lower Fert (Ihak_23a.1) ##	73	0.6	Low	Low	n/a
Merriburn Lower Fert (Apar_6a.1) ##	11	0.6	Low	Low	n/a
Merriburn No Fert (Ihak_23a.1)	5	0.5	Low	n/a	n/a
Merrivale (Waiki_36a.1) ##	97	0.6	Low	Medium	n/a
Merrivale (Makar_3b.1) ##	62	2.1	High	High *	n/a
Merrivale Lower Fert (Waiki_36a.1)	32	0.8	Low	Low	n/a
Merrivale Lower Fert (Malok_3a.1)	22	0.8	Medium	Low	n/a
Merrivale No Fert (Malok_3a.1)	21	0.7	Medium	n/a	n/a
Merrivale No Fert (Waiki_36a.1)	10	0.7	Low	n/a	n/a
Kale	23	0.4	n/a	n/a	n/a
Plantation Forest	12	0.1	n/a	n/a	n/a
Beech Forest	6	0.1	n/a	n/a	n/a
Other farm sources	70				
Whole farm	529	0.6			

** Fertiliser loss is outside the range for New Zealand data - see comments for each block

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

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Appendix 3 – Fertiliser Records

Nutrient summary report

WOLDWIDE RUNOFF LTD - 60842387

Query range : 01 Jun 2017 to 31 May 2018

Name	Date	Area (ha)	Product	Rate (kg/ha or l/ha)	N kg/ha	P kg/ha	K kg/ha	S kg/ha	Ca kg/ha	Mg kg/ha
1	16/08/2017	5.3	RZR - AMM SE	134	48	-	-	13	-	-
	08/12/2017	5.2	WW R/off Post Cut Maintenance	1410	22	55	102	67	317	3
	13/02/2018	5.3	UREA BULK	109	50	-	-	-	-	-
	Area weighted total				**110**	**50**	**93**	**73**	**289**	**3**
10	16/08/2017	1.7	RZR - AMM SE	130	46	-	-	12	-	-
	13/02/2018	3.8	UREA BULK	110	51	-	-	-	-	-
	Area weighted total				**67**	-	-	**5**	-	-
100	16/08/2017	3.9	RZR - AMM SE	139	50	-	-	13	-	-
	05/09/2017	3.8	UREA BULK	151	69	-	-	-	-	-
	21/11/2017	4	WW R/off Post Cut Maintenance	1403	22	55	101	67	316	3
	12/02/2018	4.1	Urea	111	51	-	-	-	-	-
	Area weighted total				**161**	**47**	**87**	**68**	**271**	**2**
101	16/08/2017	2.1	RZR - AMM SE	135	48	-	-	13	-	-
	05/09/2017	2.3	UREA BULK	135	62	-	-	-	-	-
	21/11/2017	2.5	WW R/off Post Cut Maintenance	1426	23	56	103	68	321	3
	12/02/2018	2.5	Urea	113	52	-	-	-	-	-
	Area weighted total				**161**	**52**	**97**	**74**	**302**	**3**
12	16/08/2017	3.4	RZR - AMM SE	137	49	-	-	13	-	-
	08/01/2018	3.7	WW R/Off Pot super/Flexi/Lime	1052	23	34	33	41	275	3

ravensdown

	13/02/2018	3.7	UREA BULK	110	51	-	-	-	-	-
	Area weighted total				**107**	**30**	**30**	**48**	**246**	**3**
14	08/01/2018	4.6	WW R/Off Pot super/Flexi/Lime	1035	23	33	32	40	271	3
	13/02/2018	4.7	UREA BULK	106	49	-	-	-	-	-
	Area weighted total				**67**	**31**	**30**	**38**	**252**	**3**
15	22/11/2017	2	SELENIUM SELPRILL DOUBLE 2%SE DG CL *	219	-	-	-	-	-	-
	08/01/2018	1.3	WW R/Off Pot super/Flexi/Lime	1152	25	37	36	45	301	3
	14/03/2018	3.1	UREA	107	49	-	-	-	-	-
	Area weighted total				**47**	**12**	**12**	**15**	**101**	**1**
16	22/11/2017	3.1	SELENIUM SELPRILL DOUBLE 2%SE DG CL *	224	-	-	-	-	-	-
	13/02/2018	3.7	UREA BULK	108	50	-	-	-	-	-
	Area weighted total				**46**	**-**	**-**	**-**	**-**	**-**
16b	22/11/2017	0.4	SELENIUM SELPRILL DOUBLE 2%SE DG CL *	230	-	-	-	-	-	-
	13/02/2018	0.8	UREA BULK	121	55	-	-	-	-	-
	Area weighted total				**45**	**-**	**-**	**-**	**-**	**-**
17	22/11/2017	3.8	SELENIUM SELPRILL DOUBLE 2%SE DG CL *	233	-	-	-	-	-	-
	Area weighted total				**-**	**-**	**-**	**-**	**-**	**-**
18	22/11/2017	3.3	SELENIUM SELPRILL DOUBLE 2%SE DG CL *	227	-	-	-	-	-	-
	Area weighted total				**-**	**-**	**-**	**-**	**-**	**-**

19	13/02/2018	4.1	UREA BULK	110	50	-	-	-	-	-
	Area weighted total				**48**	**-**	**-**	**-**	**-**	**-**
2	16/08/2017	4.4	RZR - AMM SE	131	47	-	-	13	-	-
	08/12/2017	4.6	WW R/off Post Cut Maintenance	1413	23	55	102	67	318	3
	13/02/2018	4.7	UREA BULK	109	50	-	-	-	-	-
	Area weighted total				**110**	**51**	**94**	**73**	**293**	**3**
20	08/01/2018	3.3	WW R/Off Pot super/Flexi/Lime	1051	23	34	33	41	275	3
	Area weighted total				**19**	**27**	**27**	**33**	**221**	**2**
25	22/11/2017	3.2	WW R/Off Pot super/Flexi/Lime	1003	22	32	31	39	262	3
	13/02/2018	3.3	UREA BULK	110	51	-	-	-	-	-
	Area weighted total				**69**	**29**	**29**	**36**	**240**	**3**
26	22/11/2017	4.3	WW R/Off Pot super/Flexi/Lime	1015	22	32	32	40	265	3
	13/02/2018	4.5	UREA BULK	109	50	-	-	-	-	-
	Area weighted total				**65**	**28**	**28**	**35**	**233**	**2**
27	22/11/2017	3.8	WW R/Off Pot super/Flexi/Lime	1049	23	34	33	41	274	3
	13/02/2018	4.3	UREA BULK	108	50	-	-	-	-	-
	Area weighted total				**60**	**25**	**25**	**31**	**208**	**2**
28	22/11/2017	3.5	WW R/Off Pot super/Flexi/Lime	1030	23	33	32	40	269	3
	13/02/2018	3.8	UREA BULK	108	49	-	-	-	-	-
	Area weighted total				**68**	**30**	**29**	**37**	**244**	**3**
29	16/08/2017	3.4	RZR - AMM SE	135	48	-	-	13	-	-
	08/01/2018	3.3	WW R/Off Pot super/Flexi/Lime	1009	22	32	32	39	264	3
	13/02/2018	3.5	UREA BULK	110	51	-	-	-	-	-

	Area weighted total				**108**	**27**	**27**	**45**	**224**	**2**
2A	05/09/2017	1.6	AMMO 36 BULK	138	49	-	-	13	-	-
	12/02/2018	1.9	UREA BULK	123	56	-	-	-	-	-
	Area weighted total				**87**	**-**	**-**	**10**	**-**	**-**
3	16/08/2017	2.4	RZR - AMM SE	138	49	-	-	13	-	-
	22/11/2017	2.3	WW R/Off Pot super/Flexi/Lime	1028	23	33	32	40	269	3
	13/02/2018	2.5	UREA BULK	110	50	-	-	-	-	-
	Area weighted total				**105**	**27**	**26**	**44**	**221**	**2**
30	16/08/2017	4	RZR - AMM SE	128	46	-	-	12	-	-
	13/02/2018	4.4	UREA BULK	111	51	-	-	-	-	-
	Area weighted total				**79**	**-**	**-**	**10**	**-**	**-**
31	08/01/2018	4.1	WW R/Off Pot super/Flexi/Lime	1058	23	34	33	41	277	3
	Area weighted total				**21**	**30**	**29**	**37**	**246**	**3**
32	22/11/2017	4.2	SELENIUM SELPRILL DOUBLE 2%SE DG CL *	237	-	-	-	-	-	-
	Area weighted total				-	-	-	-	-	-
33	21/11/2017	4.5	WW R/off Post Cut Maintenance	1471	23	57	106	70	331	3
	13/02/2018	5.7	UREA BULK	110	51	-	-	-	-	-
	Area weighted total				**58**	**38**	**71**	**47**	**220**	**2**
34	22/11/2017	5.9	SELENIUM SELPRILL DOUBLE 2%SE DG CL *	224	-	-	-	-	-	-
	13/02/2018	6.2	UREA BULK	107	49	-	-	-	-	-
	Area weighted total				**46**	**-**	**-**	**-**	**-**	**-**
35	22/11/2017	2.8	SELENIUM SELPRILL DOUBLE 2%SE DG CL *	234	-	-	-	-	-	-

	Area weighted total				**-**	**-**	**-**	**-**	**-**	**-**
36	22/11/2017	5.3	SELENIUM SELPRILL DOUBLE 2%SE DG CL *	225	-	-	-	-	-	-
	Area weighted total				**-**	**-**	**-**	**-**	**-**	**-**
4a	**Area weighted total**				**-**	**-**	**-**	**-**	**-**	**-**
4b	16/08/2017	3	RZR - AMM SE	142	51	-	-	14	-	-
	22/11/2017	3.2	WW R/Off Pot super/Flexi/Lime	1031	23	33	32	40	270	3
	13/02/2018	3	UREA BULK	112	51	-	-	-	-	-
	Area weighted total				**110**	**30**	**30**	**49**	**249**	**3**
4c	**Area weighted total**				**-**	**-**	**-**	**-**	**-**	**-**
5	16/08/2017	5.6	RZR - AMM SE	132	47	-	-	13	-	-
	30/11/2017	6	MURIVALE KALE	392	58	66	28	3	-	-
	Area weighted total				**98**	**63**	**26**	**14**	**-**	**-**
51	**Area weighted total**				**-**	**-**	**-**	**-**	**-**	**-**
52	**Area weighted total**				-	-	-	-	-	-
53	**Area weighted total**				**-**	**-**	**-**	**-**	**-**	**-**
54	**Area weighted total**				-	-	-	-	-	-
56	16/08/2017	6.3	RZR - AMM SE	133	48	-	-	13	-	-
	08/01/2018	6.3	WW R/Off Pot super/Flexi/Lime	990	22	32	31	39	259	3
	13/02/2018	6.5	UREA BULK	108	49	-	-	-	-	-
	Area weighted total				**112**	**29**	**29**	**48**	**240**	**3**
57	16/08/2017	5.5	RZR - AMM SE	128	46	-	-	12	-	-
	22/11/2017	5.9	WW R/Off Pot super/Flexi/Lime	988	22	32	31	39	258	3
	13/02/2018	5.9	UREA BULK	108	50	-	-	-	-	-
	Area weighted total				**108**	**30**	**29**	**47**	**244**	**3**
58	16/08/2017	6	RZR - AMM SE	137	49	-	-	13	-	-

	05/09/2017	5.9	UREA BULK	128	59	-	-	-	-	-
	08/12/2017	5.8	WW R/off Post Cut Maintenance	1417	23	55	102	67	319	3
	13/02/2018	6.1	UREA BULK	105	48	-	-	-	-	-
	Area weighted total				**166**	**49**	**91**	**72**	**285**	**3**
59	16/08/2017	5.2	RZR - AMM SE	137	49	-	-	13	-	-
	05/09/2017	5.2	UREA BULK	135	62	-	-	-	-	-
	08/01/2018	4.9	WW R/Off Pot super/Flexi/Lime	1007	22	32	32	39	263	3
	13/02/2018	5.3	UREA BULK	106	49	-	-	-	-	-
	Area weighted total				**168**	**28**	**28**	**47**	**230**	**2**
6	16/08/2017	5	RZR - AMM SE	136	48	-	-	13	-	-
	30/11/2017	5.3	MURIVALE KALE	396	59	67	28	3	-	-
	Area weighted total				**102**	**65**	**27**	**15**	**-**	**-**
7	16/08/2017	4	RZR - AMM SE	133	48	-	-	13	-	-
	30/11/2017	4.4	MURIVALE KALE	404	60	68	28	3	-	-
	Area weighted total				**97**	**64**	**27**	**14**	-	-
75	16/08/2017	5.2	RZR - AMM SE	129	46	-	-	12	-	-
	05/09/2017	5.3	UREA BULK	129	59	-	-	-	-	-
	22/11/2017	5.2	WW R/Off Pot super/Flexi/Lime	997	22	32	31	39	261	3
	08/01/2018	5	WW R/Off Pot super/Flexi/Lime	973	21	31	31	38	254	3
	Area weighted total				**141**	**59**	**58**	**84**	**482**	**5**
76	16/08/2017	4.5	RZR - AMM SE	147	52	-	-	14	-	-
	05/09/2017	4.5	UREA BULK	136	63	-	-	-	-	-
	22/11/2017	4.6	WW R/Off Pot super/Flexi/Lime	999	22	32	31	39	261	3
	12/02/2018	4.5	Urea	117	54	-	-	-	-	-
	14/03/2018	4	UREA	104	48	-	-	-	-	-

	Area weighted total				**212**	**30**	**29**	**49**	**244**	**3**
77	16/08/2017	4.5	RZR - AMM SE	133	47	-	-	13	-	-
	05/09/2017	4.6	UREA BULK	134	61	-	-	-	-	-
	28/10/2017	4.5	Post Cust - Grazed mix	1062	36	27	65	33	256	5
	08/01/2018	4.5	WW R/Off Pot super/Flexi/Lime	1033	23	33	32	40	270	3
	Area weighted total				**161**	**58**	**93**	**83**	**504**	**7**
78	16/08/2017	3.3	RZR - AMM SE	141	50	-	-	13	-	-
	05/09/2017	3.3	UREA BULK	134	62	-	-	-	-	-
	28/10/2017	3.2	Post Cust - Grazed mix	1064	36	27	65	33	256	5
	08/12/2017	3	WW R/off Post Cut Maintenance	1513	24	59	109	72	340	3
	12/02/2018	3.3	Urea	113	52	-	-	-	-	-
	Area weighted total				**214**	**78**	**159**	**109**	**545**	**7**
79	16/08/2017	5.7	RZR - AMM SE	132	47	-	-	13	-	-
	05/09/2017	5.6	UREA BULK	130	60	-	-	-	-	-
	28/10/2017	5.7	Post Cust - Grazed mix	1051	36	27	64	33	253	4
	08/01/2018	5.6	WW R/Off Pot super/Flexi/Lime	1002	22	32	31	39	262	3
	21/02/2018	5.6	UREA BULK	110	50	-	-	-	-	-
	Area weighted total				**209**	**57**	**93**	**82**	**498**	**7**
8	13/02/2018	4.5	UREA BULK	108	50	-	-	-	-	-
	Area weighted total				**47**	**-**	**-**	**-**	**-**	**-**
80	16/08/2017	4.7	RZR - AMM SE	129	46	-	-	12	-	-
	05/09/2017	4.9	UREA BULK	126	58	-	-	-	-	-
	12/02/2018	4.9	Urea	107	49	-	-	-	-	-
	Area weighted total				**149**	**-**	**-**	**12**	**-**	**-**

81	16/08/2017	6.3	RZR - AMM SE	124	44	-	-	12	-	-
	05/09/2017	6.4	UREA BULK	124	57	-	-	-	-	-
	28/10/2017	6.4	Post Cust - Grazed mix	1028	35	26	63	32	248	4
	08/01/2018	6.4	WW R/Off Pot super/Flexi/Lime	1042	23	33	33	41	272	3
	13/02/2018	5.1	UREA BULK	102	47	-	-	-	-	-
	Area weighted total				**189**	**58**	**93**	**82**	**503**	**7**
82	16/08/2017	3.4	RZR - AMM SE	123	44	-	-	12	-	-
	05/09/2017	3.5	UREA BULK	119	55	-	-	-	-	-
	28/10/2017	3.6	Post Cust - Grazed mix	1107	37	28	68	35	267	5
	08/12/2017	3.4	WW R/off Post Cut Maintenance	1525	24	59	110	73	343	3
	12/02/2018	3.6	Urea	100	46	-	-	-	-	-
	Area weighted total				**198**	**83**	**168**	**112**	**578**	**7**
83	16/08/2017	6.7	RZR - AMM SE	128	46	-	-	12	-	-
	05/09/2017	6.7	UREA BULK	129	59	-	-	-	-	-
	28/10/2017	4.7	Post Cust - Grazed mix	1062	36	27	65	33	256	5
	28/10/2017	1.9	Post Cust - Grazed mix	1001	34	26	61	31	241	4
	08/01/2018	6.5	WW R/Off Pot super/Flexi/Lime	1135	25	36	36	44	297	3
	12/02/2018	6.7	Urea	111	51	-	-	-	-	-
	Area weighted total				**210**	**61**	**96**	**86**	**527**	**7**
84	16/08/2017	3.2	RZR - AMM SE	125	45	-	-	12	-	-
	05/09/2017	3.5	UREA BULK	139	64	-	-	-	-	-
	28/10/2017	3.5	Post Cust - Grazed mix	1084	37	28	66	34	261	5

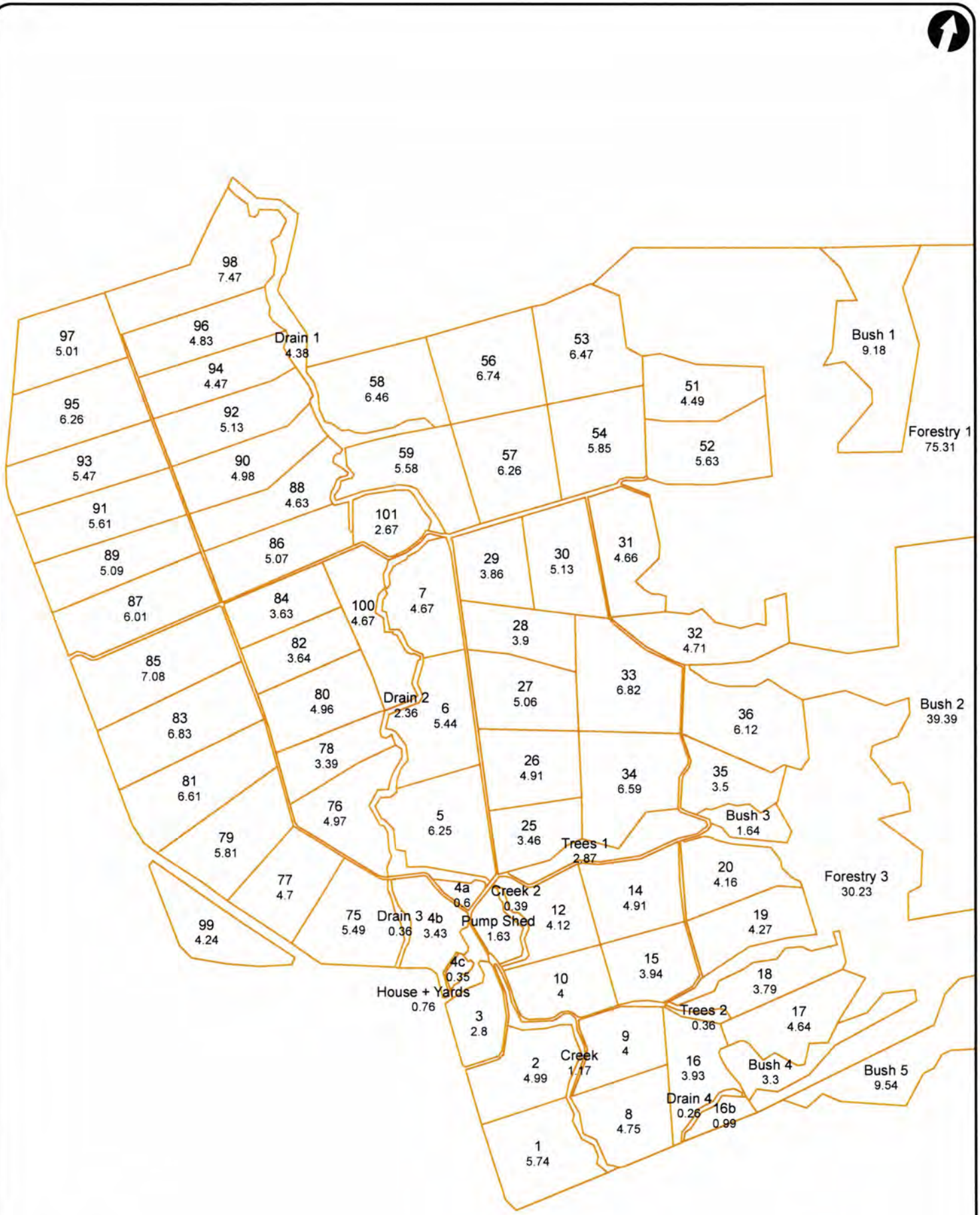
	08/12/2017	3.3	WW R/off Post Cut Maintenance	1466	23	57	106	70	330	3
	12/02/2018	3.6	Urea	113	52	-	-	-	-	-
	Area weighted total				**209**	**79**	**160**	**107**	**552**	**7**
85	16/08/2017	6.4	RZR - AMM SE	135	48	-	-	13	-	-
	05/09/2017	6.6	UREA BULK	133	61	-	-	-	-	-
	28/10/2017	6.3	Post Cust - Grazed mix	1083	37	28	66	34	261	5
	08/12/2017	6.6	WW R/off Post Cut Maintenance	1407	22	55	101	67	317	3
	12/02/2018	6.7	Urea	113	52	-	-	-	-	-
	Area weighted total				**203**	**75**	**153**	**104**	**524**	**7**
86	16/08/2017	4.4	RZR - AMM SE	139	50	-	-	13	-	-
	05/09/2017	4.5	UREA BULK	137	63	-	-	-	-	-
	08/12/2017	4.1	WW R/off Post Cut Maintenance	1537	24	60	111	73	346	3
	Area weighted total				**118**	**49**	**91**	**71**	**283**	**3**
87	16/08/2017	5.5	RZR - AMM SE	147	52	-	-	14	-	-
	05/09/2017	5.4	UREA BULK	142	65	-	-	-	-	-
	08/12/2017	0	WW R/off Post Cut Maintenance	1300	21	51	94	62	293	3
	08/12/2017	5.4	WW R/off Post Cut Maintenance	1490	24	58	107	71	335	3
	21/02/2018	5.4	UREA BULK	113	52	-	-	-	-	-
	Area weighted total				**173**	**52**	**96**	**76**	**299**	**3**
88	16/08/2017	4	RZR - AMM SE	135	48	-	-	13	-	-
	05/09/2017	4.3	UREA BULK	142	65	-	-	-	-	-
	28/10/2017	4.3	Post Cust - Grazed mix	1050	35	27	64	33	253	4

	08/12/2017	4.1	WW R/off Post Cut Maintenance	1444	23	56	104	69	325	3
	Area weighted total				**156**	**75**	**153**	**103**	**525**	**7**
89	16/08/2017	4.8	RZR - AMM SE	127	45	-	-	12	-	-
	05/09/2017	4.8	UREA BULK	136	62	-	-	-	-	-
	28/10/2017	0.6	Post Cust - Grazed mix	982	33	25	60	31	237	4
	28/10/2017	4.1	Post Cust - Grazed mix	1026	35	26	63	32	247	4
	08/12/2017	4.8	WW R/off Post Cut Maintenance	1371	22	53	99	65	309	3
	21/02/2018	4.9	UREA BULK	111	51	-	-	-	-	-
	Area weighted total				**203**	**75**	**151**	**103**	**519**	**7**
9	13/02/2018	3.3	UREA BULK	109	50	-	-	-	-	-
	Area weighted total				**42**	**-**	**-**	**-**	**-**	**-**
90	16/08/2017	4.1	RZR - AMM SE	130	46	-	-	12	-	-
	05/09/2017	4.8	UREA BULK	134	62	-	-	-	-	-
	28/10/2017	4.9	Post Cust - Grazed mix	1096	37	28	67	34	264	5
	29/01/2018	4.7	WW R/off Post Cut Maintenance	1410	22	55	102	67	317	3
	Area weighted total				**155**	**79**	**162**	**107**	**557**	**7**
91	16/08/2017	5.3	RZR - AMM SE	114	41	-	-	11	-	-
	05/09/2017	5.4	UREA BULK	112	52	-	-	-	-	-
	28/10/2017	1.6	Post Cust - Grazed mix	1081	37	28	66	34	260	5
	28/10/2017	3.8	Post Cust - Grazed mix	1063	36	27	65	33	256	5
	08/12/2017	5.4	WW R/off Post Cut Maintenance	1287	20	50	93	61	290	3
	Area weighted total				**142**	**75**	**152**	**102**	**527**	**7**

92	16/08/2017	4.4	RZR - AMM SE	124	44	-	-	12	-	-
	05/09/2017	4.9	UREA BULK	119	55	-	-	-	-	-
	21/11/2017	4.7	WW R/off Post Cut Maintenance	1356	22	53	98	65	305	3
	Area weighted total				**110**	**48**	**89**	**69**	**277**	**2**
93	16/08/2017	5.3	RZR - AMM SE	133	48	-	-	13	-	-
	05/09/2017	5.3	UREA BULK	133	61	-	-	-	-	-
	28/10/2017	5.3	Post Cust - Grazed mix	1062	36	27	65	33	256	5
	08/12/2017	5.3	WW R/off Post Cut Maintenance	1324	21	52	95	63	298	3
	21/02/2018	5.4	UREA BULK	109	50	-	-	-	-	-
	Area weighted total				**211**	**77**	**156**	**106**	**539**	**7**
94	16/08/2017	3.7	RZR - AMM SE	129	46	-	-	12	-	-
	05/09/2017	4.3	UREA BULK	130	60	-	-	-	-	-
	28/10/2017	4.3	Post Cust - Grazed mix	1002	34	26	61	31	241	4
	08/12/2017	4.2	WW R/off Post Cut Maintenance	1458	23	57	105	69	328	3
	Area weighted total				**149**	**78**	**157**	**105**	**538**	**7**
95	16/08/2017	6.1	RZR - AMM SE	121	43	-	-	12	-	-
	05/09/2017	6.1	UREA BULK	119	55	-	-	-	-	-
	28/10/2017	6	Post Cust - Grazed mix	977	33	25	60	31	235	4
	08/12/2017	6.1	WW R/off Post Cut Maintenance	1409	22	55	102	67	317	3
	21/02/2018	6.1	UREA BULK	100	46	-	-	-	-	-
	Area weighted total				**194**	**78**	**158**	**107**	**539**	**7**
96	16/08/2017	4.2	RZR - AMM SE	125	45	-	-	12	-	-
	05/09/2017	4.4	UREA BULK	122	56	-	-	-	-	-

	28/10/2017	4.7	Post Cust - Grazed mix	1019	34	26	62	32	245	4
	08/12/2017	4.6	WW R/off Post Cut Maintenance	1388	22	54	100	66	312	3
	Area weighted total				**145**	**77**	**156**	**105**	**537**	**7**
97	16/08/2017	4.7	RZR - AMM SE	135	48	-	-	13	-	-
	05/09/2017	4.8	UREA BULK	133	61	-	-	-	-	-
	28/10/2017	4.9	Post Cust - Grazed mix	1027	35	26	63	32	247	4
	08/12/2017	4.6	WW R/off Post Cut Maintenance	1407	22	55	101	67	317	3
	21/02/2018	4.9	UREA BULK	113	52	-	-	-	-	-
	Area weighted total				**210**	**76**	**155**	**105**	**533**	**7**
98	16/08/2017	6.6	RZR - AMM SE	144	51	-	-	14	-	-
	05/09/2017	6.8	UREA BULK	130	60	-	-	-	-	-
	28/10/2017	7.1	Post Cust - Grazed mix	1059	36	27	65	33	255	4
	08/12/2017	0.5	WW R/off Post Cut Maintenance	1728	28	67	125	82	389	3
	08/12/2017	7.1	WW R/off Post Cut Maintenance	1420	23	55	102	68	320	3
	21/02/2018	5.3	UREA BULK	111	51	-	-	-	-	-
	Area weighted total				**193**	**83**	**167**	**114**	**573**	**7**
99	**Area weighted total**				**-**	**-**	**-**	**-**	**-**	**-**
Weighted average rate based on applied areas and rates for selected areas					**109**	**38**	**62**	**51**	**254**	**3**

Note: Total and average rates assume product applications cover effective area of paddock(s) selected.
This is dependent on positional accuracy of paddock boundaries
* The product that you have created, is missing nutrient values. This will affect any averages or totals in the Nutrient summary. Please go to the event concerned and add the nutrient values to the appropriate product.



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

Merrivale

0 80 160 320 480 640 Metres

ravensdown

11 October 2018

Nutrient summary report

WOLDWIDE RUNOFF LTD - 60842387

Query range : 01 Jun 2017 to 31 May 2018

Name	Date	Area (ha)	Product	Rate (kg/ha or l/ha)	N kg/ha	P kg/ha	K kg/ha	S kg/ha	Ca kg/ha	Mg kg/ha
2A	05/09/2017	1.6	AMMO 36 BULK	138	49	-	-	13	-	-
	12/02/2018	1.9	UREA BULK	123	56	-	-	-	-	-
	Area weighted total				**87**	**-**	**-**	**10**	**-**	**-**
A1	05/09/2017	4	AMMO 36 BULK	139	50	-	-	13	-	-
	12/02/2018	4	UREA BULK	108	50	-	-	-	-	-
	Area weighted total				**89**	**-**	**-**	**12**	**-**	**-**
B1	05/09/2017	6.2	AMMO 36 BULK	129	46	-	-	12	-	-
	24/11/2017	5.9	Post Cut mix to be cut again	355	58	10	54	12	22	7
	12/02/2018	6.4	UREA BULK	109	50	-	-	-	-	-
	Area weighted total				**146**	**9**	**49**	**23**	**20**	**7**
B2	05/09/2017	7.7	AMMO 36 BULK	144	52	-	-	14	-	-
	10/01/2018	7.8	Merriburn Grazed MaintenanCE+N	887	43	23	-	29	240	5
	12/02/2018	8.2	UREA BULK	115	53	-	-	-	-	-
	Area weighted total				**132**	**21**	**-**	**37**	**211**	**5**
barn lane?	05/09/2017	1.1	AMMO 36 BULK	122	44	-	-	12	-	-
	12/02/2018	1.2	UREA BULK	105	48	-	-	-	-	-
	Area weighted total				**78**	**-**	**-**	**10**	**-**	**-**
C1	05/09/2017	5.9	AMMO 36 BULK	129	46	-	-	12	-	-
	24/11/2017	6	Post Cut mix to be cut again	352	57	10	53	12	21	7
	12/02/2018	6.2	UREA BULK	110	50	-	-	-	-	-

ravensdown

	Area weighted total				**146**	**9**	**50**	**22**	**20**	**7**
C2	05/09/2017	6.2	AMMO 36 BULK	137	49	-	-	13	-	-
	10/01/2018	6.1	Merriburn Grazed MaintenanCE+N	894	44	24	-	29	242	5
	12/02/2018	6.3	UREA BULK	110	51	-	-	-	-	-
	Area weighted total				**136**	**22**	**-**	**39**	**225**	**5**
C3	05/09/2017	3.7	AMMO 36 BULK	148	53	-	-	14	-	-
	08/12/2017	3.2	Post Cust - Grazed mix	1118	38	29	68	35	269	5
	Area weighted total				**67**	**20**	**47**	**35**	**184**	**3**
D1	05/09/2017	4	AMMO 36 BULK	133	48	-	-	13	-	-
	24/11/2017	4	Post Cut mix to be cut again	358	58	10	54	12	22	7
	12/02/2018	4.2	UREA BULK	114	53	-	-	-	-	-
	Area weighted total				**150**	**9**	**51**	**23**	**20**	**7**
D2	05/09/2017	4.5	AMMO 36 BULK	150	54	-	-	14	-	-
	24/11/2017	4.4	Merriburn Grazed Maintenance+N	932	45	25	-	30	252	6
	12/02/2018	4.7	UREA BULK	112	51	-	-	-	-	-
	Area weighted total				**133**	**21**	**-**	**38**	**216**	**5**
D3	05/09/2017	2.5	AMMO 36 BULK	138	50	-	-	13	-	-
	Area weighted total				**30**	**-**	**-**	**8**	**-**	**-**
E1	05/09/2017	1	AMMO 36 BULK	135	48	-	-	13	-	-
	24/11/2017	0.8	Merriburn Grazed Maintenance+N	972	47	26	-	31	263	6
	12/02/2018	1.2	UREA BULK	120	55	-	-	-	-	-
	Area weighted total				**114**	**15**	**-**	**29**	**157**	**4**
E2	05/09/2017	2.1	AMMO 36 BULK	135	48	-	-	13	-	-
	24/11/2017	2.9	Merriburn Grazed Maintenance+N	992	48	26	-	32	269	6

	12/02/2018	3.3	UREA BULK	112	52	-	-	-	-	-
	Area weighted total				**113**	**21**	**-**	**33**	**212**	**5**
E3	05/09/2017	3.2	AMMO 36 BULK	141	51	-	-	14	-	-
	11/01/2018	1.1	Merriburn Grazed Maintenance+N	872	42	23	-	28	236	5
	12/02/2018	4	UREA BULK	118	54	-	-	-	-	-
	Area weighted total				**100**	**6**	**-**	**18**	**60**	**1**
F1	05/09/2017	3	AMMO 36 BULK	132	47	-	-	13	-	-
	24/11/2017	2.2	Merriburn Grazed Maintenance+N	924	45	24	-	30	250	6
	12/02/2018	3.7	UREA BULK	116	53	-	-	-	-	-
	Area weighted total				**98**	**12**	**-**	**23**	**122**	**3**
F2	05/09/2017	6.7	AMMO 36 BULK	144	52	-	-	14	-	-
	11/01/2018	7.3	Merriburn Grazed Maintenance+N	913	44	24	-	30	247	6
	12/02/2018	7.3	UREA BULK	108	50	-	-	-	-	-
	Area weighted total				**134**	**23**	**-**	**40**	**236**	**5**
F3	05/09/2017	4.8	AMMO 36 BULK	140	50	-	-	13	-	-
	11/01/2018	5.2	Merriburn Grazed Maintenance+N	901	44	24	-	29	244	6
	12/02/2018	5.3	UREA BULK	113	52	-	-	-	-	-
	Area weighted total				**136**	**23**	**-**	**40**	**232**	**5**
F4	05/09/2017	0.7	AMMO 36 BULK	145	52	-	-	14	-	-
	Area weighted total				**9**	**-**	**-**	**2**	**-**	**-**
G1	05/09/2017	1.4	AMMO 36 BULK	120	43	-	-	11	-	-
	24/11/2017	1.4	Merriburn Grazed Maintenance+N	865	42	23	-	28	234	5
	21/02/2018	1.5	UREA BULK	102	47	-	-	-	-	-
	Area weighted total				**120**	**20**	**-**	**35**	**206**	**5**
G2	05/09/2017	5.6	AMMO 36 BULK	145	52	-	-	14	-	-

	24/11/2017	5.6	Merriburn Grazed Maintenance+N	956	47	25	-	31	259	6
	11/01/2018	6.6	Merriburn Grazed Maintenance+N	957	47	25	-	31	259	6
	12/02/2018	7.1	UREA BULK	114	53	-	-	-	-	-
	Area weighted total				**169**	**43**	**-**	**63**	**435**	**10**
G3	05/09/2017	5.8	AMMO 36 BULK	145	52	-	-	14	-	-
	Area weighted total				**31**	**-**	**-**	**8**	**-**	**-**
G4	**Area weighted total**				**-**	**-**	**-**	**-**	**-**	**-**
H1	05/09/2017	0.6	AMMO 36 BULK	136	49	-	-	13	-	-
	24/11/2017	0.6	Merriburn Grazed Maintenance+N	936	46	25	-	30	253	6
	21/02/2018	0.7	UREA BULK	104	48	-	-	-	-	-
	Area weighted total				**113**	**19**	**-**	**34**	**194**	**4**
H2	16/08/2017	4.2	RZR - AMM SE	139	50	-	-	13	-	-
	24/11/2017	4.1	Post Cut mix to be cut again	358	58	10	54	12	22	7
	Area weighted total				**100**	**9**	**50**	**23**	**20**	**7**
H3	05/09/2017	3.2	AMMO 36 BULK	141	51	-	-	14	-	-
	24/11/2017	3.1	Merriburn Grazed Maintenance+N	930	45	25	-	30	252	6
	21/02/2018	3.3	UREA BULK	119	55	-	-	-	-	-
	Area weighted total				**124**	**20**	**-**	**35**	**200**	**5**
H4	16/08/2017	2.3	RZR - AMM SE	140	50	-	-	13	-	-
	24/11/2017	0.3	Post Cut mix to be cut again	374	61	10	57	12	23	8
	08/12/2017	2.1	Post Cust - Grazed mix	1137	38	29	70	36	274	5
	21/02/2018	2.1	UREA BULK	126	58	-	-	-	-	-
	Area weighted total				**119**	**23**	**58**	**39**	**210**	**4**

H5	05/09/2017	3.6	AMMO 36 BULK	140	50	-	-	13	-	-
	Area weighted total				**28**	**-**	**-**	**7**	**-**	**-**
H6	**Area weighted total**				-	-	-	-	-	-
R1	05/09/2017	6.2	AMMO 36 BULK	138	49	-	-	13	-	-
	06/12/2017	6.6	DAP Boron/ Potash and Slugbait	399	46	52	56	3	-	1
	Area weighted total				**87**	**49**	**53**	**14**	**-**	**1**
R10	05/09/2017	4.2	AMMO 36 BULK	134	48	-	-	13	-	-
	29/01/2018	3.9	WW R/off Post Cut Maintenance	1389	22	54	100	66	313	3
	12/02/2018	4.3	UREA BULK	109	50	-	-	-	-	-
	Area weighted total				**99**	**41**	**77**	**61**	**239**	**2**
R11	05/09/2017	3.6	AMMO 36 BULK	137	49	-	-	13	-	-
	24/11/2017	3.6	Post Cut mix to be cut again	361	59	10	55	12	22	7
	12/02/2018	3.7	UREA BULK	122	56	-	-	-	-	-
	Area weighted total				**155**	**9**	**52**	**24**	**21**	**7**
R12	05/09/2017	8.1	AMMO 36 BULK	135	48	-	-	13	-	-
	19/10/2017	0.1	TZT - AGL SUP	155	-	7	-	9	44	-
	17/11/2017	0.1	GERMINATION MIX	612	32	44	27	54	98	-
	24/11/2017	8.3	Post Cut mix to be cut again	382	62	10	58	13	23	8
	12/02/2018	8.8	UREA BULK	111	51	-	-	-	-	-
	14/03/2018	0.2	UREA	95	44	-	-	-	-	-
	Area weighted total				**138**	**10**	**49**	**22**	**22**	**7**
R13	19/10/2017	7.1	TZT - AGL SUP	171	-	8	-	9	48	-
	17/11/2017	7.6	GERMINATION MIX	731	38	52	32	64	117	-
	14/03/2018	7.8	UREA	113	52	-	-	-	-	-
	Area weighted total				**79**	**52**	**28**	**63**	**139**	**-**
R14	16/08/2017	6.4	RZR - AMM SE	134	48	-	-	13	-	-

	12/02/2018	6.5	UREA BULK	111	51	-	-	-	-	-
	Area weighted total				**93**	**-**	**-**	**12**	**-**	**-**
R15	16/08/2017	6	RZR - AMM SE	135	48	-	-	13	-	-
	05/09/2017	2.1	AMMO 36 BULK	122	44	-	-	12	-	-
	24/11/2017	8	Post Cut mix to be cut again	361	59	10	55	12	22	7
	12/02/2018	8.2	UREA BULK	111	51	-	-	-	-	-
	Area weighted total				**142**	**9**	**49**	**22**	**20**	**7**
R16	05/09/2017	3.2	AMMO 36 BULK	133	48	-	-	13	-	-
	08/12/2017	3.4	Post Cust - Grazed mix	1078	36	28	66	34	260	5
	10/01/2018	3.2	Merriburn Grazed MaintenanCE+N	1012	49	27	-	33	274	6
	12/02/2018	3.4	UREA BULK	109	50	-	-	-	-	-
	Area weighted total				**158**	**47**	**58**	**68**	**457**	**9**
R17	16/08/2017	2.8	RZR - AMM SE	132	47	-	-	13	-	-
	08/12/2017	3.2	Post Cust - Grazed mix	1051	36	27	64	33	253	4
	10/01/2018	3.1	Merriburn Grazed MaintenanCE+N	1029	50	27	-	33	278	6
	12/02/2018	3.3	UREA BULK	112	51	-	-	-	-	-
	Area weighted total				**162**	**48**	**58**	**69**	**474**	**10**
R18	16/08/2017	2.1	RZR - AMM SE	141	50	-	-	14	-	-
	05/09/2017	1.2	AMMO 36 BULK	121	43	-	-	12	-	-
	04/12/2017	3.4	DAP Boron/ Potash and Slugbait	418	48	55	59	3	-	1
	Area weighted total				**82**	**48**	**51**	**13**	**-**	**1**
R19	16/08/2017	3.1	RZR - AMM SE	130	46	-	-	12	-	-
	04/12/2017	3.4	DAP Boron/ Potash and Slugbait	432	50	57	61	3	-	2

	Area weighted total				**82**	**50**	**54**	**12**	**-**	**1**
R2	05/09/2017	3.1	AMMO 36 BULK	152	54	-	-	15	-	-
	24/11/2017	2.9	Merriburn Grazed Maintenance+N	956	47	25	-	31	259	6
	12/02/2018	3.2	UREA BULK	120	55	-	-	-	-	-
	Area weighted total				**133**	**20**	**-**	**37**	**209**	**5**
R20	16/08/2017	4.4	RZR - AMM SE	131	47	-	-	12	-	-
	04/12/2017	4.6	DAP Boron/ Potash and Slugbait	396	46	52	56	3	-	1
	Area weighted total				**88**	**51**	**54**	**14**	**-**	**1**
R21	16/08/2017	4.6	RZR - AMM SE	131	47	-	-	13	-	-
	04/12/2017	5.3	DAP Boron/ Potash and Slugbait	396	46	52	56	3	-	1
	Area weighted total				**79**	**47**	**51**	**12**	**-**	**1**
R3	16/08/2017	2.1	RZR - AMM SE	157	56	-	-	15	-	-
	24/11/2017	3.4	Merriburn Grazed Maintenance+N	960	47	25	-	31	260	6
	21/02/2018	3.3	UREA BULK	111	51	-	-	-	-	-
	Area weighted total				**123**	**24**	**-**	**38**	**243**	**5**
R4	05/09/2017	4.8	AMMO 36 BULK	130	46	-	-	12	-	-
	24/11/2017	4.7	Merriburn Grazed Maintenance+N	909	44	24	-	29	246	6
	12/02/2018	5	UREA BULK	110	51	-	-	-	-	-
	Area weighted total				**127**	**21**	**-**	**37**	**215**	**5**
R5	19/10/2017	2.6	TZT - AGL SUP	166	-	7	-	9	47	-
	19/10/2017	4.7	TZT - AGL SUP	338	-	15	-	19	95	-
	17/11/2017	4.7	GERMINATION MIX	719	37	52	32	63	115	-
	12/02/2018	5	UREA BULK	121	56	-	-	-	-	-
	Area weighted total				**86**	**63**	**28**	**77**	**209**	**-**
R6	05/09/2017	4.2	AMMO 36 BULK	138	49	-	-	13	-	-

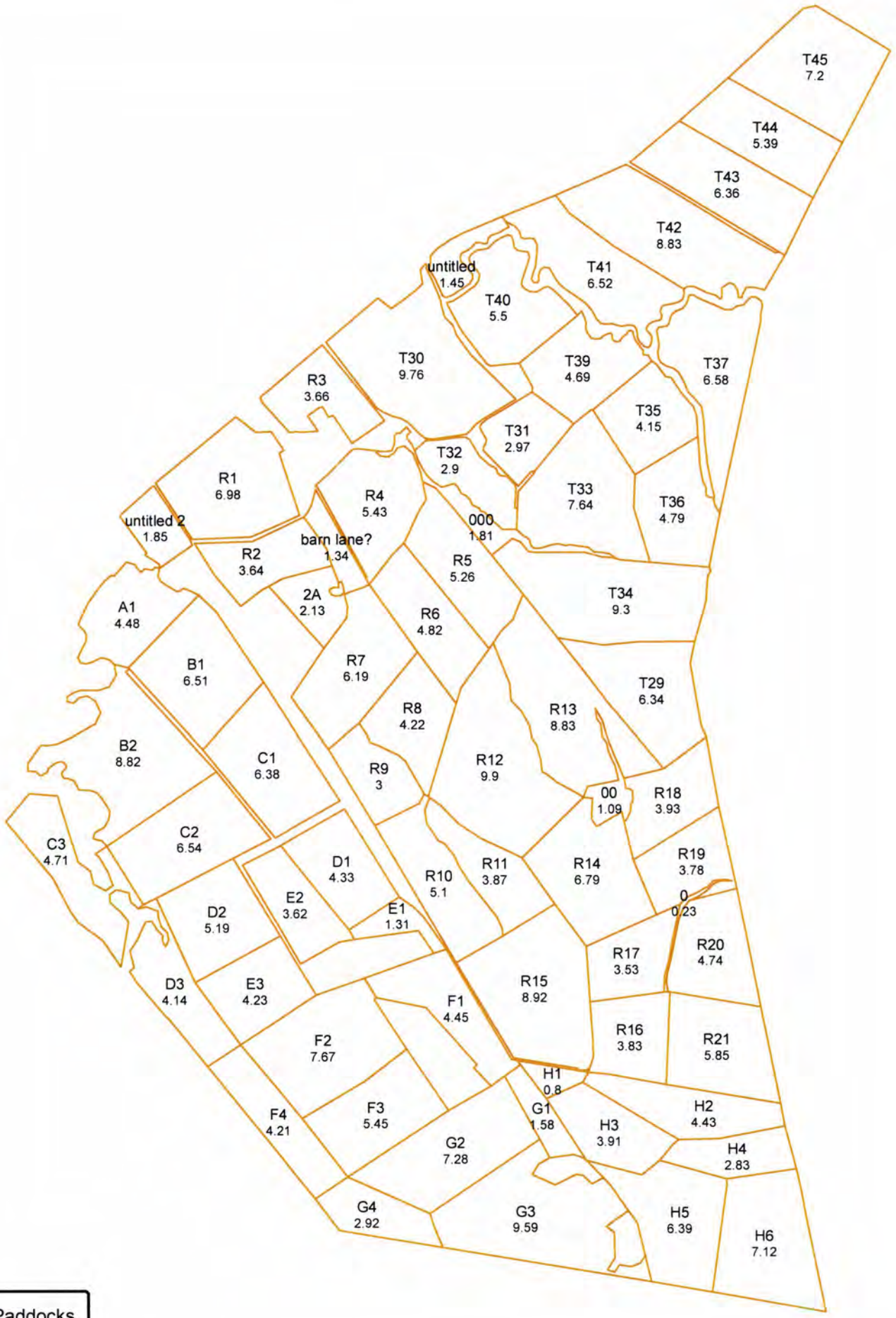
	12/02/2018	4.6	UREA BULK	110	51	-	-	-	-	-
	Area weighted total				**92**	**-**	**-**	**12**	**-**	**-**
R7	05/09/2017	4.2	AMMO 36 BULK	133	48	-	-	13	-	-
	12/02/2018	4.3	UREA BULK	110	51	-	-	-	-	-
	Area weighted total				**68**	**-**	**-**	**9**	**-**	**-**
R8	05/09/2017	3.6	AMMO 36 BULK	135	48	-	-	13	-	-
	24/11/2017	3.6	Merriburn Grazed Maintenance+N	964	47	26	-	31	261	6
	12/02/2018	4	UREA BULK	115	53	-	-	-	-	-
	Area weighted total				**131**	**22**	**-**	**37**	**222**	**5**
R9	05/09/2017	2.3	AMMO 36 BULK	139	50	-	-	13	-	-
	08/12/2017	2.4	Post Cust - Grazed mix	1128	38	29	69	35	272	5
	12/02/2018	2.7	UREA BULK	118	54	-	-	-	-	-
	Area weighted total				**116**	**23**	**56**	**39**	**219**	**4**
T29	05/09/2017	4.7	AMMO 36 BULK	140	50	-	-	13	-	-
	12/02/2018	5.9	UREA BULK	119	55	-	-	-	-	-
	Area weighted total				**88**	**-**	**-**	**10**	**-**	**-**
T30	16/08/2017	4.5	RZR - AMM SE	145	52	-	-	14	-	-
	24/11/2017	4.6	Merriburn Grazed Maintenance+N	919	45	24	-	30	249	6
	06/12/2017	3.9	DAP Boron/ Potash and Slugbait	413	48	54	58	3	-	1
	Area weighted total				**64**	**33**	**23**	**22**	**118**	**3**
T31	19/10/2017	2.8	TZT - AGL SUP	311	-	14	-	17	87	-
	17/11/2017	2.9	GERMINATION MIX	689	36	49	31	60	110	-
	29/01/2018	2.8	UREA BULK	110	50	-	-	-	-	-
	Area weighted total				**83**	**62**	**30**	**76**	**191**	**-**
T32	19/10/2017	2.6	TZT - AGL SUP	322	-	14	-	18	90	-
	17/11/2017	2.6	GERMINATION MIX	730	38	52	32	64	117	-

	29/01/2018	2.4	UREA BULK	112	52	-	-	-	-	-
	Area weighted total				**77**	**59**	**28**	**72**	**183**	**-**
T33	19/10/2017	7.3	TZT - AGL SUP	163	-	7	-	9	46	-
	17/11/2017	7.4	GERMINATION MIX	704	37	51	31	62	112	-
	29/01/2018	7.2	UREA BULK	109	50	-	-	-	-	-
	Area weighted total				**82**	**56**	**30**	**68**	**152**	**-**
T34	19/10/2017	8	TZT - AGL SUP	160	-	7	-	9	45	-
	17/11/2017	7.8	GERMINATION MIX	684	35	49	30	60	109	-
	14/03/2018	8.2	UREA	106	49	-	-	-	-	-
	Area weighted total				**73**	**48**	**26**	**58**	**130**	**-**
T35	19/10/2017	3.9	TZT - AGL SUP	317	-	14	-	17	89	-
	17/11/2017	4	GERMINATION MIX	683	35	49	30	60	109	-
	29/01/2018	3.7	UREA BULK	110	51	-	-	-	-	-
	Area weighted total				**79**	**60**	**29**	**74**	**188**	**-**
T36	05/09/2017	4.7	AMMO 36 BULK	146	52	-	-	14	-	-
	12/02/2018	4.7	UREA BULK	119	55	-	-	-	-	-
	Area weighted total				**105**	**-**	**-**	**14**	**-**	**-**
T37	05/09/2017	6.1	AMMO 36 BULK	145	52	-	-	14	-	-
	24/11/2017	6.2	Merriburn Grazed Maintenance+N	1007	49	27	-	33	272	6
	Area weighted total				**94**	**25**	**-**	**43**	**255**	**6**
T39	19/10/2017	4.1	TZT - AGL SUP	335	-	15	-	18	94	-
	17/11/2017	4	GERMINATION MIX	693	36	50	31	61	111	-
	29/01/2018	3.8	UREA BULK	111	51	-	-	-	-	-
	Area weighted total				**71**	**55**	**26**	**67**	**174**	**-**
T40	19/10/2017	5.3	TZT - AGL SUP	321	-	14	-	18	90	-
	17/11/2017	5	GERMINATION MIX	704	37	51	31	62	112	-
	29/01/2018	5	UREA BULK	110	51	-	-	-	-	-
	Area weighted total				**80**	**60**	**28**	**73**	**190**	**-**

T41	16/08/2017	5.8	RZR - AMM SE	138	49	-	-	13	-	-
	06/12/2017	5.8	DAP Boron/ Potash and Slugbait	400	46	52	56	3	-	1
	Area weighted total				**85**	**46**	**50**	**14**	**-**	**1**
T42	16/08/2017	8.5	RZR - AMM SE	136	49	-	-	13	-	-
	17/11/2017	8.3	UREA BULK	110	50	-	-	-	-	-
	08/12/2017	8.2	Post Cust - Grazed mix	1088	37	28	67	34	262	5
	12/02/2018	8.5	UREA BULK	111	51	-	-	-	-	-
	Area weighted total				**178**	**26**	**62**	**44**	**245**	**4**
T43	16/08/2017	6.1	RZR - AMM SE	134	48	-	-	13	-	-
	17/11/2017	6.3	UREA BULK	111	51	-	-	-	-	-
	08/12/2017	6.2	Post Cust - Grazed mix	1019	34	26	62	32	245	4
	21/02/2018	6.2	UREA BULK	111	51	-	-	-	-	-
	Area weighted total				**179**	**25**	**60**	**43**	**238**	**4**
T44	16/08/2017	4.9	RZR - AMM SE	127	45	-	-	12	-	-
	17/11/2017	5.2	UREA BULK	99	46	-	-	-	-	-
	08/12/2017	5.2	Post Cust - Grazed mix	1039	35	27	64	33	250	4
	21/02/2018	5.1	UREA BULK	97	45	-	-	-	-	-
	Area weighted total				**161**	**26**	**61**	**42**	**240**	**4**
T45	16/08/2017	6.9	RZR - AMM SE	131	47	-	-	12	-	-
	17/11/2017	6.8	UREA BULK	110	50	-	-	-	-	-
	08/12/2017	6.5	Post Cust - Grazed mix	1048	35	27	64	33	252	4
	21/02/2018	6.9	UREA BULK	108	50	-	-	-	-	-
	Area weighted total				**171**	**24**	**58**	**41**	**227**	**4**
untitled	16/08/2017	1	RZR - AMM SE	155	55	-	-	15	-	-

	06/12/2017	0.9	DAP Boron/ Potash and Slugbait	400	46	52	56	3	-	1
	Area weighted total				**67**	**33**	**35**	**12**	**-**	**1**
untitled 2	24/11/2017	1.6	Merriburn Grazed Maintenance+N	999	49	26	-	32	270	6
	Area weighted total				**41**	**22**	**-**	**27**	**227**	**5**
Weighted average rate based on applied areas and rates for selected areas					**103**	**25**	**25**	**33**	**125**	**3**

Note: Total and average rates assume product applications cover effective area of paddock(s) selected.
This is dependent on positional accuracy of paddock boundaries



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

0 80 160 320 480 640 Metres

ravensdown

19 October 2016

NIWA
Taihoro Nukurangi

7 September 2018

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

RE: Woldwide Drop Test, August 2018

Dear John

At your request, we have reviewed the data collected for the above test. From this we confirm that:

1. The raw data collected via our Neon data collection system is as you have stated.
2. There were no significant complicating factors during the test.
3. Your conclusion that leakage from the pond complies with the Council's effluent discharge rule appears to be correct.

Yours faithfully

Jeremy Bulleid
NIWA Instrument Systems

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

16 August 2018

Abe De Wolde
Woldwide Four Ltd
104 Shaws Trees Road
RD 3
Winton 9783

Dear Abe

Drop Test Results: Woldwide Four Ltd Effluent Pond, 10 - 12 August 2018.

1. Background
The discharge consent for the property is 20181320-01.

As required by Environment Southland, to confirm your effluent pond is not leaking, a drop down test was carried out between the 10 & 12 August 2018.

Site and Set Up
The farm is located at Mayfield Rd, Drummond.

Dung on the yard is scraped upslope into a concrete sump. Liquid effluent flows by gravity from the dairy shed to a pump sump. The liquid is then pumped to a clay lined storage pond. The pond has been emptied in the last 12 months. There was no crust on the pond and the surface was not frozen during testing.

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 62.0m
East 30.8m
South 62.3m
West 33.2m

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Phone 03 215 4381, Fax 03 215 4391
Email: scandrettrural@xtra.co.nz

The dimensions of the storage pond at the top bank level during the test period were:
North 64.0m
East 33.4m
South 63.4m
West 34.0m

The total pond catchment area was 7 % greater than the wetted area during the test.

The maximum design depth for the pond is 2.1m including 0.5m of freeboard. At the time of the test the liquid level was 0.6 below total bank height, i.e.94% full.

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

3. Test Methodology

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

3.1. Water Level Monitoring Unit

A laser distance measuring unit was set up vertically over the pond surface. A reflective disc was placed on the pond surface to ensure constant, repeatable readings.

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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.

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.
To record evaporation in real time a second bucket was installed suspended from a strain gauge with 9.0L of effluent in it, on the pond bank.

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 summarized 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 set up is recorded. For this test the equipment was located at **E**1221882, **N**4883618, at the west end of the pond.

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Laser at the west side of the pond.

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 waves on the pond surface. 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 15:27:00 hours on the 10 August 2018.
The distance from the laser to the reflective disc on the pond surface was 264.2mm and the wind speed 0.3m/sec.

The finish time was assumed to be at 16:15:10 hours on the 12 August 2018.
The distance reading was 265.7mm and the wind speed 0.5m/sec.

The total time elapsed was 48 hours and 48 minutes, 10 seconds.

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The laser measured a change in distance to the pond surface of a 1.5mm increase. Therefore the pond surface fell 1.5mm over the test period.

There was no rainfall during the test. The evaporation bucket on the pond bank was calculated to lose 1.2mm depth during the test period.

The pond should have mimicked the evaporation bucket result. It can be concluded the pond should have fell 1.2mm due to evaporation. The change in pond height was a decrease of 1.5mm. This is close to the expected result, the difference of 0.3mm is leakage.

TABLE 1 : DROP TEST RESULTS SUMMARY, Woldwide Four Ltd

Start Time	10 August, 15:27:00
Finish Time	12 August, 16:15:10
Total Time	48hrs, 48 minutes, 10 seconds
Start Depth (mm)	264.2
Finish depth (mm)	265.7
Change in depth (mm)	-1.5
Rainfall (mm)	+0
Evaporation (mm)	-1.2
Net Change in Depth After	
Rain and Evaporation (mm)	-0.3
Net Change per 24 Hours (mm)	-0.15
Pond Level, % of Design Depth	94
Net Change if Pond at 75% of	
Design Height. (mm/24hrs)	

6. Conclusion

The pond complies with the requirement of the Environment Southland Land and Water Regional Plan for effluent discharge (Rule 32 D, (2) (b), Appendix P, with a leakage rate of less than 1.8 mm / day.

The pond is suitable for storing effluent as the infiltration rate from the pond is less than 1.8mm per 24 hours.

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Yours faithfully

JOHN SCANDRETT
Agricultural & Engineering Consultant

Appended
Depth and wind speed graph for the test period.
Depth and rainfall 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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Investigation of cracking soils: Heddon Bush, January 2018.
Michael Killick, Technical Specialist (Soils and Groundwater Quantity)

On January 30, 2018, I visited dairy farms of the Woldwide group with the owner, Abe de Wolde, in the area of Heddon Bush, to see if we could observe soil cracking as is described for the Central Plains physiographic unit. We looked at a paddock ('Site 1') on the corner of Hundred Line Road and Drummond Heddon Bush Road which in the Topoclimate survey is mapped as Braxton + Pukemutu soils. There were noticeable cracks in the soil at this site, 3-10mm wide, less than 150mm long, 5-10m apart. It was not clear how many cracks might be hidden by pasture, but there were areas of sparse pasture which had no cracks.

A shallow hole (~15cm deep) at the site showed the soil was friable with many small to medium well-formed peds. A creek on the west side of the paddock which is a small tributary of Middle Creek was dry at the culvert where the bed was a metre or so below ground level. Site 1 was described by Abe as wet in winter with areas of standing water, the effects of which could still be observed in the dry conditions of our visit (re-sowing with new pasture had been prevented in one place due to previous muddy conditions). See figures 1-5.

Figure 1. Cracked soil at Site 1.

Figure 2. Uncracked soil at Site 1.

Figure 3. Creek bed at Site 1.

Figure 4. Site 1 locations.

Figure 5. Soil at Site 1.

We also looked at a site ('Site 2') on the north side of Hundred Line Rd mapped as Glenelg soils. This soil did not appear cracked although the soil surface was disrupted by the remains of past pugging so it was not easy to observe. A hole dug to about 15cm depth at this site brought up a number of stones supporting the mapped classification as Glenelg soil.

We walked a transect of approximately 50m at a third site ('Site 3', Figure 7) mapped as Glenelg + Drummond soils (close to the boundary of Braxton + Pukemutu soils). Cracks in this soil were observed at a density of at least one in the region of each stride i.e. $1/m^2$. The cracks were smaller than at Site 1, 2-4mm wide and less than 100mm long (see Figure 6). A hole dug to about 15cm depth at this site brought up two large stones (~90mm) and a number of small stones. A steel ruler was inserted easily into a crack to a depth of ~20cm, but could be inserted with similar ease to similar depth in soil without cracks at the site. (The depth of the cracks could not otherwise be ascertained as it was not visible from the surface and the soil structure and cracks collapsed easily with digging.)

Figure 6. Cracking at Site 3. These cracks do not show up well in the photo because of their smaller size and the high contrast shadows but were easily visible at the time.

A fourth site ('Site 4') on Braxton + Pukemutu soils with heavier pasture cover than sites 1 and 3 showed no cracking although the soil surface was difficult to see beneath the pasture. Large cracks would have been visible if a reasonable number had been there, but possibly smaller cracks such as those at Site 3 might have been present but not seen.

A site mapped as Tuatapere soils on Bayswater Road showed cracking at similar or somewhat greater density than Site 3 and the cracks were a similar or somewhat smaller size. There were frequent small stones on the surface of this soil. Tuatapere soil is described

Figure 7. Site 3 location.

as having stones at greater than 45cm depth, but it is contiguous in this area with stonier soils (Waiau and Glenelg) and may also have been modified by cultivation at some point.

Following the field observations on 30 January, sustained rainfall occurred on the properties and across the region beginning late January 31 and continuing through February 1. At Site 1 further observations were made by Abe to see how it responded to rainfall. At the location described above which was muddy in winter (i.e. where re-sowing had been prevented) no surface ponding occurred after 30mm rainfall or after 60mm rainfall. As this location was a slight depression, prone to ponding in winter, it is not thought that the rainfall was shed in runoff.

At the Environment Southland site, Central Plains Aquifer at Heddon Bush, about 2.7 km from Site 1, rise in the groundwater level in the 6m deep bore occurred within 12 hours of the onset of rainfall. The location of this site is mapped as Braxton and Pukemutu soils but it was found at installation to be stony, so the site description was changed to Glenelg soils. Earlier, lesser rainfall events in January had little effect on groundwater level. See Figure 8.

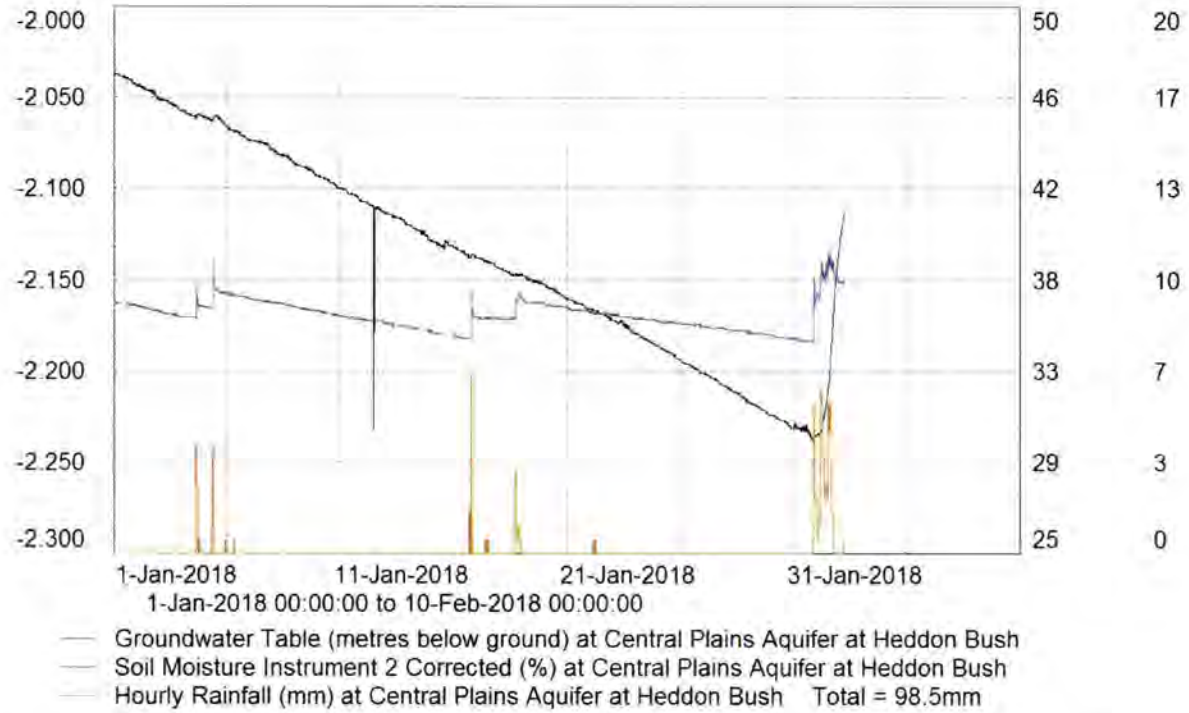

Figure 8. Groundwater level, soil moisture and rainfall at the Environment Southland Heddon Bush monitoring site.

Discussion

All the soils observed were dry and pasture was stressed and sparse to varying degrees. Some soils mapped as Braxton + Pukemutu showed cracks, while other soils with this mapped description did not. Likewise, some stony soils (mapped as Glenelg and Tuatapere) in the area were cracked and some not. It is not surprising that some stony soils were cracked as the fine matrix material in these soils is sourced from the same mafic parent materials in the Takitimu Mountains as the Braxton and Pukemutu soils, and so may also contain clays prone to shrink-swell behaviour. Cracking in stony soils may, however, have drawn less attention in studies of soil behaviour as it would not greatly alter the soil properties from those they are already thought to possess i.e. free drainage with risk of nutrient leaching.

The largest cracks seen were ~10mm wide. Most were 2-5mm wide. As discussed above, some Braxton/Pukemutu soils or variants were not cracked. Glenelg soils at the nearby Environment Southland monitoring site (Central Plains Aquifer at Heddon Bush) had volumetric soil moisture <35% throughout December 2017-January 2018 and <30% for two weeks prior to the observations[1] (and were not visibly cracked). Soil moisture at comparable sustained, low levels was last recorded at the Heddon Bush site in January-February 2008 which was recognized as a drought year. Soil temperature in the two weeks prior to the current observations was 18-27°C. In these conditions further drying of the soil occurs only slowly as the residual moisture is tightly held in fine pores, hence it would take a significant

[1] These soil moisture figures are the average of two calibrated soil moisture sensors at the Heddon Bush site. Calibration is against periodic neutron probe measurements.

continuation or intensification of the conditions then current to make the soils significantly drier with whatever structural changes might accompany that.

It seems reasonable to conclude that the occurrence of very large cracks such as feature in some anecdotes about the soils (e.g. 'to reach your arm into') would now be rare in the soils observed for this investigation, and might not occur. Continued development or changes in management of the soils e.g. the ongoing effects of drainage, or conversion from sheep to dairy, may have influenced the historical pattern of soil behaviour. Or it may be that occurrences of Braxton soils other than those described here, crack more.

The strong, friable structure of the Braxton/Pukemutu soils observed raises the prospect that they may behave as free draining soils when very dry, with or without visible cracking. This behaviour of the dry soils with regard to drainage, and the effects of cracks where present, has not been quantified, but is described in the literature relating to the Central Plains physiographic zone (see following link).

http://eswaterandland.datacomsphere.com.au/southland-science/physiographic-zones/physiographics-and-farm-management

The potential for Braxton and related soils to crack when dry – as was observed for some soils in the investigation described above - has perhaps attracted more attention than the general capacity of these soils for 'bi-modal' transport of leachate and contaminants, as described in the physiographic zone technical sheet, via more general structural changes which may include visible cracking. Understanding the transition from the 'summer soil' to the 'winter soil' – when wetting of dry soils occurs - could help further explain nutrient loss processes in the Central Plains physiographic unit where the observations described above were made.

During the investigation there was some discussion of the possible influence of different pasture conditions, or variations in soil type, on the prevalence or absence of cracking. Some soils in the area are thought to have been mapped previously as Makarewa soils (now Braxton). The distinction between these soils apparently relates to the geomorphic setting with Braxton soils on terraces and Makarewa soils on flood plains (because of this, Makarewa soils may also be younger). It was seen, however, that cracking could occur in a variety of soils in the area. Further investigations could shed light on the influence of pasture condition, soil type and moisture content on the drainage capacities of soils and thresholds of dryness and rainfall associated with deep drainage.

Further pictures of soil cracks follow, at the risk of emphasizing these at the expense of areas where cracks were few or absent. As there are not many pictures of the cracks, however, they are included here for interest.

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Farm Scenario Plan

Current and Proposed System Nutrient Budgets for Effluent consent

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22/02/2019
Reviewed by Andree Callaghan (CNMA)

optimiser

Executive Summary

Woldwide Five farm Ltd, have requested OVERSEER® Nutrient Budgets to reflect the current and proposed estimated nutrient losses from their consented 262.6 ha dairy farm as a renewal of their effluent discharge consent and an expansion of the dairy farm with an overall addition of land (73.0 ha) from a sheep farm (136.3 ha) purchased and split between Woldwide 4 (Report 163(a)) and Woldwide 5 dairy farms. An additional example is provided for a wintering barn that is to be established later on. The farm is located at 800 Bayswater Road, Heddon Bush, 20 km west North West from Winton Township, 41 km nor-north west from Invercargill city and 34 km from the south west coast (Orepuki). The property is a dryland dairy farm, milking approximately 680 cows (consented numbers 800; modelled at 680 from current 540 average with the additional cows modelled allowed for the 44.3 ha of consented land yet converted).

Current (combined) Farm System

Average Nitrogen lost from the root zone, calculated from the combined current farm systems modelled, using OVERSEER® Nutrient Budgets (OVERSEER) 6.3.0 was **15,882 kg N/year** or **47 kg N/ha/year.**

Average Phosphorus lost from the combined current farm systems modelled using OVERSEER® Nutrient Budgets (OVERSEER) 6.3.0 was **237 kg P /year** or **0.7 kg P/ha/year.**

Proposed Farm System

Average Nitrogen lost from the root zone, calculated from the proposed farm system modelled, using OVERSEER® Nutrient Budgets (OVERSEER) 6.3.0 was **15,937 kg N/year** or **47 kg N/ha/year.**

Average Phosphorus lost from the proposed farm system modelled using OVERSEER® Nutrient Budgets (OVERSEER) 6.3.0 was **231 kg P /year** or **0.7 kg P/ha/year.**

Winter Barn Example

Average Nitrogen lost from the root zone, calculated from the proposed farm system modelled, using OVERSEER® Nutrient Budgets (OVERSEER) 6.3.0 was **15,639 kg N/year** or **47 kg N/ha/year.**

Average Phosphorus lost from the proposed farm system modelled using OVERSEER® Nutrient Budgets (OVERSEER) 6.3.0 was **245 kg P /year** or **0.7 kg P/ha/year**

The productivity and urine patch deposition on gley plus recent soils with a high and low buffering capacity to leaching (high and low PAW and deep to shallow topsoil's) from increased stock intensity, artificial drainage and crops are key risk reducing and increasing factors respectively.

In the proposed farm scenario, the additional land with the increased number (consented) of dairy cows, but with the use of the wintering pads; altered tonnage of supplements imported into the farm system and with the cropping able to be carried out on the more versatile soils, has the effect of reducing the overall risk of P losses, but N losses are similar but slightly higher.

The wintering barn example largely negates the effect of cropping losses and increased stock intensity, but this is less evident on the more vulnerable soils to N leaching (Upukeroroa), and so mitigating this by lowered calving and peak cow numbers (by 70) plus grazing times on these soils enables the farm to reduce the impacts of N loss to below the current combined losses calculated.

The farm is in a zone with a mostly moderate to high risk to nitrate levels and the physiographic zones point to high nitrates in ground water, nitrate accumulation and artificial drains as being risk factors. Both the proposed farm system and winter barn example, as modelled by OVERSEER®, includes strategies to reduce these risks of Nitrogen loss to water. These strategies are summarised in the report, with no cropping (or cropping on less vulnerable soils) and reduced stocking in autumn and spring by use of winter barns or feed pads key mitigations. Riparian strip planting, allowing the capture of sediment from crops and laneways through adequate buffer zones, as well as having soil test phosphate levels within the agronomic optimal range, are all practices which will reduce the risk of P losses. Ensuring the lowest volume applications and depths are applied to the tiled soils, with none applied at the highest risk times plus cropping on the more versatile soils are further mitigations that should be used.

Overseer Nutrient Budget Version 6.3.0 have been used to create the nutrient budgets presented in this report.

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Important Points to Note

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Mark Crawford

Farm Environmental Consultant

Dated 22nd February 2019

General

Aim and Purpose of Farm Scenario Plan

Woldwide Five Ltd, has requested current and proposed OVERSEER® Nutrient Budgets to reflect the current and proposed estimated nutrient losses from their consented 262.2 ha dairy farm as a renewal of their effluent discharge consent, with the addition of 73.0 ha of a 136.3 ha neighbouring sheep farm (the remaining area is included in Woldwide 4). The farm is located at 800 Bayswater Road, Heddon Bush, 20 km west North West from Winton Township, 41 km nor-north west from Invercargill city and 34 km from the south west coast (Orepuki). The property is a dryland farm, currently milking approximately 560 cows (consented numbers 800; note with additional consented area yet to be converted (44.3 ha) included in actual dairy farm of 218.3 ha, it is now modelled 680 cows calving).

The total titled area of the property is 246.6 ha, and the GIS map with paddock areas calculates to 262.6 ha which is modelled. In this figure there is 12.9 ha of riparian edges and river margin (modelled as a "Riparian" block in Overseer). The effective area is calculated at 241.2 ha, close to the owner stated 240 ha of paddocks. In addition there is an estimated 8.5 ha of non-effective area, comprising of sheds, lanes, feed pads and yards. The property is of flat to gently rolling topography (modelled flat).

Soil types on the farm are (with the addition of the consented 44.3 ha land) mostly Tuatepere_6b.2, Silt Loam, (Orthic Melanic soil, Well drained, PAW (plant available water) to 60 cm of 81.2 mm), 135.5 ha; Braxton_4a.1, Silt Loam over clay, (Orthic Gley soil, Poorly drained, PAW (plant available water) to 60 cm of 147.6 mm), 75.4 ha; plus an area of Upukerora_8a.1 Sandy Loam, (Recent soil, Well drained, PAW (plant available water) to 60 cm of 37.6 mm), 51.7 ha. The Braxton and Tuatapere soils are both deep to moderately deep soils and the Braxton being a heavier silty loam texture meaning a lower risk of nitrogen leaching.

Overseer modelling of the system has been undertaken in accordance with the Overseer 6.3.0 "best practice data input standards" (BPDIS) and has been reviewed by a certified nutrient management advisor.
The following report summarises the respective Overseer 6.3.0 nutrient budgets and key assumptions made.

Property Details

Location/address	800 Bayswater Road, Heddon Bush 9783 RD 3, Winton
Legal Description	Lot 1 Deposited Plan 344176,Lot 2 Deposited Plan 344176, Lot 1 Deposited Plan 310140, Part Lot 12 Deposited Plan 238 and Lot 2-3 Deposited Plan 478843, Lot 1 Deposited Plan 12253 plus Lot 1 Deposited Plan 478843 (additional 44.3 ha)
Total area (ha)	246.57 ha titled total farmed land calculated at 262.6 ha including roadside and river margins. Effective area estimated at 241.2 ha,
Owners	A & JJ DE WOLDE
Contact details	
Phone	(03) 2258344 mobile (027) 2272537
Email	abe@woldwide.nz
Farm Type	Seasonal supply Dairy farm

Current Farm System Analysis

Climate

Climate data for the property has been sourced from Overseer's Climate Station Tool data and has been entered as rainfall –978 mm/year, PET – 719 mm/year and average temperature – 9.8 ^{o}C, based on location close to latitude/longitude - 46.09075; 168.08465 (transect 9 co-ordinates). Climate data has been modelled as per Overseer BPDIS.

Description of Current Farm System

The 262.6 ha property is operated as a seasonal dryland dairy farm including a consented block of 44.3 ha not yet converted but included in the current assessment of environmental effects given it has been consented. Given this, the numbers subsequently used were adjusted using averages from the current farm system of 218.3 ha and 540 cows calved. The current adjusted property is calving 680 cows (800 consented) and peak milking 665 (540 kg LW) Friesian cows. Adjusted milk production averaged over the last two years is 314,081 kg MS/year (465 kg MS/cow). Cow numbers are shown in the table below (page 10). All cows are wintered on-farm for June and July on the developing block crops plus the first calving heifers (170 and at 500 kg LW), which come back from grazing off in May, with all cows brought back to the dairy platform in mobs over the month of August. An additional number of grazers are currently wintered given the additional crop area currently cultivated during the conversion stage and have been included. Mean calving date is the 20th August for the main herd, with the first calvers a week earlier on the 12th of August

The dry-off date is the 1st of June and the 25th of May for the cows and first calving heifers respectively. All replacements (170) are grazed off-the platform from weaning until they return as in calf rising two year old (R2) heifers in May. Cows are milked once a day or 16 hourly occasionally over autumn drying off (modelled never) and all calves are fed colostrum and waste milk.

Friesian Bulls (20) at 700 kg LW are run with the herd over December and January.

The 28.1 ha of developing Upukerora crop block has been used to winter the 540 dairy cows, as well as the 170 in calf heifer replacements, plus additional dairy cows and in calf replacement heifer grazers. With the increase in milking cow numbers for the consented area added in, the number of grazers wintered was reduced to allow for the wintering of these extra cows. It now winters all dairy cows and replacement heifers plus an additional 200 in calf dairy heifer replacements wintered from mid-May till the 25th August.

Supplements

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

- 254 T DM Barley grain and 254 T DM distilled Brewers grain imported and used over the season through the milking shed (averaged amount of 508 T DM grain split in half between grain types).
- 61 T DM of Molasses imported and fed through the shed.
- 203 T DM of Palm Kernel Expeller (PKE); fed through dairy shed.
- 300 T DM of silage purchased on average and fed to dairy cows on blocks.
- 80 T DM of silage purchased and fed to dry stock on pastoral blocks, however, some of this will also be fed on crop, but not modelled as such given the difficulty in reconciling this with the crop blocks and crop yields in the model.

Supplementary feed made and fed during the season is assumed to be minor, and is cut and fed in the same season, thus no areas were modelled as being cut and/or baled for silage/baleage. Given the net importing of silage onto the platform, this would be a reasonable expectation.

Farm System - Dairy			
Herd Type/Breed	Friesian	**Total Milk Solids (kg/year)**	314,081
Seasonal Supply	Seasonal	**Winter milk**	No
Number of cows	680 (665 peak)	**Milk Solids (kg/cow)**	465
Stocking rate (cows/ha)	2.8 (3.3/ha grazed)*	**Milk Solids (kg/ha)**	1302/ha effective (1513/ ha grazed)*
Other Information			
Winter off milking platform		Yes, all cows and in calf heifers on crop blocks and additional replacement heifer grazers	
Stock grazed off (%)		Nil, cows and first calvers, who return in May, in June and July and August	
Young stock reared off milking platform		Yes from weaning until before winter, wintered on crop areas	
Imported Feeds	508 T DM Grain (50 % each Barley and distilled brewers grain), fed through shed to milking cows, 61 T DM of Molasses to dairy cows through shed; 203 T DM of PKE fed through milking shed; 380 T DM silage purchased, 300 T DM fed on pastoral blocks to dairy cows and 80 T DM silage fed on pastoral to dry stock over winter. Total 1152 T DM		

		Current				
Cows	Av weight kg LW	540 kg LW main herd; 500 kg LW for first calving heifers				
	Median calving Date	20th August for main Herd, 12th August for Heifers				
	Dry-Off date	1st June for main herd and 25th May for Heifers				
	Peak Milk (1 Dec)	665 cows				
	Cow Numbers		**No cows Dairy Herd & first calvers**	**In calf Heifers**	**Dry cows & Bulls & repl. grazers**	**In shed feeding (Y/N)**
		Jul	0 & 20	150	510&0&165	N
		Aug	201 & 162	8	309	Y
		Sept	470 & 170		40	Y
		Oct	505 & 168		0	Y
		Nov	505 & 165		0	Y
		Dec	500 & 165		0 & 20	Y
		Jan	500 & 165		0 & 20	Y
		Feb	490 & 160		0	Y
		Mar	470 & 160		0	Y
		Apr	470 & 155		0	Y
		May	460 & 120	170	35 &0&100	Y
		Jun	0	170	510&0&200	N
	Production kg/MS	314,081				
	Lactation length	287 days used				
	Once a day Milking (e.g half season, dry off, never)	Never				
	Calves fed milk powder (Y/N)	No				
Supplements Imported		**Amount (T/DM)**	**Fed (e.g. paddock, shed, trough, crop)**			
	Barley & distillers grain and Molasses	254 & 254 & 61	Fed to dairy milking cows through shed			
	Silage/Baleage	380	Purchased and fed to dairy cows on pastoral blocks (300) & Dry cattle (80)			
	Other PKE	203	Fed to dairy cows on pastoral blocks			
Supplements Made		**Amount (T/DM)**	**Ha**	**Fed or stored?**		
	Fodder beet	25	28.1	Fed to replacements and dry cows in May, June July and August		
Effluent	Type/system	Holding Pond system after stone trap and applied via K Line pods.				
	Application Depth mm	Application depth at < 10 mm per application (modelled < 12 mm) from August to May (spray irregularly as not modelling June or July to receive effluent). Due to travelling irrigator used, sludge applied in months Nov to February to mimic stir and spray operation, whilst K line used of rest of season.				
Replacements	On/off farm when & what age	Off farm from weaning, back to support block as in calf heifers in May				

* Calculated on milking platform area only excluding the crop area and non-effective area.

Fertiliser

Fertiliser applications have been modelled from Ravensdown past sale records and farmer information, and are based on average monthly rates. Practices are similar to Woldwide 4, Ammo 36 is applied to the whole farm in August at rates of 120 kg/ha. Urea is then applied in October, November, and February behind the cows at rates of 50 to 60 kg/ha. There are liquid applications of Nitrogen in September and March at 100 L/ha at the equivalence of 18 Kg N/ha made with Express a gibberellic acid. The Effluent blocks receive less nitrogen with no urea applications in January. Maintenance applications of Potash Superphosphate and Flexi N are made in December at the same rate for both effluent and non-effluent.

There is also modelled effluent exported from Woldwide 3 farm and spread on the whole farm. It was modelled as an amount exported from an area on that farm, with that total amount then pro rata applied as organic fertiliser to equate to the total amount of nutrient which is 3660 kg N; 2562 kg P; 2196 kg K; 854 kg S; 5368 kg Ca; 2074 kg Mg and 366 kg Na. The total fertiliser nitrogen applied is 219 and 192 kg N/ha/year for the Non effluent and Effluent farm blocks and 172 kg N/ha across all blocks (whole property) on average, which includes the weighted average in NPKS of 14-10-8-3 from the dairy effluent imported.

Non Effluent block:

Month	Fertiliser	NPKS nutrient rating (kg/ha)
August	Ammo 36	43-0-0-12
September	Urea	18-0-0-0
October	Urea	28-0-0-0
November	Urea	23-0-0-0
December	Potash Superphosphate and FlexiN	21-55-30-66
December	Organic dairy effluent (solid)	18-12-10-4
January	Urea	28-0-0-0
February	Urea	23-0-0-0
March	Urea (liquid)	18-0-0-0
Total Nutrients		219-68-40-82*

Effluent block:

Month	Fertiliser	NPKS nutrient rating (kg/ha)
August	Ammo 36	43-0-0-12
September	Urea	18-0-0-0
October	Urea	28-0-0-0
November	Urea	23-0-0-0
December	Potash Superphosphate and FlexiN	21-55-30-66
December	Organic dairy effluent (solid)	18-12-10-4
February	Urea	23-0-0-0
March	Urea (liquid)	18-0-0-0
Total Nutrients		192-67-41-82*

* Please note that variance between actual fertiliser nutrients applied and total nutrients shown is the slurry effluent nutrients applied for the block

Soil Test Results

Taken from 2016/17 soil tests for the various areas in table below;

Soil tests	Olsen P	QTK	QT Ca	QT Mg	QT Na	Org S
Brax_4a.1 Non Effluent blocks	16	9	14	31	13	13
Brax_4a.1 Effluent blocks	21	9	14	31	13	13
Brax_4a.1 Effluent tile blocks	35	12	13	35	13	13
Tuap_6b.2 Effluent	32	11	18	43	15	12
Tuap_6b.2 Non effluent	25	14	16	38	14	10
Upukerora soils	27	23	13	43	14	8

Pasture Production

The predominant pasture species on the dairy farm is ryegrass/white clover. Annual pasture production has been weighted by relative productivity as 1 between dairy blocks on Brax_4a.1 and Tuap_6b2. Soil types, and 0.8 for the Upukerora grazing blocks on the stony river flats as they are drier:

Block	Relative productivity	T DM/ha/year
Dairy pastoral areas	1.0	15.4
Upuk_8a.1 Non Eff & Dev.	0.8	12.4

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

Structures

There are three wintering pads on the property, left by the previous owner and have not been currently used. They have a rotten rock base, with a knap rock layer on top and topped off with bark chips on top of this. It has the ability to stand off mobs of 100 to150 cows, with ad lib feeding of baleage in ring feeders. Effluent would be the solids from the bark which is scrapped after each season and spread by muck spreader.

Fodder Cropping

A fodder cropping cycle of Pasture to Fodder Beet (last two years in beet) before being re sown into pasture in October is practiced for approximately 25 to 30 ha or 10 % of the actual dairy block as a means of development. The area currently being cropped is the stonier land by the river, and so block history is entered as 5 years with crop to crop blocks having fallow as prior land use as they were cropped prior to conversion. Please note that the third crop block (Upuk_8a.1 FBt>YG) is effectively a pastoral block in its reporting year and not included in calculation for crop area Crops are modelled as crop blocks and information entered is;

- Fodder beet are sown in October after full cultivation, with dry cows and replacements grazed over May, June, July, and in August before calving.
- Sown with Cropmaster DAP, Ammonium sulphate, Potassium chloride plus boron and salt mix, NPKS rating (24-23-30-25) and a further application of Urea/potassium chloride made in February (NPKS rating 69-0-25-0).
- Yields are averaged at 25 T DM/ha and grazed in situ. Grazing durations (months grazed and % dairy/beef) were altered so to align animal metabolic intakes with crop yield and availability given the models inability to optimise feed demand and supply. All dry cattle are on crop over June, July and August, with some crop in May plus fodder supplement and pasture, whilst the dairy herd is allocated a small amount of crop in May and August in addition to pasture and supplement.

Effluent

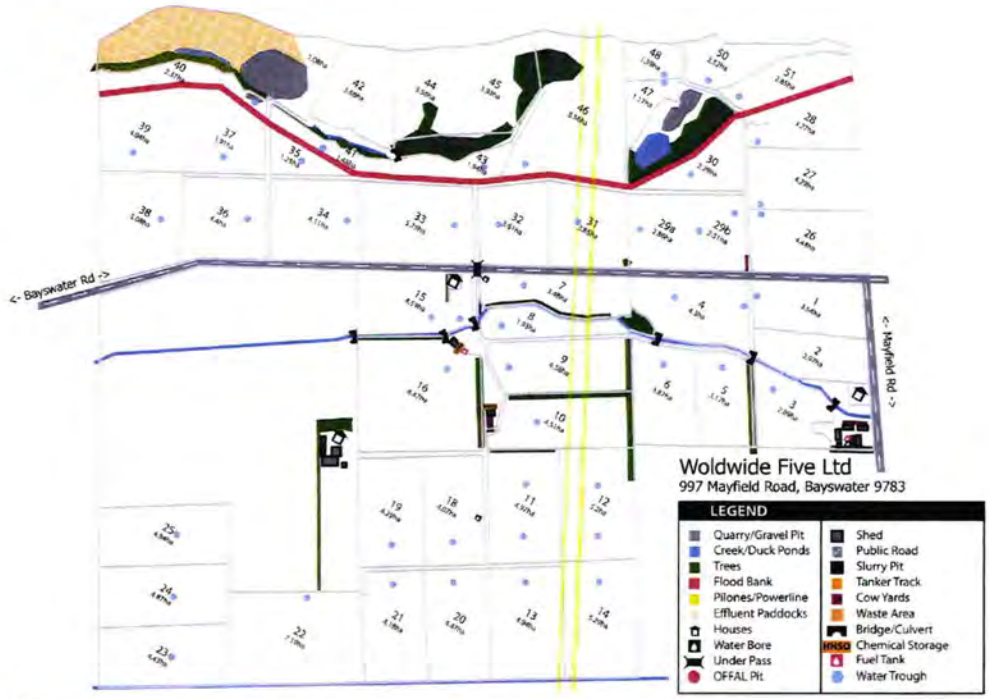
Effluent has been modelled as using Overseer default values, and calculated as applying 43 kg N/ha/year (liquid) plus 10 kg N/ha/year solids over the 112 ha, which is 86 % (adjusted to equal GIS area) of the modelled 130.1 ha (86.1 ha total area plus area consented of 44.3 ha less other area of 0.3 ha); plus 3 kg N/ha/year (solids) applied from pond sludge to the Non effluent areas. Currently, the effluent system has effluent gravity fed into a stone trap and sump then into holding tanks, from which the effluent is pumped through K Line pods applying liquids at depths of 10 mm per application or less by a pulsation system (modelled < 12 mm) or travelling irrigators. The current holding pond is estimated to hold 180 (6 tanks of 30,000 L) cubic metres of effluent (owner stated). Liquid effluent is sprayed during the months of August to May inclusive (modelled infrequently spray so as no effluent is modelled to be applied in June or July), with sludge applied in November to February to mimic the travelling irrigator applications. The rest of the sludge from the pond is modelled to be spread on the non-effluent areas in October every year by a slurry tanker (refer table below).

Management Unit details and Soil Information: Table 1

Block Name	Stock	Block Type	Soil Order	Drainage Class	Effluent	PAW (0-60cm)	Effective Area (ha)
Brax_4a.1 Effluent	Dairy	Pastoral	Orthic Gley	Poorly drained	Liquid & Sludge	148.7	18.4
Brax_4a.1 Eff Tile	Dairy	Pastoral	Orthic Gley	Poorly drained	Liquid & Sludge	148.7	52.5
Tuap_6b.2 Effluent	Dairy	Pastoral	Orthic Melanic	Well drained	Liquid & Sludge	81.2	59.2
Brax_4a.1 Non Eff	Dairy	Pastoral	Orthic Gley	Poorly drained	Pond Sludge	148.7	2.4
Tuap_6b.2 Non Eff	Dairy	Pastoral	Orthic Melanic	Well drained	Pond Sludge	81.2	69.7
Upuk_8a.1 Non Eff	Dairy	Pastoral	Fluvial Recent	Well drained	Pond Sludge	37.6	4.3
Upuk_8a.1 Non Eff dev	Dry stock	Pastoral	Fluvial Recent	Well drained		37.6	1.1
Riparian 1	Riparian	Riparian	Various	Poorly drained	n/a	n/a	12.9
Upuk_8a.1 FBt>FBt	Dry stock	Crop	Fluvial Recent	Well drained		37.6	22.3
Upuk_8a.1 Past>FBt	Dry stock	Crop	Fluvial Recent	Well drained		37.6	5.8
Upuk_8a.1 FBt>YG	Dry stock	Crop	Fluvial Recent	Well drained		37.6	5.5
Non-Productive area							8.5
Total							**262.6**

*PAW Landcare S maps calculated

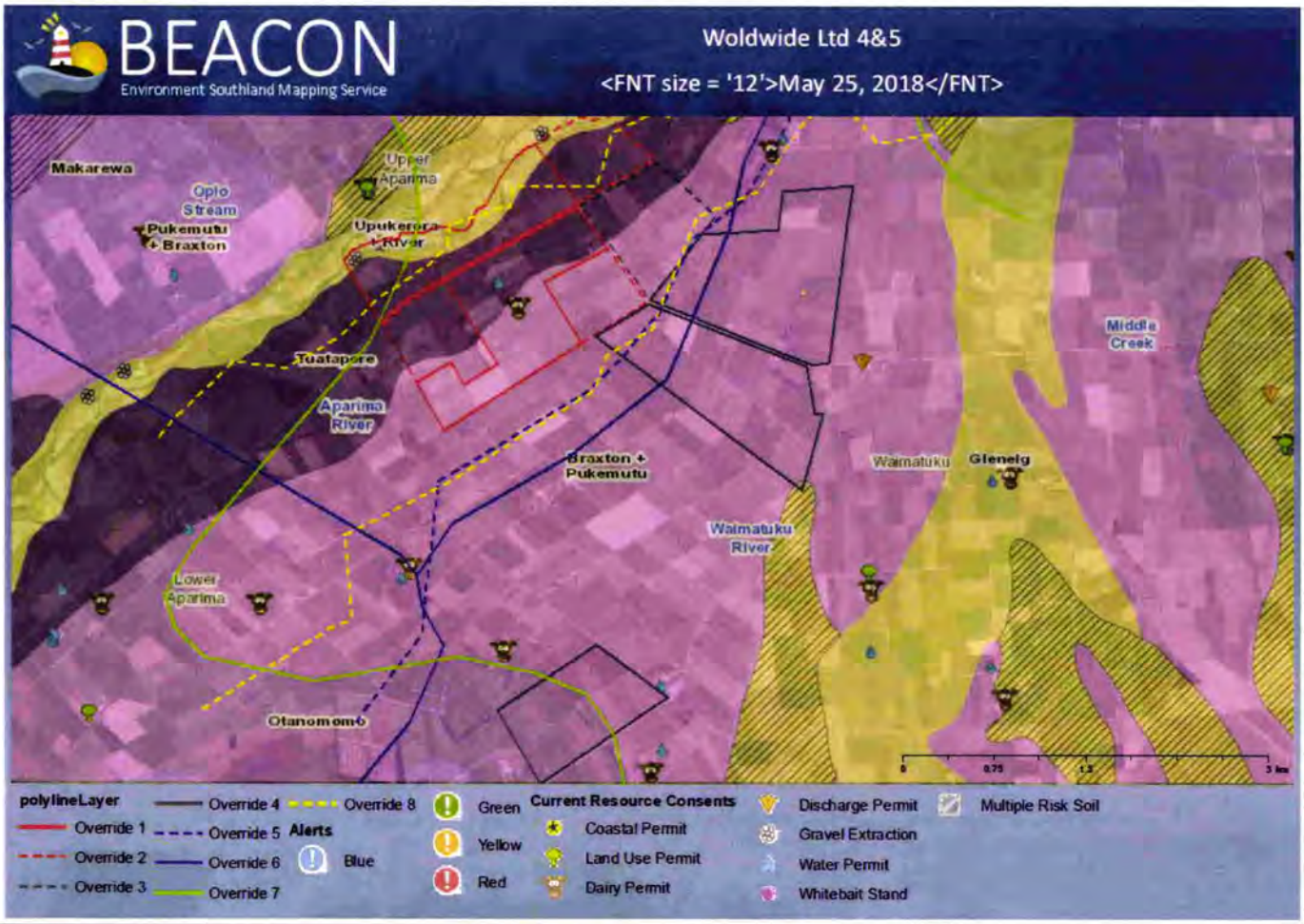
Land Management Unit Map and Farm Map



Farm map with area of 216.03 ha , discharge area has additional 44.3 ha included (excludes 30.54 ha title not drawn in top RHS) for current Effluent block indicated being paddocks 18 to 25 & 7 to 16, plus 44.3 ha, 130.1 ha in total less estimated setback areas based on 86 % equates to 111.9 ha. Total titled area is 246.57, GIS calculated area is 262.6 ha, estimated pastoral area of 241.2 ha.

Title area of 202.25 ha and soils, with additional 44.3 ha and soils from additional consented area plus river margin actual farm area included in paddocks calculated to be 262.6 ha GIS assessed.

Nitrate Levels and Physiographic Zonal Environment Southland Beacon Maps



Physiographic zones are Central plains (Braxton plus Pukemutu soils) brown oxidising (Tuatapere) and Riverine (Upukerora) soils (pink, dark and light yellow along river), with the blue dotted line denoting the two different sub catchments of Waimatuku river and the main Coastal catchment plus the Aparima river and the Aparima major catchment. The solid blue line denotes the three different ground water catchment zones, the lower Aparima and Upper Aparima with subsoils of quaternary gravel on top of tertiary sediment, plus the Waimatuku zone of alluvial gravel. The Green line separates minor to moderate (LHS) and moderate to high (RHS) nitrate levels with a hot spot situated nearby at drinking water threshold (not shown) nitrate levels.

The yellow dotted line is the division between the spring fed and lowland hard bed surface water zones.

The farm dairy effluent (FDE) risks are associated with the soil types, with the Braxton being a risk with artificial drainage and coarse soil structure, and the Tuatapere and Upukerora being well drained flat land and other well drained but very stony flat land.

The farms are Woldwide 4 is in dark green and the red line is the boundary for Woldwide 5. The dotted lines are the additions for the proposals.

Nutrient related resource Consents held by the Landowner

Resource Consent No.	Condition No.	Condition Text	Resource consent expiry date
AUTH-20157537-04	1.	This consent authorises the conversion of the subject land for use as a dairy farm as described in the application for resource consent dated 24 December 2015, further information dated 4 February 2015 and Conversion Environmental Plan dated 24 December 2014. The scope of the dairy farm activity to be established is described in the application and Conversion Environmental Plan as being; The milking of up to 800 cows up to twice per day; The construction and maintenance of: o A dairy milking shed The discharge of dairy shed effluent to a discharge area of no more than 126 hectares; The application to land of no more than 202 kilograms of nitrogen per hectare per year as a result of fertiliser application; The establishment of environmental management practices as detailed in the Conversion Environmental Plan dated 24 December 2014.	Granted for an unlimited term
	2.	This consent shall be exercised in conjunction with Discharge Permit AUTH-20157537-01 and Water Permit AUTH-20157537-02, or any subsequent replacement permits.	
	20157537-01	The discharge to land of dairy shed effluent generated from milking of up to 800 cows up to twice per day. The discharge of farm dairy effluent to land via a low rate pod system. The discharge of dairy shed effluent to a discharge area of no more than 126 hectares as per the plan attached as Appendix 1. The discharge authorised by this consent shall not exceed the following rates at any time: (a) For the pod set irrigation system: A maximum depth of application of 1 millimetre for each individual application, at an instantaneous rate not exceeding 1 millimetre per hour; (b) a minimum return period of 28 days between applications; (c) a maximum combined depth of application of 25 mm per year to any land area; and (d) The maximum loading rate of nitrogen onto any land area as a result of the exercise of this consent shall not exceed 150 kilograms of nitrogen per hectare per year.	

Current Sheep Farm System Analysis

Description of Current Farm System

The farm dairy platform will be increased by 136.3 ha after including 63.26 ha of a purchased sheep block (Woldwide 4) and the additional 73.0 ha added to the Woldwide 5 platform. A conversation was had with the original owner, Mr Cochrane to confirm some figures used in a budget already completed for this property, with the resulting data used and modelled for this sheep farm.

The total titled area of the property is 136.3 ha. In this figure there is 4.2 ha of non-effective area (comprising of sheds, lanes, and yards) and river margin. The effective area is calculated at 132.1 ha. It is of flat to gently rolling topography (modelled flat).

Soil types on the farm are mostly Braxton_4a.1, Silt Loam over clay, (Orthic Gley soil, Poorly drained, PAW (plant available water) to 60 cm of 147.6 mm), 77.0 ha; Tuatepere_6b.2, Silt Loam, (Orthic Melanic soil, Well drained, PAW (plant available water) to 60 cm of 81.2 mm), 55.5 ha plus an area of Upukerora_8a.1 Sandy Loam, (Recent soil, Well drained, PAW (plant available water) to 60 cm of 37.6 mm), 3.8 ha.

The 136.3 ha property was operated as a dryland sheep farm, lambing 1550 mixed age (M.A.) ewes (Romney based) Data entered is as follows;

- Mean lambing date is the 28th August for the main mob, with weaning finished by the 28th of November. Lambing rate is 155 % STS (survival to sale), ewes mating weight is 65 kg LW, with weaning weights at 33 kg LW average.
- 390 ewe lambs kept as replacements (winter weight of 48 kg LW), not mated.
- 20 Romney breeding rams (110 kg LW) and 12,000 kg/year wool shorn and sold on average.
- All remaining lambs sold to works at 19 kg carcass; with 604 left by the end of February (30 %) and 15 % sold off mothers at weaning (301).

	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	LW (kg)
M.A Ewes	1550	1550	1520	1510	1510	1510	1180	1550	1550	1550	1550	1550	65
Replacement Lambs	0	0	0	0	390	390	390	390	390	385	385	385	48
Ewe Hoggets	385	385	380	380	380	380	380						65
Rams	20	20	20	20	20	20	20	20	20	20	20	20	110
Works Lambs	0	0	0	0	2010	1709	1408	1006	604	303			19 c/c

Supplements

There is no Supplementary feed imported onto the property, however, 15 T DM baleage is used from storage and is as follows:

- 8 T DM Baleage stored and used over the following season on pastoral blocks to sheep.
- 7 T DM Baleage stored and used over the following season on winter fodder crop block

Supplementary feed made and stored during the season is as above and is as follows;

- 15 T DM of grass baleage; made on the Braxton and Tuatapere blocks and stored. None is made on the river flats

Fodder Cropping
There is 9 ha of fodder crop (swedes) cultivated and returned to pasture in the following spring (October). Detail is as follows;

- Sown in November, conventionally cultivated with 150 kg/ha of Cropzeal boron boost
- A further urea application of 100 kg/ha is made in January.
- Yield is 14 T DM/ha and it is fed from May to August by sheep, in situ.

Fertiliser
All pastoral blocks receive a dressing of 275 kg/ha of 15 % sulphur superphosphate in November with some areas receiving a urea application at varying rates in spring. This was deemed to be 60 kg/ha of Sustain N on average across all pastoral blocks, and modelled so.

Drainage
Only the heavier Braxton soils were drained by moles and tile drainage, and so it was deemed by the owner 90 % of these paddocks would be effective drained by tiles and moles.

Pasture Production

The predominant pasture species on the sheep farm is ryegrass/white clover. Annual pasture production has been weighted by relative productivity as 1 between heavier silt soils and 0.8 for the lighter river sandy loam blocks on the river flats:

Block	Relative productivity	T DM/ha/year
Tuap_6b.2 Sheep	1.0	15.6
Brax_4a.1 Sheep	1.0	15.6
Upuk_8a.1 Sheep block	0.8	12.5

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

Management Unit details and Soil Information: Table 1b

Block Name	Stock	Block Type	Soil Order	Drainage Class	Fodder Crop rotates through	PAW (0-60cm)	Effective Area (ha)
Brax_4a.1 Sheep Block	Sheep	Pastoral	Orthic Gley	Poorly drained	Yes	148.7	72.8
Tuap_6b.2 Sheep Block	Sheep	Pastoral	Orthic Melanic	Well drained	Yes	81.2	55.5
Swedes	Sheep	Fodder Crop	Various	Various	(9 ha)	n/a	-
Upuk_8a.1 Sheep block	Sheep	Pastoral	Recent	Well drained	No	36.7	3.8
Non-Productive area							4.2
Total							**136.3**

*PAW Landcare S maps calculated

Proposed Farm System Analysis

Description of Proposed Farm System

The farm dairy platform will be increased by 73.0 ha after excluding 63.26 ha of the purchased sheep block (which is added to Woldwide 4), with the effluent area remaining the same, and an increase to consented cow numbers calved (800). A decision regarding if the cropping is to remain on the developing river flats block was made. With the need to renew the sheep pastures, the cropping area has shifted to the Braxton and Tuatapere soils, predominantly of the sheep blocks, with the area reduced as there is no longer need to winter additional; replacement stock. There will be 26 ha of fodder beet grown in the proposed scenario.

The 335.5 ha property will be operated as a dryland dairy farm, calving 800 cows (795 modelled with deaths) and peak milking 785 (540 kg LW) Friesian cows. Milk production aimed for is increased to 360,000 kg MS/year (453 kg MS/cow). Cow numbers are shown in the table below. All cows are wintered on-farm for June and July on the crop

blocks plus the first calving heifers (190 and at 500 kg LW), which come back from grazing off in May. Mean calving date is the 20th August for the main herd, with the first calvers a week earlier on the 12th of August.

The dry-off dates are altered to reflect the increased calving numbers, with the dry-off date now being the 25th of May for the cows and first calving heifers. All replacements (190) are grazed off-the platform until they return as in calf R2 heifers in May. Cows are milked once a day or 16 hourly occasionally over autumn drying off (modelled never) and all calves are fed colostrum and waste milk. The other production factors remain the same as before

Friesian Bulls (20) at 700 kg LW are run with the herd over December and January.

	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	LW (kg)
Dairy cows		244	565	605	600	600	590	590	570	565	443		540
First calving heifers	20	182	190	187	185	185	185	180	180	175	105		500
Dairy grazers (milking cows)	610	366	40								154	610	540
Dairy grazers (replacements)	0										190	190	480
Dairy grazers (replacements)	170	8											500
Bulls						20	20						700

Supplements

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

- 215 T DM Barley grain and 215 T DM distilled Brewers grain imported and used over the season through the milking shed (averaged amount of 430 T DM grain split in half between grain types).
- 61 T DM of Molasses imported and fed through the shed.
- 200 T DM of Palm Kernel Expeller (PKE); fed through the shed
- 85 T DM of baleage purchased, 20 T DM fed on crops and the rest on the wintering pads.
- 100 T DM of Cereal silage (lower Nitrogen feed) fed to dairy cows on pasture over spring (August September 25%) and autumn (March April 75%)

Because of the reduced stocking given the larger area, imported supplementary feed has reduced to the above amounts to reconcile the pastoral productivity between the two systems.

Supplementary feed made and fed during the season is the same as the original current scenario, with an assumption that any silage and baleage made is fed out in the same season, made from all the farm blocks.

Structures

The three wintering pads on the property, will now be used, as an environmental mitigation tool. They will stand off mobs of 100 cows each (modelled 25 % milking cows in April; 50 % in May; 50% in August and 25 % in September), modelled an uncovered wintering pad, with ad lib feeding of baleage in ring feeders and effluent which is scrapped after each season is spread by muck spreader in October to crop blocks and is not stored.

Fodder Cropping

The cropping management remains the same between the two systems modelled, however, the area is reduced by 4 ha as there are less cattle wintered and, and the area cropped is changed to the new additional areas of Tuatapere and Braxton soils (26 ha out of 117.3 ha (73.0 plus 44.3 ha) rotating). Please note that the third crop block is effectively a pastoral block in its reporting year and not included in calculation for crop area. Block history is still 5 years. The following detail was modelled;

- Fodder beet are sown in October after full cultivation, with dry cows and replacements grazed over May, June, July, and in August before calving.
- Sown with Cropmaster DAP, Ammonium sulphate, Potassium chloride plus boron and salt mix, NPKS rating (24-23-30-25) and a further application of Urea/potassium chloride made in February (NPKS rating 69-0-25-0).
- Yields are averaged at 25 T DM/ha and grazed in situ. Grazing durations (months grazed and % dairy/beef) were altered so to align animal metabolic intakes with crop yield and availability given the models inability to optimise feed demand and supply. The smaller blocks of Braxton crop is May to July grazing's, with May being 50/50 dairy/dry cattle, and June and July 100 % dry cattle. For the larger Tuatapere crop blocks, grazing is June to August, with the ratios being 100% dry cattle for June July and 20% dairy and 80 % dry cattle for 4 hours grazing in August. All dry cattle are on crop over June, July and August, with some crop in May plus fodder supplement and pasture, whilst the dairy herd is allocated a small amount of crop in May and August in addition to pasture and supplement.

Fertiliser

This has changed between the two systems modelled. The total fertiliser nitrogen applied is now, due to area changes and less urea applied with the greater effluent being spread, 206 and 174 kg N/ha/year for the Non effluent and Effluent farm blocks and 164 kg N/ha across all blocks (whole property) on average which includes the weighted average in NPKS of 14-10-8-3 from the same amount of dairy effluent imported across a greater area (207.7 ha pastoral blocks in current scenario to 268.4 ha of Tuatapere and Braxton pastoral blocks plus crop blocks). The Upukeroroa blocks due to their productivity and risk of N loss, have reduced fertiliser amounts by stopping the January application and no imported dairy effluent, as mitigation steps.

Non Effluent block:

Month	Fertiliser	NPKS nutrient rating (kg/ha)

August	Ammo 36	43-0-0-12
September	Urea	18-0-0-0
October	Urea	23-0-0-0
November	Urea	23-0-0-0
December	Potash Superphosphate and FlexiN	21-55-30-66
December (not applied to Upukeroroa)	Organic dairy effluent (solid)	14-10-8-3
January (not applied to Upukeroroa)	Urea	23-0-0-0
February	Urea	23-0-0-0
March	Urea (liquid)	18-0-0-0
		206-65-38-81

Effluent block:

Month	Fertiliser	NPKS nutrient rating (kg/ha)
August	Ammo 36	43-0-0-12
September	Urea	18-0-0-0
October	Urea	23-0-0-0
November	Urea	18-0-0-0
December	Potash Superphosphate and FlexiN	21-55-30-66
December	Organic dairy effluent (solid)	14-10-8-3
February	Urea	18-0-0-0
March	Urea (liquid)	18-0-0-0
Total		174-65-38-81

Effluent

Effluent has been modelled as using Overseer default values, and calculated as applying 47 kg N/ha/year (liquid) over the 107 ha (130.1 ha total area less 14 % areas not receiving effluent; calculated to 112 ha less crop area) effluent area, plus 12 kg N/ha/year (solids) applied from pond sludge, as well as 3 kg N/ha/year from pond sludge to the Non effluent areas, except the Upukeroroa blocks, again as a mitigating step, given their vulnerability to N loss. The effluent system remains the same.

Pasture Production

The predominant pasture species on the dairy farm is ryegrass/white clover. Annual pasture production has been weighted by relative productivity as 1 between dairy blocks, and 0.8 for the stonier Upukerora grazing blocks on the river flats:

Block	Relative productivity	T DM/ha/year
Dairy pastoral areas	1.0	15.4
Upuk_8a.1 Non Eff &dev	0.8	12.3

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

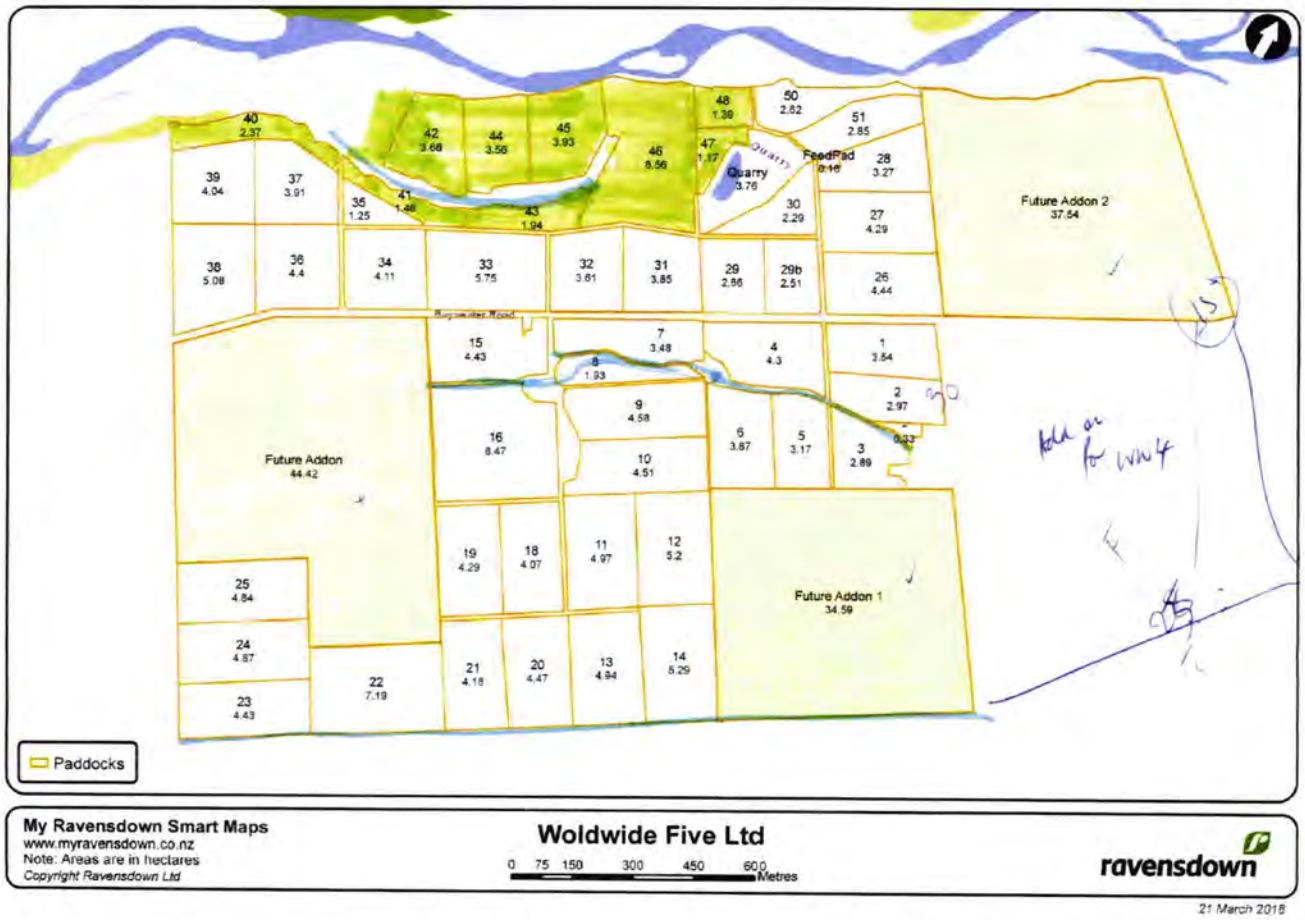
All other factors have remained the same.

Management Unit details and Soil Information: Table 1b

Block Name	Stock	Block Type	Soil Order	Drainage Class	Effluent	PAW (0-60cm)	Effective Area (ha)	Increased or Reduced Area Sheep
Brax_4a.1 Effluent	Dairy	Pastoral	Orthic Gley	Poorly drained	Liquid & Sludge	148.7	18.4	
Brax_4a.1 Eff Tile	Dairy	Pastoral	Orthic Gley	Poorly drained	Liquid & Sludge	148.7	47.2	
Tuap_6b.2 Effluent	Dairy	Pastoral	Orthic Melanic	Well drained	Liquid & Sludge	81.2	59.2	
Brax_4a.1 Non Eff	Dairy	Pastoral	Orthic Gley	Poorly drained	Pond Sludge	148.7	33.0	+ 30.6 ha (sheep)
Tuap_6b.2 Non Eff	Dairy	Pastoral	Orthic Melanic	Well drained	Pond Sludge	81.2	71.7	+ 2.0 ha (sheep)
Upuk_8a.1 Non Eff	Dairy	Pastoral	Fluvial Recent	Well drained		37.6	13.6	+ 3.6 ha (sheep)
Upuk_8a.1 Non Eff dev	Dairy	Pastoral	Fluvial Recent	Well drained		37.6	29.2	
Riparian 1	n/a	Riparian			n/a	148.7	12.9	
Tuap_6b.2 FBt>FBt	Diary & Dry stock	Crop	Orthic Melanic	Well drained	Winter pad solids	81.2	10	+ 10.0 ha (sheep)
Tuap_6b.2 Past>FBt	Diary & Dry stock	Crop	Orthic Melanic	Well drained	Winter pad solids	81.2	10	+ 10.0 ha (sheep)
Tuap_6b.2 FBt>YG	Diary & Dry stock	Crop	Orthic Melanic	Well drained		81.2	10	+ 10.0 ha (sheep)
Brax_4a.1 Past>FBt	Diary & Dry stock	Crop	Orthic Gley	Poorly drained	Winter pad solids	148.7	3	+ 1.23 ha (sheep)
Brax_4a.1 FBt>FBt	Diary & Dry stock	Crop	Orthic Gley	Poorly drained	Winter pad solids	148.7	3	+ 1.23 ha (sheep)
Brax_4a.1 FBt>YG	Diary & Dry stock	Crop	Orthic Gley	Poorly drained		148.7	3	+ 1.23 ha (sheep)
Non-Productive area							11.4	+ 2.9 ha (sheep)
Total							**335.6 (262.6+73.0)**	**+73.0 (sheep)**

*PAW Landcare S maps calculated

Land Management Unit Map and Farm Map



Farm map with additional blocks outlined, 117.6 ha in total according to title (117.3 plus 63.3 ha added in Woldwide 4 less consented 44.3 ha equals 136.3 ha sheep unit), and added to 218.3 ha assessed by GIS. Total area now 335.5 ha, 12.9 ha of riparian and river margin and 11.4 ha of non-productive, estimated pastoral area of 311.2 ha.

Title area of 319.83 ha and soils above excludes highlighted area which is part of Woldwide 4, actual farm area included in paddocks calculated to be 335.5 ha

Proposed Farm System Analysis: Winter Barn Example

Description of winter barn Farm System example

To provide an example of a wintering barn, it is easier to use the existing Woldwide 5 platform as the basis for the dairy platform example, with the dairy cows no longer wintered on this block, nor do the additional 200 cows in the current scenario (see pages 8 & 9 for full explanation). The effluent area will remain the same. With wintering all mixed age cows inside in the barn, there will no longer be any of fodder beet grown (33.6 ha for current scenario or 39 ha for original proposal), but to pay for the barn, additional cows are milked with a longer lactation given they can keep milking cows indoors towards the end of the season.

The 335.6 ha property will be operated as a dryland dairy farm, calving 960 cows and peak milking 930 (540 & 500 kg LW) Friesian cows. Milk production aimed for is at 535,000 kg MS/year (575 kg MS/cow peak). Cow numbers are shown in the table below. All mixed age cows are wintered in the barn, with in calf first calving heifers not coming back from grazing off until they are calving towards the end of July and August. Mean calving date is still the 20th August for the main herd, with the first calvers a week earlier on the 12th of August.

The dry-off date is now the 15th of June and the 31st of May for the cows and first calving heifers. All replacements (245) are grazed off-the platform until they return as in calf R2 heifers in late July/August as mentioned. Cows are never milked once a day over autumn drying off (modelled never) and all calves are fed colostrum and waste milk.

Friesian Bulls (20) at 700 kg LW are run with the herd over December and January.

	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	LW (kg)
Dairy cows		265	715	705	695	695	675	665	655	645	600	260	540
First calving heifers	30	220	245	240	235	235	235	225	225	225	195		500
Dairy grazers (milking cows)	715	450									0	455	540
Bulls						20	20						700

Supplements

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

- 350 T DM Barley grain and 250 T DM distilled Brewers grain imported and used over the season through the milking shed. A further 35 T DM is fed to milking cows in the wintering barn
- 99 T DM of Molasses imported and fed through the shed.
- 500 T DM of Palm Kernel Expeller (PKE); 350 T DM fed through the shed, with the remainder fed on pastoral blocks. A further 40 T DM is fed to milking cows in the wintering barn
- Approximately 700 T DM of grass silage; made on the support block and fed ***evenly across pastoral blocks*** to dairy cows.
- 410 T DM of silage made on the support block and fed to ***dry cattle*** in the wintering barn
- 140 T DM silage made on the support block and fed to the ***milking cows*** in the wintering barn

Because of the increased stocking and longer lactation, imported supplementary feed has increased to the above amounts to mostly reconcile the pastoral productivity between the two systems. However, additional fertiliser and barn slurry is also been used to reconcile the increased pastoral productivity also. In addition, it is noted the two barn examples for both Woldwide 4 & 5 are also similar in pasture productivity.

Supplementary feed made and fed during the season remains as before and is less likely given the increased stocking rates over the milking season will mean all pasture is more likely utilised by milking animals within the platform.

Fodder Cropping

This is now no longer required compared to the other two systems modelled. The losses are likely lower on blocks which in the past wintered the mixed age cows on crop. Pasture renewal is now by grass to grass renewal.

Fertiliser

This changes again between the two systems modelled. This is given the increased need given the higher pastoral productivity (an increase of 0.35 T DM/ha over the current system), however more nitrogen is supplied by effluent and barn slurry, so the additional nitrogen required equates to roughly a ***decrease*** for the effluent block and ***a nil increase*** for the non-effluent blocks, with in effect ***a reduction in fertiliser N***; 28 kg of N/ha decrease for effluent block (but only a 3 kg N/ha decrease for the tiled effluent areas receiving no barn slurry; Brax_4a.1 effluent tiled) and a 10 to 23 kg of N/ha decrease for non-effluent blocks, depending on which receives the solid effluent from Woldwide 3. The total fertiliser nitrogen applied is now 192 and 179 for the non-effluent blocks(160 for the Upukeroroa block) plus 171 and 146 kg N/ha/year for the Effluent farm blocks depending on which receives barn slurry, with 156 kg N/ha across all blocks (whole property) on average, which includes the weighted average in NPKS of 14-10-8-3 and 13-10-8-3 from the same amount of dairy effluent imported across a greater

area (207.7 ha pastoral blocks in current scenario to 231.8 ha of Tuatapere and Braxton pastoral blocks). See fertiliser reconciliation summary page 39.

Note also maintenance fertiliser was also adjusted to account for the Phosphate in the barn slurry

Non Effluent block:

Month	Fertiliser	NPKS nutrient rating (kg/ha)	NPKS nutrient rating (kg/ha)*
August	Ammo 36	43-0-0-12	43-0-0-12
September	Urea	23-0-0-0	23-0-0-0
October	Urea	30-0-0-0	23-0-0-0
November	Organic dairy barn slurry	25-6-34-3	23-0-0-0
December	Organic Dairy Barn Slurry	24-6-33-3	23-26-50-28
January	Potash Superphosphate and FlexiN (and Organic effluent pad solids WW3)	32-14-19-17 (19-4-11-14 & 13-10-8-3)**	
February	Urea	23-0-0-0	
March	Urea	23-0-0-0	23-0-0-0
April	Urea (liquid)	18-0-0-0	
Totals		241-26-86-35	158-26-50-40

* Upukeroroa blocks ** Tuatapere Non effluent block

Effluent block:

Month	Fertiliser	NPKS nutrient rating (kg/ha)
August	Ammo 36	43-0-0-12
September	Urea	23-0-0-0
October	Urea	23-0-0-0
November	Organic dairy barn slurry	24-6-33-3**(25-6-0-8)
December	Superphosphate and FlexiN	25-13-0-16
January	Organic effluent pad solids WW3	18-12-11-4
March	Urea	23-0-0-0
April	Urea (liquid)	9-0-0-0
Total		188-31-44-35**189-31-11-40

**Soluble fertiliser and no slurry on tiled effluent block

Effluent

Effluent has been modelled as using Overseer default values, and calculated as applying 66 kg N/ha/year (liquid) over the 112.0 ha (130.1 ha total area less 14 % areas not receiving effluent; calculated to 112 ha, increased area due to no cropping) effluent area, plus 11 kg N/ha/year (solids) applied from pond sludge to the Non effluent areas. The effluent system remains the same as what was detailed in the "current" farm system analysis. Wintering barn effluent is as detailed in the consent for Woldwide 1&2 and is a slurry which is exported and re imported as a dairy organic fertiliser. Solids applied to the Non effluent areas equates to 6 kg N/ha/year

Farm dairy feeding structure: Wintering Barn.

There is one housing barn on farm that has been modelled as two structures so as to contain the milking herd (winter barn plus grazing) and dry cows (winter pad only) at the times specified in table below. In addition, due to a modelling error, the dry cows are required to be grazing a pastoral block for the model to run, however in reality these animals will be all in the barn. To work around this, 99 % of the dry cattle are in the barn in August, with the Braxton and Tuatapere effluent and non-effluent blocks grazing these dry cattle for only 1% of the time in August.

The nutrient concentration of wintering barn effluent is higher than dairy shed effluent due to lack of dilution and the housing of cows in the barns for up 24 hours per day.

The nutrient content of pond effluent (slurry) was tested as part of a 2011 AgResearch study "Characterising dairy manures and slurries – Case study 15." The nutrient content of slurry at the applicant's pond was measured at: 3,200 g/m^3 N; 800 g/m^3 P; 4,400 g/m^3 K; 400 g/m^3 S
Applying 15.2 m^3/hectare applies slurry effluent at a depth of 1.5 mm. Discharging slurry effluent at 15.2 m^3/hectare applies:
49 kg of N; 12 kg of P; 69 kg of K; and 6 kg of S.

Table: Winter barn management:

Pad type	Covered animal shelter
Bunker lining material	No lining material
Bunker cleaning method	Scraped
Concrete feeding apron	Scraped
Solids separated	No
Solids storage	N/A
Time in storage	N/A
Liquid effluent	All exported as a slurry, as effluent composition different to dairy shed effluent
Solids management	Re imported as slurry, spread on all blocks bar the tiled effluent and Upukeroroa blocks. The Non effluent blocks receive a full application and effluent blocks half an application of barn slurry.
Months applied	November and December for non-effluent blocks
Separated solids from pond and housing barn on pasture N application rate, Kg N/ha/year	24 for effluent blocks, 49 for non-effluent blocks

Table: Feeding management in winter barn:

Herd		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Milking herd	% of cows					100	100	100	100				
	Hours/ day grazing					10	0	0	10				
Dry cows	% of cows						100	100	99				
	Hours/ day grazing						0	0	0				

Pasture Production

The predominant pasture species on the dairy farm is ryegrass/white clover. Annual pasture production has been weighted by relative productivity as 1 between dairy blocks, and 0.8 and 0.5 for the rougher grazing blocks on the platform and support block respectively:

Block	Relative productivity	T DM/ha/year
Dairy pastoral areas	1.0	15.8
Upukeroroa river soils	0.8	12.6

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

All other factors have remained the same.

Management Unit details and Soil Information: Table 1b

Block Name	Stock	Block Type	Soil Order	Drainage Class	Effluent	PAW (0-60cm)	Effective Area (ha)	Increased or Reduced Area Sheep
Brax_4a.1 Effluent	Dairy	Pastoral	Orthic Gley	Poorly drained	Liquid & Sludge & Barn slurry *0.5	148.7	18.4	
Brax_4a.1 Eff Tile	Dairy	Pastoral	Orthic Gley	Poorly drained	Liquid & Sludge	148.7	52.5	
Tuap_6b.2 Effluent	Dairy	Pastoral	Orthic Melanic	Well drained	Liquid & Sludge & Barn slurry *0.5	81.2	59.2	
Brax_4a.1 Non Eff	Dairy	Pastoral	Orthic Gley	Poorly drained	Pond Sludge & Barn slurry * 1.0	148.7	36.7	+ 34.3 ha (sheep)
Tuap_6b.2 Non Eff	Dairy	Pastoral	Orthic Melanic	Well drained	Pond Sludge & Barn slurry * 1.0	81.2	101.7	+32.0 ha (sheep)
Upuk_8a.1 Non Eff	Dairy	Pastoral	Fluvial Recent	Well drained		37.6	13.6	+ 3.6 ha (sheep)
Upuk_8a.1 Non Eff dev	Dairy	Pastoral	Fluvial Recent	Well drained		37.6	29.2	
Riparian 1	n/a	Riparian			n/a	148.7	12.9	
Non-Productive area							11.4	+ 2.9 ha (sheep)
Total							**335.6 (262.6+73.0)**	**+73.0 (sheep)**

*PAW Landcare S maps calculated

Summary of Current and Proposed Farm System Scenario: Table 2

	Current scenario	Current Sheep Farm	Proposed scenario	Winter Barn Example
System Type	Seasonal dairy supply block	Sheep breeding and finishing	Seasonal dairy supply block	Seasonal dairy supply
Total Area (ha)	262.6	136.3 (only 73.0 ha transferred to WW5)	335.6	335.6
Effluent area (ha)	112 ha (86 % of 130.1) receiving liquids & sludge from dairy shed plus 76.4 ha non-effluent having pond sludge from the holding pond applied	n/a	107 ha (86 % of 130.1 less crop) receiving liquids & sludge from dairy shed plus 147.4 ha non-effluent having pond sludge from the holding pond applied	112 ha (86 % of 130.1) receiving liquids & sludge from dairy shed plus 138.4 ha non-effluent having pond sludge from the holding pond applied. All wintering barn effluent re imported as fertiliser and applied to non-tiled effluent and non-effluent areas
Stocking rate (s.u/ha)	7,686 s.u* or 31.9 s.u/ha effective or 2.8 cows/ha platform (3.3 cows/ha grazed)	2,642 s.u* or 19.4 s.u/ha effective or 20.0/ha grazed	8,591 s.u* or 27.6 s.u/ha effective or 2.6 cows/ha platform (2.9 cows/ha grazed)	11,318 s.u* or 34.9 s.u/ha effective or 3.1 cows/ha platform (33.7 s.u/ha total or 2.9 cows/ha total)
N use (kg N/ha/year)	172 across the whole farm (158 fertiliser)	30 across the whole farm	164 across the whole farm (153 fertiliser)	194 across the whole farm
Production (kg MS/ha grazed)	1,302/ha effective platform (1,513/ha total grazed)	1,117 kg LW sold/ha grazed	1,157/ha effective platform (1,323/ha total grazed)	1,719/ha effective platform (1,594/ha total farm)
Supplements Imported (kg DM/ha/year)	1,152 T DM in total or 4,776 per effective platform.	n/a	876 T DM in total or 2,815 per effective platform.	2,524 T DM in total or 8,108 effective platform.
Wintering system	On farm on crop plus in calf heifers wintered on plus additional 200 in calf dairy replacements	On farm on crop and pasture	On farm on crop plus in calf heifers wintered on with no additional in calf heifers	In wintering barn on platform plus in calf heifers wintered off
Pasture production(kg DM/ha/year) - Platform Pastures - Upukerora paddocks	 15,456** 12,365	 15,614 12,491	 15,354** 12,283	 15,795** 12,636

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

Summary of Current Whole Farm Nutrient Loss Indicators: Table 3

	Current average	Sheep Farm (136.3 ha)	Combined current (less 63.3 ha)	Proposed scenario	Winter Barn Example
Nitrogen leaching loss to water (Total kg N)	14,493	2,509 (less 1,120)	15,882	15,937	15,639
Nitrogen leaching loss to water (kg N/ha)	55	18 (19)	47	47	47
Phosphorus runoff to water (Total kg P)	207	56 (less 26)	237	231	245
Phosphorus runoff to water (kg P/ha)	0.8	0.4 (0.4)	0.7	0.7	0.7

* Losses split apportionately with riparian, trees and other losses. Note Sheep Block apportioned in the following table:

Sheep Block (Brax_4a.1)	Pastoral	72.80	38.50	34.30
Sheep Block (Tuap_6b.2)	Pastoral	55.50	23.50	32.00
Sheep Block (Upuk_8a.1)	Pastoral	3.80		3.80
Swedes	Fodder Crop	-	***4.65***	***4.35***
Non prod		4.20	1.30	2.90
Totals		136.3	WW4 (63.3)	WW5 (73.0)

Discussion on Whole Farm Nutrient Loss Indicators

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

Current scenario Farm System

- The N loss from the root zone from the farm system modelled was calculated using OVERSEER® (v6.3.0) to be **55 kg N/ha/year or 14,493 kg N/year.**
- The P loss risk from the farm system modelled was calculated using OVERSEER® (v6.3.0) to be **0.8 kg P/ha/year or 207 kg P/year.**

Combined Current Farm System

- The N loss from the root zone from the combined farm system (less the 63.3 ha included in Woldwide 4) modelled was calculated using OVERSEER® (v6.3.0) to be **47 kg N/ha/year or 15,882 kg N/year.**
- The P loss risk from the farm system (less the 63.3 ha included in Woldwide 4) modelled was calculated using OVERSEER® (v6.3.0) to be **0.7 kg P/ha/year or 237 kg P/year.**

Proposed Farm System

- The N loss from the root zone from the farm system modelled was calculated using OVERSEER® (v6.3.0) to be **47 kg N/ha/year or 15,937 kg N/year.**
- The P loss risk from the farm system modelled was calculated using OVERSEER® (v6.3.0) to be **0.7 kg P/ha/year or 231 kg P/year.**

Winter barn example Farm System

- The N loss from the root zone from the farm system modelled was calculated using OVERSEER® (v6.3.0) to be **47 kg N/ha/year or 15,639 kg N/year.**
- The P loss risk from the farm system modelled was calculated using OVERSEER® (v6.3.0) to be **0.7 kg P/ha/year or 245 kg P/year.**

Key factors influencing Nutrient Loss include:

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

  The soil type has a large impact on N leached. The soils on the property are mainly well drained silt loams, with poorly drained silt loams over clay and well drained stony sandy loams on the river flat. Plant Available Water (PAW) values range between (and would be considered) 'high' at 148.7 mm (0-60cm) to 'low' at 37.6 mm (0-60 cm). The Plant Available Water is described as "the amount of water potentially available to plant growth that can be stored in the soil to specific soil depths". It therefore makes sense that the soils with high PAW will have lower N leaching as there will be less drainage from these soils. Soils with lower PAW are less able to buffer against changes in nitrogen losses to the bottom of the root zone (from stocking rates, crop yields, irrigation volumes) as the soils have larger pores and are flushed frequently as compared to a poorer draining soil with a higher PAW and are less versatile (see N report in Appendix where the Tuatapere soil in the proposal loses 50 kg N/ha/year compared to the Braxton soils, losing 28 kg N/ha/year respectively on the Effluent pastoral blocks under the current system). The Upukerora soils lose on average 88 kg N/ha/year, twice as much as the Tuatapere non-effluent soil (42 kg N/ha/year), with a PAW approximately twice (2.16) as much.

  These heavier soils are often tile drained (artificially drained, and are here) to remove water from the profile and enable higher productivity. The risk is that these drains also provide a conduit to nutrient flows and effluent discharges direct to water ways. Ensuring the nutrients are captured by plant growth and minimising effluent applications when soil PAW are near capacity will reduce this. This is evident with the tiled effluent area which has loses 1 kg N/ha/year higher than the non-tiled effluent block.

- Pastoral productivity

  The higher the pastoral productivity from dairy land and the associated higher stocking, the higher the risk of N losses on dairy farms, especially under the climatic, rainfall and evapotranspiration rates for Southland. The current system has a higher production per ha (1,513 kg MS/ha grazed) at a high stocking rate of 3.3 cows/ha platform grazed; (cf. to 2.73 cows/ha & 1056 kg MS/ha, NZ Southland Dairy statistics 2015-16) with a high amount (4,776 kg DM/ha) of supplement imported which supports the stocking and consequently the pasture production required at 15,456 kg DM/ha/year as seen in table 2, page 28. This leads to the high amount of urine deposition on pastures from the resulting cow intakes, resulting in increased risk from N leaching. The results point to a similar influence from urinary deposition in the proposal, with the amount of N loss attributed to urine similar as a percentage 70 % (for both), the rest due to N losses from cropping and effluent applications (other sources) plus direct losses (tiles). It is noted the sheep unit is also at a similar pastoral productivity (15,614 kg DM/ha), and higher per ha productivity

than district averages also. Losses here are at 33 % from urinary deposition given the lower risk from urine leaching with sheep.

- Cropping

  The crop blocks for the current system contribute 3,742 kg N/ha or 111 kg N/ha/year on average (26.2 % of total N losses and yet accounts for 12.8 % of the total land area). (Figures as in Block Nitrogen reports, pages 34, 35 & 39). It is the higher concentration of stock in a smaller area and thus the greater urine deposition which leads to this increased risk of losses. This is also exacerbated by these crops being grazed at a time when drainage events are most likely to occur, and that the crops are on the lightest soils of this farm. The losses are lower between the current and proposed scenarios, with the proposed crop losses being 63 kg N/ha/year on average or 2499 kg N/year total (15.7 % of total losses and 11.6 % of area), due to the crop blocks now being on soils with lower risk of N losses from leaching. As well, it is the crop losses on the sheep block which on a proportionate basis contributes 33 % of total losses from 6.4 % of the total 73.0 ha which lifts the sheep losses to the overall N loss of 19 kg N/ha/year.

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

The other environmental risk indices are the current P losses to surface water at 0.8 kg P/ha/year as seen in the Phosphate reports pages 33 & 38, which are low to moderate risk in their impact. The P risk is mostly influenced by losses from other sources (123 kg or 59.4 % of total of 207 kg, refer Phosphorous block reports, pages 34 39) which is run off from tracks and yards into drains and ditches from the farm. Riparian strip planting and vegetation buffer zones for crops and lane ways can reduce this and have been implemented on this farm. Olsen P levels are mostly within or below the optimum agronomic ranges, with the current fertiliser rates receiving above maintenance rates due to the recent conversion process. This will reduce in future. As well, the topography where the all of the fertiliser is applied is flat, which also helps to minimise P losses. Any new Effluent storage plus low volume applications will help to mitigate this risk and allow applications to be reduced on tiled soils at "at risk" times also. The proposed P losses are only 231 kg P/year, 6 kg P/year lower than the combined P losses and due mostly to the reduced losses on the cropping blocks, being mitigated by shifting to deeper less vulnerable soils.

The current scenario is rated 13.9, the lower side of category 2 under the Soil versatility rating system (Landcare Research, 2002), as calculated in the table 4 below. The proposal reduces this score (13.4), as there is a greater percentage of less vulnerable soils (Braxton and Tuatapere). The farm already uses a number of effective Nitrogen mitigation strategies to minimise losses for the proposal and allowing the proposal to crop less on these vulnerable soils culminating in the results above.

Soil Vulnerability Land Management Rating: Table 4

Soil Type (Proposed)	Soil Vulnerability	Vulnerability rating	% Farm	Rating score
Braxt_4a.1	Moderate	10	28.7 (33.6)	2.87 (3.36)
Tuap_6b.2	Moderate	10	51.6 (49.9)	5.16 (4.99)
Upuk_8a.1	Limited	30	19.7 (16.5)	5.91 (4.95)
Total			**100.0**	**13.94 (13.30)**

The property is situated in the Aparima River sub catchment, and the Aparima catchment of the proposed Environment Southland Regional Water and Land Plan. It is 29 % on a Central plain physiographic zone, with no variants, 50 % on the oxidising physiographic with no variants and 16.5 % on the riverine physiographic. (See map, page 17 and table above), meaning the farm must attach significance to these zones in its environmental management. The farm is within zones having influence in the high nitrate levels in ground water and is at risk from summer shrinking of soils and nitrogen losses from leaching. Water quality is characterised by lowland hard bed and spring fed, with quaternary gravel upon tertiary sediment in the Upper Aparima groundwater management zone. Implications of this information are unknown at present but some catchment areas will be required to reduce their impacts. The zonal information would point to the presence of nitrate leaching; and nitrogen accumulation as key risk factors for the zone. An additional key risk factor for the Braxton soil is the losses of nitrogen through tiles which is the case here. No effluent applications to the highest risk soil during the highest risk periods would be helpful. This plus the use of the wintering pads at the riskier shoulder seasons and the reduction of wintering on the Upukerora would be mitigations to be used to reduce the risk of N loss over the autumn winter period. In addition, created Riparian strips and wetlands would be activities which would be required to mitigate any overland flows.

Summary of Mitigations re winter barn:

	Mitigations modelled:	Reason/Rationale:	Effect:
Winter Barn Farm System	1. Effluent mitigations (area maintained and targeted fertiliser applications)	Ensure effluent only applied to appropriate areas, with Nitrogen applications taking into account the additional effluent nutrients from barn slurry.	Effluent area maintained. Decrease Nitrogen applications to account for the application of the imported slurry to Non effluent areas (1 x apply) and effluent areas (0.5 x apply), not applying to Upukeroroa and tiled effluent areas. Adjust fertiliser applications to account for this and required pastoral productivity. Other blocks have additional fertiliser applied. Adjust effluent solids too
	2. Alter cropping regime with the Winter Barn	With the winter barn, no crop area is required.	No crop area over winter reduces Nitrogen losses in Upukeroroa blocks in current scenario from 4,404 to 3,388 kg N/ha, plus the risk of P losses is also reduced. Note the interim stage showed cropping on the Braxton would lower losses to 2,448 kg N/year, but these losses can be used to counter the increase in urine patch losses from pastures on the more vulnerable Upukeroroa soils
	3. Winter Barn	With the additional milking cows, the use of the barn over May and August gives the farm system an ability to reduce risk of pugging to pastures over spring and at autumn as required.	The risk of pugging reduces infiltration of soils and increases overland flow of nutrients. Also nutrients are held and spread onto soil by effluent applications when pastures more able to receive the nutrients and thus lowers risk of losses.
	4. Supplementary feed	Additional feed is able to be used for the extended lactation and for the wintering of cattle, with an ability to lower losses and ensure higher utilisation	Higher amounts of grain and PKE can mean one can reduce the pastoral productivity further, and so with a lower pastoral productivity and higher supplement use overall N losses will reduce. It was decided to use more N fertiliser to equate pastoral productivity and the example still shows an equal amount of losses for the system when compared to the interim stage of more cows and added area.
	5. Mitigate stocking on more vulnerable Upukeroroa soils	Higher stocking on the dairy platform could lead to increased urine patch losses on the free draining river soils	Mitigate this by not grazing milking cows on these soils over autumn, and the lower productivity will mean reduced fertiliser applications on these soils. In addition the numbers wintered, calved and peak milked are lowered to account for this as well.

The sum effect from the wintering barn is to maintain the level of environmental losses from the increased farming system intensity (more cows and longer lactation with higher milk production) required to provide an added return on the additional capital invested. These effects are less able to be buffered by the freer draining and high vulnerability to leaching Upukeroroa soils, but more so by less vulnerable Braxton soils.

Fertiliser Reconciliation Summary:

		Non Effluent			Effluent	
	Fert reconciliation	Braxton	Tuatapere	Upukeroroa	Non tiled	Tiled
Current	Pasture production	15.5	15.5	12.4	15.5	15.5
	N fert	202	202	202	174	174
	Dairy slurry(barn)					
	Dairy solid	18	18	18	18	18
	Effluent dairy	3	3	3	53	53
	Total	**223**	**223**	**223**	**245**	**245**
	N fix	56	56	18	60	60
Proposal	Pasture production	15.4	15.4	12.3	15.4	15.4
	N fert	192	192	169	160	160
	Dairy slurry(barn)					
	Dairy solid	14	14		14	14
	Effluent dairy	3	3		64	64
	Total	**209**	**209**	**169**	**238**	**238**
	N fix	76	78	73	78	78
Barn Ex	Pasture production	15.8	15.8	12.6	15.8	15.8
	N fert	192	179	160	146	171
	Dairy slurry(barn)	49	49		24	0
	Dairy solid	0	13		18	18
	Effluent dairy	6	6		77	70
	Total	**247**	**247**	**160**	**265**	**259**
	N fix	62	71	77	81	73

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

OVERSEER v6.3.0 onwards has a new irrigation module to better reflect the management practices of irrigators. The Best Practice Data Input Standards give some guidance on what is now required. The model requires more information from users about their irrigation system and how water application decisions are made on farm. The extra data needed includes depth of water per application; return time and depending on how soil water is monitored what are the trigger points and targets (mm deficit). Ideally, this data needs to be actual long term average data as OVERSEER uses 30 year average climate data. Best estimates of these data will generally generate more drainage, and hence N loss to water, than has been the case with previous OVERSEER versions.

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

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

Appendices

Current farm System Whole Farm Nutrient Budget

Abe and Anita De Wolde
WoldWide 5
Client reference: 60876935
Farm name: WoldWide 5 Current Scenario-efflntxtra (16/17)

Mark Crawford
Ravensdown
Dunedin

Farm Nutrient Budget - Whole farm

	N	P	K	S	Ca	Mg	Na
	(kg/ha/yr)						
Nutrients added							
Fertiliser, lime & other	172	57	39	69	24	8	2
Rain/clover N fixation	48	0	2	4	2	5	23
Irrigation	0	0	0	0	0	0	0
Supplements imported	107	17	48	12	13	8	6
Nutrients removed							
As products	86	14	22	4	18	2	6
Exported effluent	0	0	0	0	0	0	0
As supplements	0	0	0	0	0	0	0
To atmospheric	74	0	0	0	0	0	0
To water	55	0.8	20	92	102	4	15
Change in internal pools							
Plant material	9	1	4	2	0	0	1
Organic pool	98	9	5	-13	1	1	0
Inorganic mineral	0	2	-12	0	-3	-4	-5
Inorganic soil pool	4	48	51	0	-79	18	13

Sheep Farm

Report from OVERSEER® Nutrient budgets. Copyright © 2018 MPI, AgResearch and Fertiliser Association of New Zealand. All rights Reserved.
Version 6.3.0, on 2018-06-08 11:35:37

Abe and Anita De Wolde
WoldWide 4 plus Gladfiled Run Off
Client reference: 60877676
Farm name: Woldwide 4 Current (16/17)

Mark Crawford
Ravensdown
Dunedin

Farm Nutrient Budget - Whole farm

	N	P	K	S	Ca	Mg	Na
	(kg/ha/yr)						
Nutrients added							
Fertiliser, lime & other	195	26	49	37	0	0	1
Rain/clover N fixation	41	0	2	4	2	5	21
Irrigation	0	0	0	0	0	0	0
Supplements imported	83	15	37	11	8	7	4
Nutrients removed							
As products	87	15	21	5	19	2	6
Exported effluent	0	0	0	0	0	0	0
As supplements	0	0	0	0	0	0	0
To atmospheric	78	0	0	0	0	0	0
To water	30	0.9	17	59	74	2	9
Change in internal pools							
Plant material	23	2	11	2	2	1	1
Organic pool	96	12	3	-13	1	0	0
Inorganic mineral	0	4	-13	0	-2	-3	-4
Inorganic soil pool	4	8	49	0	-82	11	15

Current Farm System Nutrient Loss Indicators

P report

Block P

Client reference: 60876935
Farm name: WoldWide 5 Current Scenario-effintxtra (16/17)

Dunedin

Block Phosphorus

Block name	Total P lost (kg P/yr)	P lost (kg P/ha/yr)	P loss categories		
			Soil	Fertiliser	Effluent
Brax_4a.1 Effluent	5	0.3	Low	Low	Low
Brax_4a.1 Eff Tile	32	0.6	Low	Low	Low
Tuap_6b.2 Effluent	9	0.2	Low	Low	Low
Brax_4a.1 Non Eff	1	0.2	Low	Low	n/a
Tuap_6b.2 Non Eff	9	0.1	Low	Low	n/a
Upuk_8a.1 Non Eff	2	0.4	Low	Low	n/a
Upuk_8a.1 Non Eff dev	0	0.4	Low	Low	n/a
Riparian 1	1	0.1	n/a	n/a	n/a
Upuk_8a.1 FBt>FBt	17	0.8	n/a	n/a	n/a
Upuk_8a.1 Past>FBt	4	0.7	n/a	n/a	n/a
Upuk_8a.1 FBt>YG	3	0.5	n/a	n/a	n/a
Other farm sources	123				
Whole farm	207	0.8			

Sheep Farm

Abe and Anita De Wolde
New Sheep Farm
Client reference:
Farm name: Purchased Sheep Farm Current - copy 1 (17/18)

Mark Crawford
Ravensdown
Ravensbourne

Block Phosphorus

Block name	Total P lost (kg P/yr)	P lost (kg P/ha/yr)	P loss categories		
			Soil	Fertiliser	Effluent
Sheep Block (Brax_4a.1) ##	30	0.4	Low	Low	n/a
Sheep Block (Tuap_6b.2) ##	6	0.1	Low	Low	n/a
Swedes	2	0.2	n/a	n/a	n/a
Sheep Block (Upuk_8a.1)	1	0.3	Low	Low	n/a
Other farm sources	18				
Whole farm	56	0.4			

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

N report

Farm N

Abe and Anita De Wolde
WoldWide 5
Client reference: 60876935
Farm name: WoldWide 5 Current Scenario-efflntxtra (16/17)

Mark Crawford
Ravensdown
Dunedin

Farm Nitrogen

	Units	Benchmark farm	Current farm
Inputs (farm average)			
Clover N	kg N/ha/yr		46
Fertiliser N	kg N/ha/yr		158
Other N added	kg N/ha/yr		123
Indices			
Average N loss to water	kg N/ha/yr		55
includes N lost as effluent	kg N/ha/yr		0
N_2O emissions	kg N/ha/yr		17.9
For pastoral area of farm:			
Farm N surplus	kg N/ha/yr		240
N conversion efficiency	%		26

Sheep Farm

Abe and Anita De Wolde
New Sheep Farm
Client reference:
Farm name: Purchased Sheep Farm Current - copy 1 (17/18)

Mark Crawford
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Farm Nitrogen

	Units	Benchmark farm	Current farm
Inputs (farm average)			
Clover N	kg N/ha/yr		104
Fertiliser N	kg N/ha/yr		30
Other N added	kg N/ha/yr		2
Indices			
Average N loss to water	kg N/ha/yr		18
includes N lost as effluent	kg N/ha/yr		0
N_2O emissions	kg N/ha/yr		14.2
For pastoral area of farm:			
Farm N surplus	kg N/ha/yr		113
N conversion efficiency	%		17

Block N

Client reference: 60876935 Dunedin

Farm name: WoldWide 5 Current Scenario-efflntxtra (16/17)

Block Nitrogen

Block name	Total N lost (kg N/yr)	N lost to water (kg N/ha/yr)	N in drainage * (ppm)	N surplus (kg N/ha/yr)	Added N ** (kg N/ha/yr)
Brax_4a.1 Effluent	593	32	10.1	246	245
Brax_4a.1 Eff Tile	1743	33	10.1	246	245
Tuap_6b.2 Effluent	3415	58	**16.1**	254	245
Brax_4a.1 Non Eff	73	30	9.6	219	222
Tuap_6b.2 Non Eff	3877	56	**15.6**	232	222
Upuk_8a.1 Non Eff	527	123	**29.9**	298	222
Upuk_8a.1 Non Eff dev	135	122	**29.8**	295	219
Riparian 1	39	3	N/A		
Upuk_8a.1 FBt>FBt	2458	110	**25.3**	113	93
Upuk_8a.1 Past>FBt	720	124	**29.3**	94	93
Upuk_8a.1 FBt>YG	564	102	**24.0**	48	113
Other farm sources	350				
Whole farm	14493	55			
Less N removed in wetlands	0				
Farm output	14493	55			

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

** Sum of fertiliser and external factory effluent inputs.

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

Sheep Farm

Farm name: Purchased Sheep Farm Current - copy 1 (17/18)

Block Nitrogen

Block name	Total N lost (kg N/yr)	N lost to water (kg N/ha/yr)	N in drainage * (ppm)	N surplus (kg N/ha/yr)	Added N ** (kg N/ha/yr)
Sheep Block (Brax_4a.1) ##	669	10	3.1	120	28
Sheep Block (Tuap_6b.2) ##	761	15	4.1	118	28
Swedes	891	99	**23.9**	59	71
Sheep Block (Upuk_8a.1)	143	38	9.2	115	28
Other farm sources	45				
Whole farm	2509	18			
Less N removed in wetlands	0				
Farm output	2509	18			

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

** Sum of fertiliser and external factory effluent inputs.

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

Hs a fodder crop rotating though; results for pastoral block component only

Current System Pasture Production, Other Values and Effluent Report

Abe and Anita De Wolde
WoldWide 5
Client reference: 60876935
Farm name: WoldWide 5 Current Scenario-effintxtra (16/17)

Mark Crawford
Ravensdown
Dunedin

Block Pasture

Block name	On-farm fresh pasture intake (kg DM/ha/yr)	Estimated utilisation (%)	Supplements removed (kg DM/ha/yr)	Pasture growth (kg DM/ha/yr)
Brax_4a 1 Effluent	13138	85	0	15456
Brax_4a 1 Eff Tile	13138	85	0	15456
Tuap_6b 2 Effluent	13138	85	0	15456
Brax_4a 1 Non Eff	13138	85	0	15456
Tuap_6b 2 Non Eff	12790	83	0	15456
Upuk_8a 1 Non Eff	8841	72	0	12365
Upuk_8a 1 Non Eff dev	8841	72	0	12365
Riparian 1	0	0	0	0
Upuk_8a 1 FBt>FBt	0	0	0	0
Upuk_8a 1 Past>FBt	511	83	0	615
Upuk_8a 1 FBt>YG	10947	85	0	12879

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

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

Abe and Anita De Wolde
WoldWide 5
Client reference: 60876935
Farm name: WoldWide 5 Current Scenario- copy 1 (16/17)

Mark Crawford
Ravensdown
Dunedin

Other values for farm - WoldWide 5 Current

Milking herd size (peak cows/ha grazed)	3.3
Milk solids (kg/ha grazed)	1513
Milk production per cow (kg milk solids / cow)	465.3
Default calving data	06 August
Total liveweight brought (kg/ha grazed)	3871
Total liveweight reared (kg/ha grazed)	101
Total liveweight sold (kg/ha grazed)	3808
No fertiliser costs entered	
GHG Allocation to milk	0.82
Dairy stock rate (RSU)	6712
Dairy replacements stock rate (RSU)	0
Beef / dairy grazing stock rate (RSU)	974
Sows per ha	NaN

Abe and Anita De Wolde
WoldWide 5
Client reference: 60876935
Farm name: WoldWide 5 Current Scenario-effintxtra (16/17)

Mark Crawford
Ravensdown
Dunedin

Effluent Report

	Units	Current farm
Current effluent area		
Area of effluent blocks	ha	112
% of pastoral farm area	%	34
Area of farm to apply effluent to achieve rates of:		
150 kg N/ha/yr	ha	47
Maintenance K	ha	5110
100 kg K/ha/yr	ha	74
Source of N applied to effluent blocks		
Average of N applied to effluent blocks	kg N/ha/yr	50
Effluent from farm dairy	%	84
Effluent from wintering pad	%	0
Effluent from feed pad	%	0
Average fertiliser N	kg N/ha/yr	174
Average other elements	kg N/ha/yr	10

The Sheep Farm

Abe and Anita De Wolde
New Sheep Farm
Client reference:
Farm name: Purchased Sheep Farm Current - copy 1 (17/18)

Mark Crawford
Ravensdown
Ravensbourne

Block Pasture

Block name	On-farm fresh pasture intake (kg DM/ha/yr)	Estimated utilisation (%)	Supplements removed (kg DM/ha/yr)	Pasture growth (kg DM/ha/yr)
Sheep Block (Brax_4a.1)	10848	70	117	15614
Sheep Block (Tuap_6b.2)	10832	70	140	15614
Swedes	0	0	0	0
Sheep Block (Upuk_8a.1)	8744	70	0	12491

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

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

Abe and Anita De Wolde
New Sheep Farm
Client reference:
Farm name: Purchased Sheep Farm Current - copy 1 (17/18)

Mark Crawford
Ravensdown
Ravensbourne

Other values for farm - Purchased Sheep Farı

Total liveweight brought (kg/ha grazed)	831
Total liveweight reared (kg/ha grazed)	424
Total liveweight sold (kg/ha grazed)	1117
No fertiliser costs entered	
GHG: Allocation to wool - breeding mob	0.25
GHG: Allocation to wool - trading mob	0.02
Sheep stock rate (RSU)	2642
Sows per ha	NaN

Current System Parameter Report
Available on request.

Proposed farm System Whole Farm Nutrient Budget

Abe and Anita De Wolde
WoldWide 5
Client reference: 60876935
Farm name: WoldWide 5 Proposed - consnt# - xtraeff copy 1 (16/17)

Mark Crawford
Ravensdown
Dunedin

Farm Nutrient Budget - Whole farm

	N	P	K	S	Ca	Mg	Na
	(kg/ha/yr)						
Nutrients added							
Fertiliser lime & other	164	56	36	70	19	6	2
Rain/clover N fixation	64	0	2	4	2	5	23
Irrigation	0	0	0	0	0	0	0
Supplements imported	61	11	27	8	5	5	3
Nutrients removed							
As products	79	13	19	4	17	2	6
Exported effluent	0	0	0	0	0	0	0
As supplements	0	0	0	0	0	0	0
To atmospheric	71	0	0	0	0	0	0
To water	47	0.7	24	89	94	4	16
Change in internal pools							
Plant material	7	1	3	1	0	0	0
Organic pool	81	9	2	-13	1	0	0
Inorganic mineral	0	2	-18	0	-3	-4	-5
Inorganic soil pool	3	42	35	0	-82	14	10

Proposed Farm System Nutrient Loss Indicators

P report

Block P

Client reference: 60876935
Farm name: WoldWide 5 Proposed - consnt# - xtraeff copy 1 (16/17)

Dunedin

Block Phosphorus

Block name	Total P lost (kg P/yr)	P lost (kg P/ha/yr)	P loss categories		
			Soil	Fertiliser	Effluent
Brax_4a.1 Effluent	6	0.3	Low	Low	Low
Brax_4a.1 Eff Tile	29	0.6	Low	Low	Low
Tuap_6b.2 Effluent	9	0.2	Low	Low	Low
Brax_4a.1 Non Eff	8	0.2	Low	Low	n/a
Tuap_6b.2 Non Eff	9	0.1	Low	Low	n/a
Upuk_8a.1 Non Eff	5	0.4	Low	Low	n/a
Upuk_8a.1 Non Eff dev	12	0.4	Low	Low	n/a
Riparian 1	1	0.1	n/a	n/a	n/a
Tuap_6b.2 FBt>FBt	3	0.3	n/a	n/a	n/a
Tuap_6b.2 Past>FBt	3	0.3	n/a	n/a	n/a
Tuap_6b.2 FBt>YG	2	0.2	n/a	n/a	n/a
Brax_4a.1 Past>FBt	2	0.7	n/a	n/a	n/a
Brax_4a.1 FBt>FBt	2	0.8	n/a	n/a	n/a
Brax_4a.1 FBt>YG	2	0.5	n/a	n/a	n/a
Other farm sources	138				
Whole farm	231	0.7			

N report

Farm N

Abe and Anita De Wolde
WoldWide 5
Client reference: 60876935
Farm name: WoldWide 5 Proposed - consnt# - xtraeff copy 1 (16/17)

Mark Crawford
Ravensdown
Dunedin

Farm Nitrogen

	Units	Benchmark farm	Current farm
Inputs (farm average)			
Clover N	kg N/ha/yr		62
Fertiliser N	kg N/ha/yr		153
Other N added	kg N/ha/yr		74
Indices			
Average N loss to water	kg N/ha/yr		47
includes N lost as effluent	kg N/ha/yr		0
N_2O emissions	kg N/ha/yr		16.6
For pastoral area of farm:			
Farm N surplus	kg N/ha/yr		209
N conversion efficiency	%		28

Block N

Abe and Anita De Wolde
WoldWide 5
Client reference: 60876935
Farm name: WoldWide 5 Proposed - consnt# - xtraeff copy 1_2 (16/17)

Mark Crawford
Ravensdown
Dunedin

Block Nitrogen

Block name	Total N lost (kg N/yr)	N lost to water (kg N/ha/yr)	N in drainage * (ppm)	N surplus (kg N/ha/yr)	Added N ** (kg N/ha/yr)
Brax_4a.1 Effluent	518	28	8.8	219	238
Brax_4a.1 Eff Tile	1384	29	8.8	219	238
Tuap_6b.2 Effluent	2947	50	**13.9**	222	233
Brax_4a.1 Non Eff	860	26	8.2	187	209
Tuap_6b.2 Non Eff	3306	46	**12.9**	192	209
Upuk_8a.1 Non Eff	1134	83	**20.3**	174	169
Upuk_8a.1 Non Eff dev	2631	90	**21.9**	184	169
Riparian 1	39	3	N/A		
Tuap_6b.2 FBt>FBt	837	84	**20.9**	129	118
Tuap_6b.2 Past>FBt	719	72	**18.2**	141	118
Tuap_6b.2 FBt>YG	510	51	**12.9**	53	127
Brax_4a.1 Past>FBt	130	43	**12.1**	126	118
Brax_4a.1 FBt>FBt	158	53	**14.3**	113	118
Brax_4a.1 FBt>YG	94	31	8.9	52	127
Other farm sources	669				
Whole farm	15937	42			
Less N removed in wetlands	0				
Farm output	15937	47			

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

** Sum of fertiliser and external factory effluent inputs.

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

Proposed System Pasture Production, Other Values and Effluent Report

Abe and Anita De Wolde
WoldWide 5
Client reference: 60876935
Farm name: WoldWide 5 Proposed - consnt# - xtraeff copy 1_2 16/17]

Mark Crawford
Ravensdown
Dunedin

Block Pasture

Block name	On-farm fresh pasture intake (kg DM/ha/yr)	Estimated utilisation (%)	Supplements removed (kg DM/ha/yr)	Pasture growth (kg DM/ha/yr)
Brax_4a 1 Effluent	13051	85	0	15354
Brax_4a 1 Eff Tile	13051	85	0	15354
Tuap_6b 2 Effluent	13051	85	0	15354
Brax_4a 1 Non Eff	13051	85	0	15354
Tuap_6b 2 Non Eff	12705	83	0	15354
Upuk_8a 1 Non Eff	9519	77	0	12283
Upuk_8a 1 Non Eff dev	8782	72	0	12283
Riparian 1	0	0	0	0
Tuap_6b 2 FBt>FBt	0	0	0	0
Tuap_6b 2 Past>FBt	496	83	0	595
Tuap_6b 2 FBt>YG	10338	85	0	12163
Brax_4a 1 Past>FBt	496	83	0	595
Brax_4a 1 FBt>FBt	0	0	0	0
Brax_4a 1 FBt>YG	10418	85	0	12257

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

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

Abe and Anita De Wolde
WoldWide 5
Client reference: 60876935
Farm name: WoldWide 5 Proposed - consnt# - xtraeff copy 1 [16/17]

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Other values for farm - WoldWide 5 Propose

Milking herd size (peak cows/ha grazed)	2.8
Milk solids (kg/ha grazed)	1329
Milk production per cow (kg milk solids / cow)	452.8
Default calving date	26 August
Total liveweight brought (kg/ha grazed)	3073
Total liveweight reared (kg/ha grazed)	76
Total liveweight sold (kg/ha grazed)	3089
No fertiliser costs entered	
GHG: Allocation to milk	0.82
Dairy stock rate (RSU)	7652
Dairy replacements stock rate (RSU)	0
Beef / dairy grazing stock rate (RSU)	939
Sows per ha	NaN

Client reference: 60876935
Farm name: WoldWide 5 Proposed - consnt# - xtraeff copy 1 [16/17]

Dunedin

Effluent Report

	Units	Current farm
Current effluent area		
Area of effluent blocks	ha	107
% of pastoral farm area	%	39
Area of farm to apply effluent to achieve rates of:		
150 kg N/ha/yr	ha	55
Maintenance K	ha	342
100 kg K/ha/yr	ha	89
Source of N applied to effluent blocks		
Average of N applied to effluent blocks	kg N/ha/yr	58
Effluent from farm dairy	%	83
Effluent from wintering pad	%	0
Effluent from feed pad	%	0
Average fertiliser N	kg N/ha/yr	160
Average other elements	kg N/ha/yr	12

Proposed System Parameter Report

Available on request.

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Farm Scenario Plan

Current and Proposed System Nutrient Budgets for Effluent consent with Winter Barn Example

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

60877676
WOLDWIDE FOUR LIMITED
C/- A & JJ DE WOLDE
104 SHAWS TREES ROAD; RD 3 WINTON 9783
07/08/2018
Reviewed by Andrée Callaghan (CNMA)

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Executive Summary

Woldwide Four farm Ltd, have requested OVERSEER® Nutrient Budgets to model current and proposed farm system estimated nutrient losses for their dairy farm. The purpose of this work is to support a renewal of their effluent discharge consent. The proposed nutrient budget also evaluates an expansion of the dairy farm with an addition of land from a block purchased (63.3 ha). An additional example is provided for a wintering barn that is to be established later on. The 349.3 ha farm is located at 805 Mayfield Road, which includes the 78.8 ha support block located at 477 Gladfield Rd, Heddon Bush, 19 km west north west from Winton Township, 40 km nor-north west from Invercargill city and 36 km from the south west coast (Orepuki). The property is a dryland dairy farm, milking approximately 810 cows (consented numbers 850).

Current (combined) Farm System

Average Nitrogen lost from the root zone, calculated from the combined current farm systems modelled, using OVERSEER® Nutrient Budgets (OVERSEER) 6.3.0 was **11,678 kg N/year** or **30 kg N/ha/year.**

Average Phosphorus lost from the combined current farm systems modelled using OVERSEER® Nutrient Budgets (OVERSEER) 6.3.0 was **338 kg P /year** or **0.9 kg P/ha/year.**

Proposed Farm System

Average Nitrogen lost from the root zone, calculated from the proposed farm system modelled, using OVERSEER® Nutrient Budgets (OVERSEER) 6.3.0 was **11,298 kg N/year** or **27 kg N/ha/year.**

Average Phosphorus lost from the proposed farm system modelled using OVERSEER® Nutrient Budgets (OVERSEER) 6.3.0 was **343 kg P /year** or **0.8 kg P/ha/year.**

Winter Barn Example

Average Nitrogen lost from the root zone, calculated from the proposed farm system modelled, using OVERSEER® Nutrient Budgets (OVERSEER) 6.3.0 was **11,142 kg N/year** or **27 kg N/ha/year.**

Average Phosphorus lost from the proposed farm system modelled using OVERSEER® Nutrient Budgets (OVERSEER) 6.3.0 was **368 kg P /year** or **0.9 kg P/ha/year**

Factors associated with the farm system that pose risk to N loss include; artificial soil drainage and fodder crops. Comparatively, the gley soils, with a high buffering capacity to leaching (high PAW and deep topsoil's) reduce the risk of leaching.

The additional land modelled in the proposed farm system, enables the property, at an increased milking dairy cow numbers (consented), reduced supplements imported, and reduced effluent and non effluent N fertiliser to reduce the overall risk of N and P losses.

The farm is located in a zone with 'moderate to high' risk nitrate levels. The physiographic zone point to high nitrates in ground water, nitrate accumulation and artificial drains as being risk factors. The proposed farm system, as modelled by OVERSEER®, currently has a number of strategies to reduce the risk of Nitrogen loss to water. These include; an effluent system with low application depths and adequate area, a reduced stocking rate, and continued use of crop to minimise soil damage over the early spring period. Riparian strip planting to capture sediment from crops and laneways through adequate buffer zones plus optimal soil test phosphate levels, are all practices which will reduce the risk of P loss. Ensuring the lowest volume applications and depths are applied to the artificially drained soils, with none applied at the highest risk times are further mitigations that are recommended.

The associated parameter reports are available in a separate document.

Overseer Nutrient Budget Version 6.3.0 have been used to create the nutrient budgets presented in this report.

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

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.....

Mark Crawford

Farm Environmental Consultant

Dated 7th August 2018

General

Aim and Purpose of Farm Scenario Plan

Woldwide Four Ltd, has requested a current and proposed OVERSEER® Nutrient Budgets to reflect the current and proposed estimated nutrient losses from their dairy farm plus support block as a renewal of their effluent discharge consent, with the addition of 63.3 ha of a 136.3 ha neighbouring sheep farm. An additional example of a wintering barn was included to help show the likely effects on nutrient losses, using Woldwide 4 as the example given it is typical of a representative dairy farm in Southland, with a run off used to winter cows. The farm is at 805 Mayfield Road, plus a 78.8 ha support block at 477 Gladfield Rd, Heddon Bush, 19 km west north west from Winton Township, 40 km nor-north west from Invercargill city and 36 km from the south west coast (Orepuki). The property is a dryland dairy farm, milking approximately 810 cows (consented numbers 850).

The total titled area of the property is 346.2 ha, and the GIS map with paddock areas calculates to 349.3 ha. As a result, the farmed area of 349.3ha has been modelled as the total farm area in Overseer. In this figure there is 3.7 ha of riparian edges. The effective area is calculated at 337.5 ha, close to the owner stated 340 ha of paddocks. In addition there is an estimated 8.1 ha of non-effective area, comprising of sheds, lanes, feed pads and yards. The property is of flat to gently rolling topography (modelled flat).

Soil types on the farm are all homogenous and are Braxton_4a.1, Silt Loam over clay, (Orthic Gley soil, Poorly drained, PAW (plant available water) to 60 cm of 147.6 mm); there is a small area of Drummond soil 0.3 ha which is not modelled and incorporated as a Braxton soil. The Braxton soil is a deep to moderately deep soil with a heavier silty loam texture, this means this soil has a lower risk of nitrogen leaching.

Overseer modelling of the system has been undertaken in accordance with the Overseer 6.3.0 "best practice data input standards" and has been reviewed by a certified nutrient management advisor.
The following report summarises the respective Overseer 6.3.0 nutrient budgets and key assumptions made.

Property Details

Location/address	805 Mayfield Road, plus 477 Gladfield Rd Heddon Bush 9783 RD 3, Winton
Legal Description	Part Lot 2 Deposited Plan 4262 and Lot 7 and Lot 12 Deposited Plan 152, Lot 10 Deposited Plan, Lot 11 and Lot 11A Deposited Plan, Lot 24 Block III Deposited Plan 210
Total area (ha)	346.2 ha titled total farmed land calculated at 349.3 ha including roadside reserves Effective area estimated at 337.5 ha, ***includes*** 78.8 ha support block at Gladfield
Owners	A & JJ DE WOLDE
Contact details	
Phone	(03) 2258344 mobile (027) 2272537
Email	abe@woldwide.nz
Farm Type	Seasonal supply Dairy farm

Current Farm System Analysis

Climate

Climate data for the property has been sourced from Overseer's Climate Station Tool data and has been entered as rainfall – 967 mm/year, PET – 716 mm/year and average temperature – 9.8 ^{o}C, based on location close to latitude/longitude -46.94050; 168.108300 (transect 23 co-ordinates). For the Gladfield Rd support block data has been entered is as rainfall – 926 mm/year, PET – 711 mm/year and average temperature – 9.7 ^{o}C, based on location close to latitude/longitude - 46.094050; 168.108300 (transect GF 4 co-ordinates). Climate data has been modelled as per Overseer BPDIS.

Description of Current Farm System

The 349.3 ha property is operated as a seasonal dryland dairy farm ***including*** support block of 78.8 ha, calving 810 cows (850 consented) and peak milking 775 (540 & 500 kg LW) Friesian cows. Milk production averaged for the last five years is 410,452 kg MS/year (510 kg MS/cow). Cow numbers are shown in the table below. All cows are wintered off the farm platform for June and July and are instead wintered on the Gladfield block crops. In addition, the first calving heifers (180 and at 500 kg LW) are wintered on the Gladfield block from , when they come back from grazing off in May, with all cows brought back to the dairy platform in mobs over the month of August. Mean calving date is the 20th August for the main herd, with the first calvers a week earlier on the 12th of August.

The dry-off date is the 1st of June and the 25th of May for the cows and first calving heifers. All replacements (180) are grazed off-the platform until they return as in calf R2 heifers in May. Cows are milked once a day or 16 hourly occasionally over autumn drying off (modelled never) and all calves are fed colostrum and waste milk.

Friesian Bulls (20) at 700 kg LW are run with the herd over December and January.

The 78.8 ha support block is used to winter the 630 dairy cows, as well as the in calf heifer replacements and cuts silage to be exported and used to feed out on the dairy platform and crops.

Supplements

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

- 260 T DM Barley grain and 260 T DM distilled Brewers grain imported and used over the season through the milking shed (averaged amount of 520 T DM grain split in half between grain types).
- 66 T DM of Molasses imported and fed through the shed.
- 409 T DM of Palm Kernel Expeller (PKE); 50 % fed through dairy shed and 50 % fed across pastoral areas for dairy cows.
- 253 T DM of baleage purchased on average and fed to dairy cows on blocks.

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

- Approximately 365 T DM of grass silage; made on the support block and fed evenly across pastoral blocks to dairy cows.
- 115 T DM of baleage made on the support block and fed mostly to dry cattle on crop
- 50 T DM silage made on the support block and stored, which forms a small part of the silage used on the dairy platform.

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Farm System - Dairy			
Herd Type/Breed	Friesian	**Total Milk Solids (kg/year)**	410,452
Seasonal Supply	Seasonal	**Winter milk**	No
Number of cows	810 at calving	**Milk Solids (kg/cow)**	510 (Overseer calculated)
Stocking rate (cows/ha)	3.1 (3.1/ha grazed)*	**Milk Solids (kg/ha)**	1584/ha platform (1574/ ha grazed)*
Other Information			
Winter off milking platform		Yes, all cows and in calf heifers on support block	
Stock grazed off (%)		100 % (including first calvers) in June and July, returning August	
Young stock reared off milking platform		Yes from weaning until before winter before wintered on support area (May onwards)	
Imported Feeds	520 T DM Grain (50 % each Barley and distilled brewers grain), fed through shed to milking cows, 66 T DM of Molasses to dairy cows through shed; 409 T DM of PKE fed 50 % through milking shed and 50 % evenly on pastoral areas to dairy cows.; 223 T DM Baleage purchased and fed on pastoral blocks to dairy cows and 30 T DM silage fed from storage. Total 1248 T DM		

		Current				
Cows	Av weight kg LW	540 kg LW main herd; 500 kg LW for first calving heifers				
	Median calving Date	20th August for main Herd, 12th August for Heifers				
	Dry-Off date	1st June for main herd and 25th May for Heifers				
	Peak Milk (1 Dec)	775 cows				
	Cow Numbers		**No cows Dairy Herd & first calvers**	**In calf Heifers**	**Dry cows & Bulls**	**In shed feeding (Y/N)**
		Jul	0 & 20	160	630	N
		Aug	250 & 170	10	380	Y
		Sept	625 & 180		0	Y
		Oct	620 & 175		0	Y
		Nov	605 & 170		0	Y
		Dec	605 & 170		0 & 20	Y
		Jan	600 & 170		0 & 20	Y
		Feb	600 & 165		0	Y
		Mar	590 & 165		0	Y
		Apr	590 & 160		0	Y
		May	590 & 120	180	35	Y
		Jun	0	180	630	N
	Production kg/MS	410,452				
	Lactation length	288 days				
	Once a day Milking (e.g half season, dry off, never)	Never				
	Calves fed milk powder (Y/N)	No				
Supplements Imported		**Amount (T/DM)**	**Fed (e.g. paddock, shed, trough, crop)**			
	Barley & distillers grain and Molasses	260 & 260 & 66	Fed to dairy milking cows through shed			
	Silage/Baleage	30 & 223	From storage and fed to dairy cows on pastoral blocks			
	Other PKE	409	Fed to dairy cows on pastoral blocks (204) and through shed (205)			
Supplements Made		**Amount (T/DM)**	**Ha**	**Fed or stored?**		
	Silage/Baleage	365 & 50 T DM Silage & 115 T DM baleage	40.8 ha cut and carry block	Made and fed out evenly across dairy cows on pastoral blocks, or stored. Baleage fed to dry cattle on crop.		
	Fodder beet	25	24	Fed to replacements and dry cows in May, June July and August		
Effluent	Type/system	Holding Pond system after stone trap and applied via K Line pods.				
	Application Depth mm	Application depth at < 10 mm per application (modelled < 12 mm) from August to May (spray infrequently as not modelling June or July to receive effluent)				
Replacements	On/off farm when & what age	Off farm from weaning, back to support block as in calf heifers in May.				

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

Fertiliser

Fertiliser applications have been modelled from Ravensdown past sale records and farmer information, and are based on average monthly rates. Ammo 36 is applied to the whole farm in August at rates of 120 kg/ha. Urea is then applied in October, December, February and March behind the cows at rates of 50 kg/ha. There are liquid applications of Nitrogen in September and April at 100 L/ha at the equivalence of 18 Kg N/ha made with Express a gibberellic acid. The Effluent blocks receive less nitrogen with no urea applications in December and February and only 40 kg urea/ha in October. Maintenance applications of Potash Superphosphate and Flexi N are made in November and January, whilst the effluent areas receive one application of Superphosphate and Flexi N in November as fertility levels are higher. The Gladfield Rd block receives two applications of a Cropmaster DAP, Ammo 36 or sulphate and potassium chloride mix in spring (October and post-harvest December and March) plus a urea potassium chloride mix in January. The total fertiliser nitrogen applied is 222 and 169 kg N/ha/year for the Non effluent and Effluent farm blocks and 195 kg N/ha across all blocks (whole property) on average. Note that a couple of other grazing areas receive no fertiliser (calf blocks, house paddocks and grass laneways etc)

Non Effluent block:

Month	Fertiliser	NPKS nutrient rating (kg/ha)
August	Ammo 31	43-0-0-12
September	Urea	18-0-0-0
October	Urea	23-0-0-0
November	Potash Superphosphate and FlexiN	25-14-19-17
December	Urea	23-0-0-0
January	Potash Superphosphate and FlexiN	25-14-19-17
February	Urea	23-0-0-0
March	Urea	23-0-0-0
April	Urea (liquid)	18-0-0-0

Effluent block:

Month	Fertiliser	NPKS nutrient rating (kg/ha)
August	Ammo 31	43-0-0-12
September	Urea	18-0-0-0
October	Urea	18-0-0-0
November	Superphosphate and FlexiN	25-13-0-16
January	Urea	23-0-0-0
March	Urea	23-0-0-0
April	Urea (liquid)	18-0-0-0

Gladfield Support Block (RO)

Month	Fertiliser	NPKS nutrient rating (kg/ha)
October	Crop DAP & Ammo 36 & KCl	71-15-22-10
December	Crop DAP & Ammo sulphate & KCl	57-15-22-10
January	Urea and KCl (Pot. Chloride)	60-0-60-0
March	Crop DAP & Ammo sulphate & KCl	31-7-37-8

Soil Test Results

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

Soil tests	Olsen P	QTK	QT Ca	QT Mg	QT Na	Org S
Brax_4a.1 Non Effluent blocks	38	10	14	38	12	10
Brax_4a.1 Effluent blocks	50	13	16	46	14	10
Support Block (RO)	31	7	11	24	10	11

Pasture Production

The predominant pasture species on the dairy farm is ryegrass/white clover. Annual pasture production has been weighted by relative productivity as 1 between dairy blocks, and 0.8 and 0.5 for the "other areas" grazing blocks on the platform and support block respectively, these being typically areas for calves, small paddocked areas beside houses which are grazed to a lesser extent than main platform paddocks:

Block	Relative productivity	T DM/ha/year
Dairy pastoral areas	1.0	15.2
Brax_4a.1 Non Eff Calf Grazing	0.8	12.1
Brax_4a.1 RO	0.5	7.6
Cut & carry block RO	n/a	12.2

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

Structures

There are no structures on the property.

Fodder Cropping

A fodder cropping cycle of Pasture to Fodder Beet (two years in beet) before being re sown into pasture in October is practiced for approximately 24 ha or 30 % of the support block so block history is entered as 7 years. Crops are modelled as crop blocks and information entered is;

- Fodder beet are sown in October after full cultivation, with dry cows and replacements grazed over May, June, July, and in August before calving.
- Sown with Cropmaster DAP, Ammonium sulphate, Potassium chloride plus boron and salt mix, NPKS rating (47-30-70-26) and a further application of Urea/potassium chloride/Ammonium sulphate made in January (NPKS rating 47-0-20-10).
- Yields are averaged at 25 T DM/ha and grazed in situ.

Effluent

Effluent has been modelled as using Overseer default values, and calculated as applying 110 kg N/ha/year (liquid) over the 57 ha (61.7 ha total area less 8 % areas not receiving effluent; calculated to 57 ha, owner stated 56 ha) effluent area, plus 10 kg N/ha/year (solids) applied from pond sludge to the Non effluent areas. Currently, the effluent system has effluent gravity fed into a stone trap and sump then into a holding pond, from which the effluent is pumped through K Line pods applying liquids at depths of 10 mm per application or less by a pulsation system (modelled < 12 mm). The current holding pond is estimated to hold 3801 cubic metres of effluent (owner stated). Liquid effluent is sprayed during the months of August to May inclusive (modelled infrequently spray so as no effluent is modelled to be applied in July). Sludge from the pond is modelled to be spread on all main platform areas in December every year by a slurry tanker.

Artificial Drainage

There are some areas identified by the owner having known tile and mole drains, which were calculated separately and having 90 % of paddock area effectively drained. All of the Braxton soils on the purchased sheep block were tile and mole drained, at the same level of effectiveness

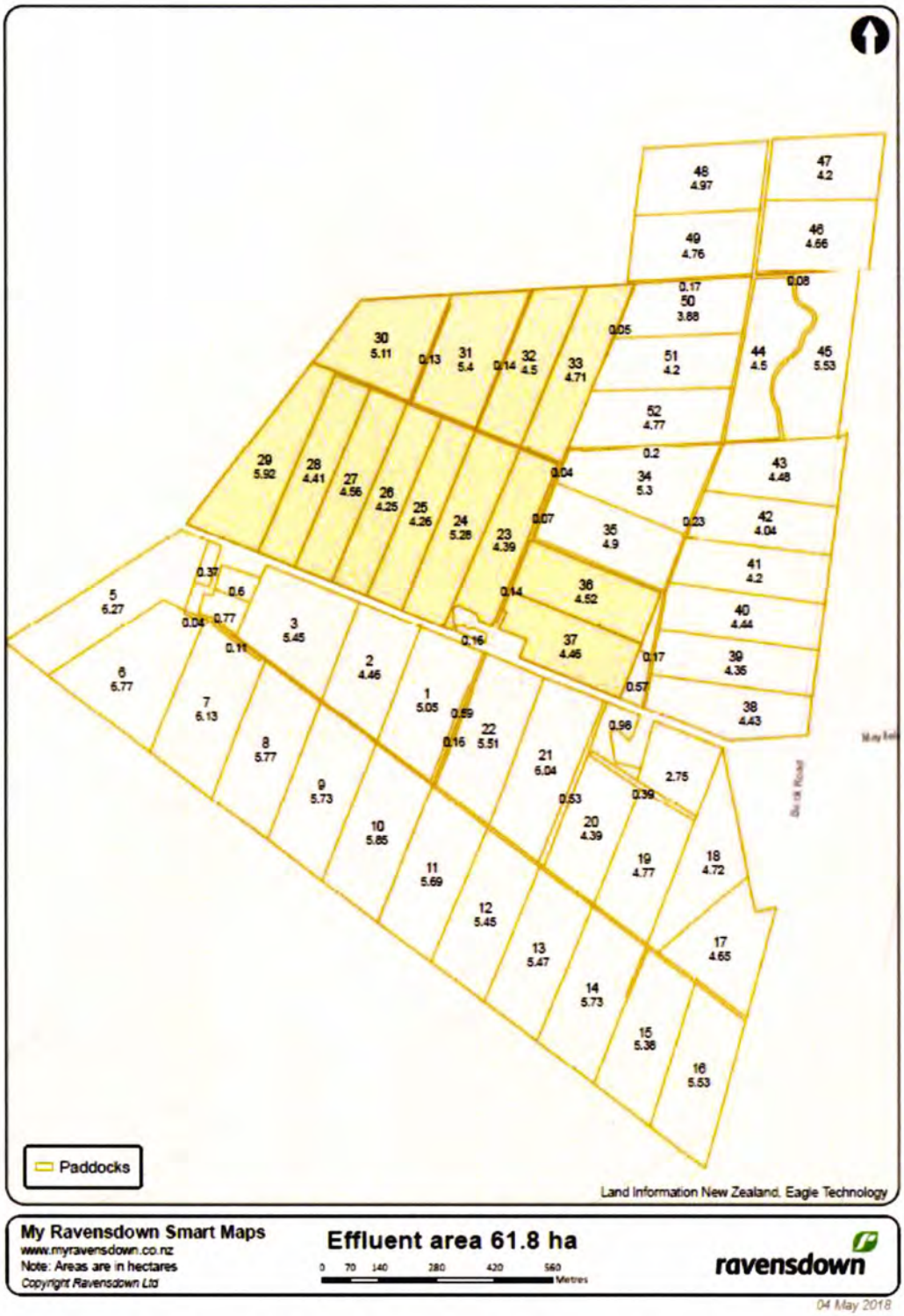
Management Unit details and Soil Information: Table 1

Block Name	Stock	Block Type	Soil Order	Drainage Class	Effluent	PAW (0-60cm)	Effective Area (ha)
Brax_4a.1 Effluent	Dairy	Pastoral	Orthic Gley	Poorly drained	Liquid	148.7	25.6
Brax_4a.1 Eff Tile	Dairy	Pastoral	Orthic Gley	Poorly drained	Liquid	148.7	36.1
Brax_4a.1 Non Eff	Dairy	Pastoral	Orthic Gley	Poorly drained	Pond Sludge	148.7	120.8
Brax_4a.1 Non Eff Tile	Dairy	Pastoral	Orthic Gley	Poorly drained	Pond Sludge	148.7	71.5
Brax_4a.1 Non Eff Calf Grzng	Dairy	Pastoral	Orthic Gley	Poorly drained	n/a	148.7	5.2
Brax_4a.1 Cut&Carry (RO Gladfield Blk)	Cut & carry	Crop	Orthic Gley	Poorly drained		148.7	40.8
Brax_4a.1 Past>FBt (RO Gladfield Blk)	Dry stock	Crop	Orthic Gley	Poorly drained		148.7	12.0
Brax_4a.1 FBt>FBt (RO Gladfield Blk)	Dry stock	Crop	Orthic Gley	Poorly drained		148.7	12.0
Brax_4a.1 FBt>Past (RO Gladfield Blk)	Dry stock	Crop	Orthic Gley	Poorly drained		148.7	12.0
Brax_4a.1 RO (Other grazing)	Dry stock	Pastoral	Orthic Gley	Poorly drained		148.7	1.5
Riparian 1							3.7
Non-Productive area							8.1
Total							**349.3**

*PAW Landcare S maps calculated

Note shaded areas are the Galdfied Support block (or run off), totally 78.3 ha, with 0.5 ha non productive

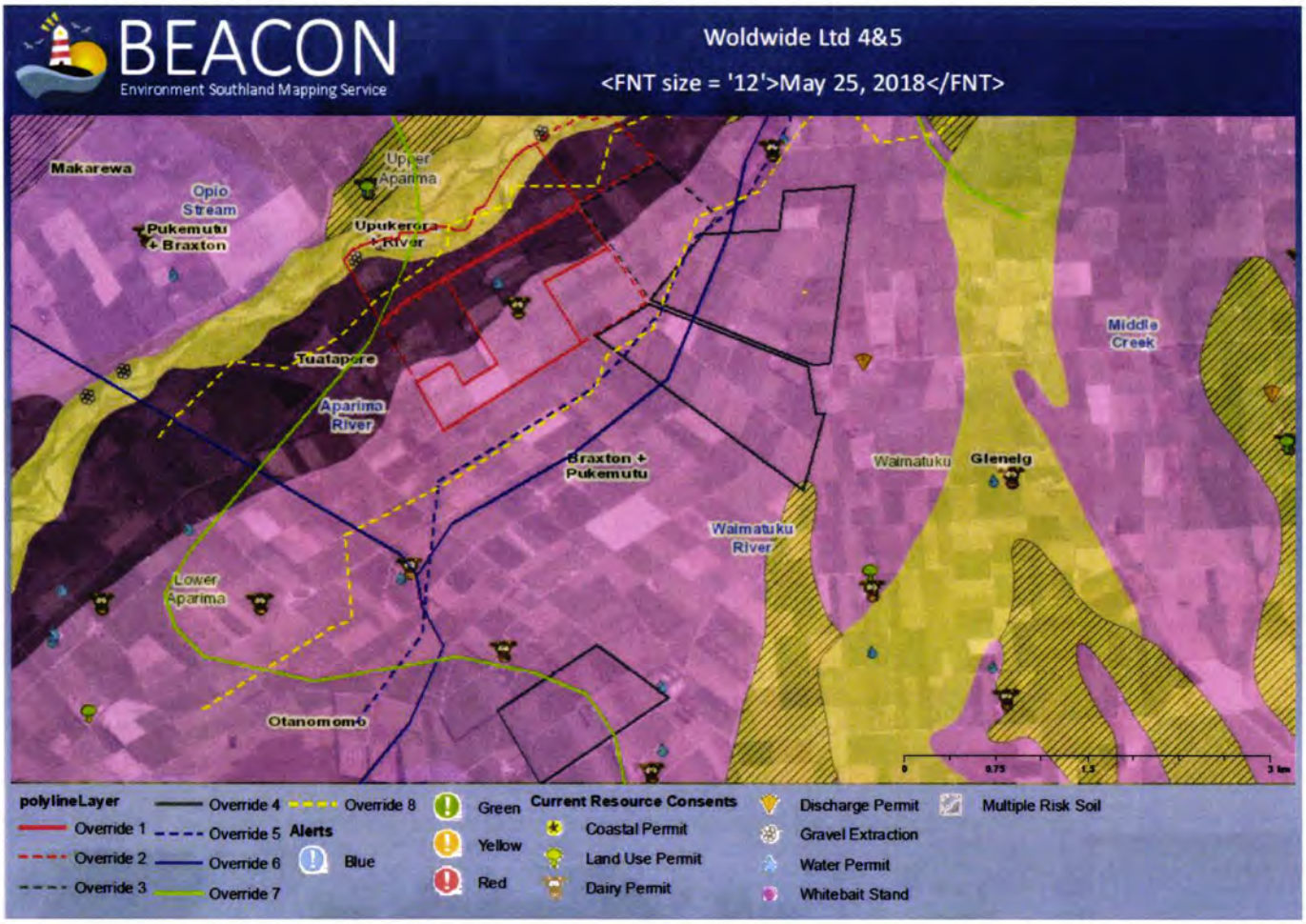
Land Management Unit Map and Farm Map



Farm map with Effluent block shaded in yellow, 61.7 ha in total less estimated setback areas based on 92 % equates to 57 ha. Total area with Gladfield support block is 349.3 ha, estimated pastoral area of 337.5 ha.

Title area of 346.2 ha and soils, actual farm area included in paddocks calculated to be 369.3 ha

Nitrate Levels and Physiographic Zonal Environment Southland Beacon Maps



Physiographic zones are Central plains (Braxton plus Pukemutu soils) brown oxidising (Tuatapere) and Riverine (Upukerora) soils (pink, dark and light yellow along river), with the blue dotted line denoting the two different sub catchments of Waimatuku river and the main Coastal catchment plus the Aparima river and the Aparima major catchment. The solid blue line denotes the three different ground water catchment zones, the lower Aparima and Upper Aparima with subsoils of quaternary gravel on top of tertiary sediment, plus the Waimatuku zone of alluvial gravel. The Green line separates minor to moderate (LHS) and moderate to high (RHS) nitrate levels with a hot spot situated nearby at drinking water threshold (not shown) nitrate levels.

The yellow dotted line is the division between the spring fed and lowland hard bed surface water zones.

The farm dairy effluent (FDE) risks are associated with the soil types, with the Braxton being a risk with artificial drainage and coarse soil structure, and the Tuatapere and Upukerora being well drained flat land and other well drained but very stony flat land.

The farms are Woldwide 4 is in dark green and the red line is the boundary for Woldwide 5. The dotted lines are the additions for the proposals.

Nutrient related resource Consents held by the Landowner

Resource Consent No.	Condition No.	Condition Text	Resource consent expiry date
Consent No: 205147	4	The land disposal system is limited to the following: (i) a maximum depth of application of 8 mm for each individual application; (ii) a minimum return period of 28 days between applications; (iii) a maximum combined depth of application of 25 mm per year to any land area; and (iv) a minimum land area of 4 hectares/100 cows for the dairy shed effluent	2 April 2018
	7	The amount of dairy shed effluent disposed of onto land shall not exceed that from 850 cows.	
	8	There shall be no surface run-off/overland flow, ponding or contamination of water resulting from the application of the dairy shed effluent to pasture. To give effect to this condition, the consent holder shall not apply effluent to land when the soils are at or above field capacity. Moisture content is to be determined by either actual monitoring on site by a method to be approved by the Council's Compliance Manager, or by reference to the appropriate Council monitoring site. (b) The land disposal system shall be operated and maintained to ensure that there is no offensive or objectionable odour beyond the property boundary, or any spray drift into or beyond the buffer zones specified in Condition 5. (c) The maximum loading rate of nitrogen onto any land area shall not exceed 150 kg of nitrogen per hectare per year from dairy shed effluent and nitrogen fertiliser combined.	
	9	The consent holder shall provide at least 3,000 m^3 of effluent storage for the purpose of: (i) avoiding irrigation of effluent when soils are at or above field capacity; (ii) providing a contingency measure when the irrigation system is inoperative; and/or (iii) for primary treatment when it is necessary for the proper operation of the effluent disposal system	
	10	The consent holder shall prepare and comply with a Farm Environmental Management Plan. The plan shall: ➢ specify and implement a nutrient budgeting system for the property; ➢ provide for the management of effluent disposal to avoid applications when soils are at or above field capacity; ➢ if relevant, provide for the operation and management of any feedlot and/or wintering pad; ➢ include the provision for monitoring application rates to ensure the consent requirements are being met;	

		➢ include the monitoring requirements specified in this consent; and address ancillary matters such as protecting well-head(s) from contamination; preventing leachate from any silage pits entering water, including groundwater; preventing soil damage; controlling runoff from lanes; and preventing stock access to watercourses on the property	

Proposed Farm System Analysis

Description of Proposed Farm System

The farm dairy platform will be increased by including 63.26 ha of the purchased sheep block. The effluent area and cattle numbers remaining the same. The soils now include 23.5 ha of Tuatapere _6b.2, Silt Loam, (Orthic Melanic soil, Well drained, PAW (plant available water) to 60 cm of 81.2 mm) The decision if cropping is to remain on the support block, with the cows and heifers wintered on crop was made to keep it on the support block rather than the new blocks as the losses are likely to be higher by shifting the cropping to the Tuatapere soils as part of the new block, in addition the block history will change in years. There will still be 24 ha of fodder beet grown.

The 394.1 ha property will be operated as a dryland dairy farm, calving 850 cows and peak milking 830 (540 & 500 kg LW) Friesian cows. Milk production aimed for is the same at 421,000 kg MS/year (507 kg MS/cow). Cow numbers are shown in the table below. All cows are wintered off-farm for June and July on the Gladfield block crops plus the first calving heifers (190 and at 500 kg LW), which come back from grazing off in May, with all cows brought back in mobs over the month of August. Mean calving date is the 20th August for the main herd, with the first calvers a week earlier on the 12th of August.

The dry-off dates and other production factors remain the same as before. That is the dry-off date is the 1st of June and the 25th of May for the cows and first calving heifers. All replacements (190) are grazed off-the platform until they return as in calf R2 heifers in May. Cows are milked once a day or 16 hourly occasionally over autumn drying off (modelled never) and all calves are fed colostrum and waste milk.

Friesian Bulls (20) at 700 kg LW are run with the herd over December and January.

The 78.8 ha support block is used to winter the 660 dairy cows, as well as the in calf heifer replacements and cuts silage to be used on the dairy platform

	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	LW (kg)
Dairy cows		260	660	655	650	650	635	630	620	615	590		540
First calving heifers	20	170	190	185	180	180	180	175	175	170	130		500
Dairy grazers (milking cows)	660	400									35	660	540
Dairy grazers (replacements)											190	190	480
Dairy grazers (replacements)	170	20											500
Bulls						20	20						700

Supplements

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

- 200 T DM Barley grain and 200 T DM distilled Brewers grain imported and used over the season through the milking shed (averaged amount of 400 T DM grain split in half between grain types).
- 66 T DM of Molasses imported and fed through the shed.
- 309 T DM of Palm Kernel Expeller (PKE);205 T DM fed through the shed, with the remainder fed on pastoral blocks

Because of the reduced stocking given the larger area, imported supplementary feed has reduced to the above amounts to reconcile the pastoral productivity between the two systems.

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

- Approximately 365 T DM of grass silage; made on the support block and fed evenly across pastoral blocks to dairy cows.
- 115 T DM of baleage made on the support block and fed to dry cattle on crop or dry cattle pastoral blocks
- 50 T DM silage made on the support block and stored, which forms a small part of the silage used on the dairy platform (30 T DM from storage).

Fodder Cropping

This remains the same between the two systems modelled. The cropping remains on the Gladfield block as the losses are likely lower than using the new block, which can be improved by grass to grass renewal.

Fertiliser

This changes between the two systems modelled. This is given the reduced need given the lower pastoral productivity (a reduction of 1 T DM/ha), however less nitrogen is available from supplements and more is supplied by effluent, this equates to roughly a reduction of 30 kg of N/ha across all blocks. The total fertiliser nitrogen applied is now 194 and 137 kg N/ha/year for the Non effluent and Effluent farm blocks and 176 kg N/ha across all blocks (whole property) on average. The Gladfield run off block is the same as before.

Non Effluent block:

Month	Fertiliser	NPKS nutrient rating (kg/ha)
August	Ammo 31	43-0-0-12
September	Urea	18-0-0-0
October	Urea	23-0-0-0
November	Potash Superphosphate and FlexiN	25-14-19-17
December	Urea	18-0-0-0
January	Potash Superphosphate and FlexiN	25-14-19-17
February	Urea	9-0-0-0
March	Urea	18-0-0-0
April	Urea (liquid)	18-0-0-0

Effluent block:

Month	Fertiliser	NPKS nutrient rating (kg/ha)
August	Ammo 31	43-0-0-12
September	Urea	18-0-0-0
October	Urea	18-0-0-0
November	Superphosphate and FlexiN	25-13-0-16
March	Urea	23-0-0-0
April	Urea	9-0-0-0

Effluent

Effluent has been modelled as using Overseer default values, and calculated as applying 116 to 117 kg N/ha/year (liquid) over the 57 ha (61.7 ha total area less 8 % areas not receiving effluent; calculated to 57 ha, owner stated 56 ha) effluent area, plus 9 kg N/ha/year (solids) applied from pond sludge to the Non effluent areas. The effluent system remains the same as what was detailed in the "current" farm system analysis.

Pasture Production

The predominant pasture species on the dairy farm is ryegrass/white clover. Annual pasture production has been weighted by relative productivity as 1 between dairy blocks, and 0.8 and 0.5 for the rougher grazing blocks on the platform and support block respectively:

Block	Relative productivity	T DM/ha/year
Dairy pastoral areas	1.0	14.2
Brax_4a.1 Non Eff Grazing	0.8	11.3
Brax_4a.1 RO	0.5	7.1
Cut & carry block Gladfield RO	n/a	12.2

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

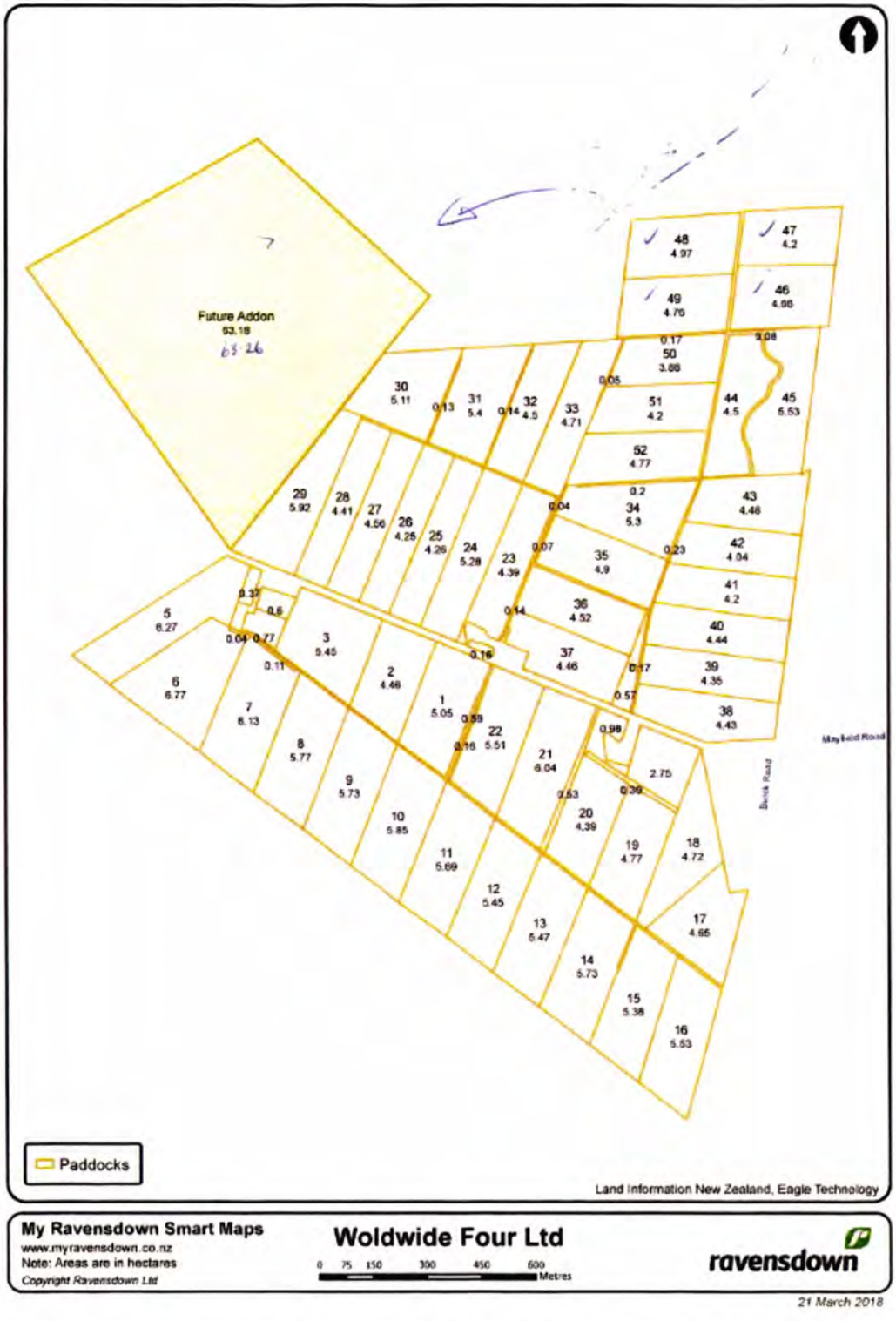
All other factors have remained the same.

Management Unit details and Soil Information: Table 1b

Block Name	Stock	Block Type	Soil Order	Drainage Class	Effluent	PAW (0-60cm)	Effective Area (ha)	Increased or Reduced Area Sheep
Brax_4a.1 Effluent	Dairy	Pastoral	Orthic Gley	Poorly drained	Liquid	148.7	25.6	
Brax_4a.1 Eff Tile	Dairy	Pastoral	Orthic Gley	Poorly drained	Liquid	148.7	36.1	
Brax_4a.1 Non Eff	Dairy	Pastoral	Orthic Gley	Poorly drained	Pond Sludge	148.7	120.8	
Brax_4a.1 Non Eff Tile	Dairy	Pastoral	Orthic Gley	Poorly drained	Pond Sludge	148.7	110.0	+ 38.5 (sheep)
Brax_4a.1 Non Eff Grzng	Dairy	Pastoral	Orthic Gley	Poorly drained	n/a	148.7	5.2	
Brax_4a.1 Cut&Carry	Cut & carry	Crop	Orthic Gley	Poorly drained		148.7	40.8	
Brax_4a.1 Past>FBt	Dry stock	Crop	Orthic Gley	Poorly drained		148.7	12.0	
Brax_4a.1 FBt>FBt	Dry stock	Crop	Orthic Gley	Poorly drained		148.7	12.0	
Brax_4a.1 FBt>Past	Dry stock	Crop	Orthic Gley	Poorly drained		148.7	12.0	
Brax_4a.1 RO	Dry stock	Pastoral	Orthic Gley	Poorly drained		148.7	1.5	
Riparian 1							4.1	+ 0.4 (sheep)
Tuap_6b.2 Non Eff	Dairy	Pastoral	Orthic Melanic	Well drained	Pond Sludge	81.2	23.5	+ 23.5 (sheep)
Non-Productive area							9.0	+0.9 (sheep)
Total							**412.6 (349.3+63.3)**	**+63.3 (sheep)**

*PAW Landcare S maps calculated

Land Management Unit Map and Farm Map



Farm map with additional block outlined, 63.3 ha in total according to GIS, plus 18.6 ha which remains and no longer added to Woldwide 3. Total area with Gladfield support block is now 412.6 ha, 4.1 ha of riparian and 9.0 ha of non-productive, estimated pastoral area of 399.5 ha.

Title area and soils above includes highlighted are which is part of Woldwide 5, actual farm area included in paddocks calculated to be 412.7 ha

Proposed Farm System Analysis: Winter Barn Example

Description of winter barn Farm System example

To provide an example of a wintering barn, it is easier to use the existing Woldwide 4 platform and run off as this is what most dairy farm systems in Southland have, a dairy platform and run off block to winter there mixed age cows and either provide grazing for the young stock or supplements for the dairy platform with young stock grazed off on someone else's support block. The effluent area and cattle numbers will remain the same. With wintering all mixed age cows inside in the barn, there will no longer be 24 ha of fodder beet grown, but to pay for the barn, additional cows are milked with a longer lactation given they can keep milking cows indoors towards the end of the season.

The 412.6 ha property will be operated as a dryland dairy farm, calving 1030 cows and peak milking 1000 (540 & 500 kg LW) Friesian cows. Milk production aimed for is at 570,000 kg MS/year (570 kg MS/cow). Cow numbers are shown in the table below. All mixed age cows are wintered in the barn, with in calf first calving heifers not coming back from grazing off until they are calving towards the end of July and August. Mean calving date is still the 20th August for the main herd, with the first calvers a week earlier on the 12th of August.

The dry-off date is now the 15th of June and the 31st of May for the cows and first calving heifers. All replacements (260) are grazed off-the platform until they return as in calf R2 heifers in late July/August as mentioned. Cows are never milked once a day over autumn drying off (modelled never) and all calves are fed colostrum and waste milk.

Friesian Bulls (20) at 700 kg LW are run with the herd over December and January.

The 78.8 ha support block is now used entirely as a cut and carry block, cutting silage to be used on the dairy platform and in the wintering barn

	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	LW (kg)
Dairy cows		300	770	760	750	750	730	720	710	700	655	295	540
First calving heifers	30	235	260	255	250	250	250	240	240	230	210		500
Dairy grazers (milking cows)	770	495									0	475	540
Bulls						20	20						700

Supplements

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

- 350 T DM Barley grain and 350 T DM distilled Brewers grain imported and used over the season through the milking shed. A further 35 T DM is fed to milking cows in the wintering barn
- 99 T DM of Molasses imported and fed through the shed.
- 500 T DM of Palm Kernel Expeller (PKE); 350 T DM fed through the shed, with the remainder fed on pastoral blocks. A further 40 T DM is fed to milking cows in the wintering barn

Because of the increased stocking and longer lactation, imported supplementary feed has increased to the above amounts to mostly reconcile the pastoral productivity between the two systems. Additional fertiliser and barn slurry is also used to reconcile pastoral productivity also.

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

- Approximately 600 T DM of grass silage; made on the support block and fed ***evenly across pastoral blocks*** to dairy cows.
- 450 T DM of silage made on the support block and fed to ***dry cattle*** in the wintering barn
- 150 T DM silage made on the support block and fed to the ***milking cows*** in the wintering barn

Fodder Cropping

This is now no longer required compared to the other two systems modelled. The losses are likely lower on blocks which in the past wintered the mixed age cows on crop. Pasture renewal is now by grass to grass renewal.

Fertiliser

This changes again between the two systems modelled. This is given the increased need given the higher pastoral productivity (an increase of 1 T DM/ha over the current system), however more nitrogen is supplied by effluent and barn slurry, so the additional fertiliser nitrogen required equates to roughly an increase of 35 kg of N/ha for the effluent blocks; 57 kg of N/ha increase for non-effluent blocks but a ***nil increase*** for the non-effluent areas receiving barn slurry (Brax_4a.1 non effluent not tiled). The total fertiliser nitrogen applied is now 279 (287 for the barn slurry block) and 204 kg N/ha/year for the Non effluent and Effluent farm blocks respectively and 216 kg N/ha across all blocks (whole property) on average. The Gladfield run off block is also changed given the additional feed required to be cut, and so this receives increased nitrogen as well as two applications of barn slurry, a good management practice to return most of the wintering barn effluent to where the feed has been cut.

Non Effluent block:

Month	Fertiliser	NPKS nutrient rating (kg/ha)	NPKS nutrient rating (kg/ha)*
August	Ammo 31	43-0-0-12	43-0-0-12
September	Urea	34-0-0-0	34-0-0-0
October	Urea	34-0-0-0	34-0-0-0
November	Potash Superphosphate and FlexiN	34-14-19-17	25-14-0-17
December	Urea	34-0-0-0	
January	Potash Superphosphate and FlexiN	34-14-19-17	25-14-19-17
February	Urea	23-0-0-0	23-0-0-0
March	Urea	23-0-0-0	23-0-0-0
April	Urea (liquid)	18-0-0-0	18-0-0-0
November	Organic Dairy Barn Slurry		60-15-83-8 (1.2 * applications)

* Non effluent receiving barn slurry

Effluent block:

Month	Fertiliser	NPKS nutrient rating (kg/ha)
August	Ammo 31	43-0-0-12
September	Urea	34-0-0-0
October	Urea	34-0-0-0
November	Superphosphate and FlexiN	25-13-0-16
January	Urea	34-0-0-0
March	Urea	23-0-0-0
April	Urea (liquid)	9-0-0-0

Gladfield Support Block (Cut and Carry)

Month	Fertiliser	NPKS nutrient rating (kg/ha)
October	Crop DAP & Ammo 36 & KCl	50-30-60-32
December	Urea	30-0-0-0
December	Barn Slurry	49-12-69-6
January	Urea	30-0-0-0
January	Barn Slurry	49-12-69-6
March	Crop DAP & Ammo sulphate & KCl	31-7-37-8

Effluent

Effluent has been modelled as using Overseer default values, and calculated as applying 109 kg N/ha/year (liquid) over the 78 ha (84.8 ha total area less 8 % areas not receiving effluent; calculated to 78 ha, increased area) effluent area, plus 11 kg N/ha/year (solids) applied from pond sludge to the Non effluent areas. The effluent system remains the same as what was detailed in the "current" farm system analysis. Wintering barn effluent is as detailed in the consent for Woldwide 1&2 and is a slurry which is exported and re imported as a dairy organic fertiliser.

Farm dairy feeding structure: Wintering Barn.

There is one housing barn on farm that has been modelled as two structures so as to contain the milking herd (winter barn plus grazing) and dry cows (winter pad only) at the times specified in table below. In addition, due to a modelling error, the dry cows are required to be grazing a pastoral block for the model to run, however in reality these animals will be all in the barn. To work around this, 99 % of the dry cattle are in the barn in August, with the calf grazing block grazing these dry cattle for only 1% of the time in August.

The nutrient concentration of wintering barn effluent is higher than dairy shed effluent due to lack of dilution and the housing of cows in the barns for up 24 hours per day.

The nutrient content of pond effluent (slurry) was tested as part of a 2011 AgResearch study "Characterising dairy manures and slurries – Case study 15." The nutrient content of slurry at the applicant's pond was measured at: 3,200 g/m^3 N; 800 g/m^3 P; 4,400 g/m^3 K; 400 g/m^3 S
Applying 15.2 m^3/hectare applies slurry effluent at a depth of 1.5 mm. Discharging slurry effluent at 15.2 m^3/hectare applies:
49 kg of N; 12 kg of P; 69 kg of K; and 6 kg of S.

Table: Winter barn management:

Pad type	Covered animal shelter
Bunker lining material	No lining material
Bunker cleaning method	Scraped
Concrete feeding apron	Scraped
Solids separated	No
Solids storage	N/A
Time in storage	N/A
Liquid effluent	All exported as a slurry, as effluent composition different to dairy shed effluent
Solids management	Re imported as slurry, spread on cut and carry block plus Braxton non tiled non effluent block
Months applied	November for non-effluent block and December and January for the cut and carry block
Separated solids from pond and housing barn on pasture N application rate, Kg N/ha/year	96 for cut and carry block, 49 for Braxton non effluent block

Table: Feeding management in winter barn:

Herd		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Milking herd	% of cows					100	100	100	100				
	Hours/ day grazing					10	0	0	10				
Dry cows	% of cows						100	100	99				
	Hours/ day grazing						0	0	0				

Pasture Production

The predominant pasture species on the dairy farm is ryegrass/white clover. Annual pasture production has been weighted by relative productivity as 1 between dairy blocks, and 0.8 and 0.5 for the rougher grazing blocks on the platform and support block respectively:

Block	Relative productivity	T DM/ha/year
Dairy pastoral areas	1.0	16.2
Brax_4a.1 Non Eff Grazing	0.8	12.9
Cut & carry block Gladfield RO	n/a	16.3

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

All other factors have remained the same.

Management Unit details and Soil Information: Table 1b

Block Name	Stock	Block Type	Soil Order	Drainage Class	Effluent	PAW (0-60cm)	Effective Area (ha)	Increased or Reduced Area Sheep
Brax_4a.1 Effluent	Dairy	Pastoral	Orthic Gley	Poorly drained	Liquid	148.7	48.7	
Brax_4a.1 Eff Tile	Dairy	Pastoral	Orthic Gley	Poorly drained	Liquid	148.7	36.1	
Brax_4a.1 Non Eff	Dairy	Pastoral	Orthic Gley	Poorly drained	Pond Sludge & Barn slurry (*1.2)	148.7	97.7	
Brax_4a.1 Non Eff Tile	Dairy	Pastoral	Orthic Gley	Poorly drained	Pond Sludge	148.7	110.0	+ 38.5 (sheep)
Brax_4a.1 Non Eff Grzng	Dairy	Pastoral	Orthic Gley	Poorly drained	n/a	148.7	5.2	
Brax_4a.1 Cut&Carry	Cut & carry	Crop	Orthic Gley	Poorly drained	Barn slurry (*2)	148.7	78.3	
Riparian 1							4.1	+ 0.4 (sheep)
Tuap_6b.2 Non Eff	Dairy	Pastoral	Orthic Melanic	Well drained	Pond Sludge	81.2	23.5	+ 23.5 (sheep)
Non-Productive area							9.0	+0.9 (sheep)
Total							**412.6 (349.3+63.3)**	**+63.3 (sheep)**

*PAW Landcare S maps calculated

Summary of Current and Proposed Farm System Scenario: Table 2

	Current scenario	Proposed scenario	Barn Example
System Type	Seasonal dairy supply and support block	Seasonal dairy supply and support block	Seasonal dairy supply and support block
Total Area (ha)	349.3	412.6	412.6
Effluent area (ha)	57 ha (92% of 61.7) receiving liquids from dairy shed plus 192.3 ha non-effluent having pond sludge from the holding pond applied	57 ha (92 % of 61.7) receiving liquids from dairy shed plus 254.3 ha non-effluent having pond sludge from the holding pond applied	78 ha (92 % of 84.8) receiving liquids from dairy shed plus 231.2 ha non-effluent having pond sludge from the holding pond applied. All wintering barn effluent re imported as fertiliser and applied to cut and carry block and non-tiled non effluent areas
Stocking rate (s.u/ha)	9,404 s.u* or 27.9 s.u/ha effective or 3.1 cows/ha platform (26.9 s.u/ha total or 2.3 cows/ha total)	9,755 s.u* or 25.6 s.u/ha effective or 2.8 cows/ha platform (23.6 s.u/ha total or 2.2 cows/ha total)	12,200 s.u* or 36.5 s.u/ha effective or 3.0 cows/ha platform (29.6 s.u/ha total or 2.4 cows/ha total)
N use (kg N/ha/year)	195 across the whole farm	176 across the whole farm	216 across the whole farm
Production (kg MS/ha grazed)	1,583/ha effective platform (1,574/ha total grazed)	1,391/ha effective platform (1,305/ha total grazed)	1,708/ha effective platform (1,381/ha total farm)
Supplements Imported (kg DM/ha/year)	1248 T DM in total or 4,815 effective platform. Note also 395 T DM silage is made on the support block and fed out on dairy pastoral blocks including 30 T DM from storage included in above imported figure	805 T DM in total or 2,660 effective platform. Note also 395 T DM silage is made on the support block and fed out on dairy pastoral blocks including 30 T DM from storage included in above imported figure	2,654 T DM in total or 7,951 effective platform. Note also 1,280 T DM silage is made on the support block and fed out on dairy pastoral blocks and wintering barn, included in above imported figure
Wintering system	Off farm on Gladfield support block on crop plus in calf heifers wintered on support block	Off farm on Gladfield support block on crop plus in calf heifers wintered on support block	In wintering barn on platform plus in calf heifers wintered off
Crop Area	24 ha Fodder beet, 12 ha Young Grass	24 ha Fodder beet, 12 ha Young Grass	Nil
Pasture production(kg DM/ha/year) - Platform Pastures - Support Block (Cut and carry)	 15,194** 12,255	 14,154** 12,255	 16,220 16,347

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

Summary of Current Whole Farm Nutrient Loss Indicators: Table 3

	Current average	Sheep Farm (63.3 ha)**	Combined current	Proposed scenario	Barn Example
Nitrogen leaching loss to water (Total kg N) Dairy platform* Support block	10,558 9,016 1,542	1,120	11,678	11,298 9,756 1,542	11,142 10,694 448
Nitrogen leaching loss to water (kg N/ha) Dairy platform Support block	30 33 20	18	30	27 29 20	27 32 6
Phosphorus runoff to water (Total kg P) Dairy platform Support block	312 270 42	26	338	343 300 43	368 353 15
Phosphorus runoff to water (kg P/ha) Dairy platform Support block	0.9 1.0 0.5	0.4	0.9	0.8 0.9 0.5	0.9 1.1 0.2

* Losses split apportionately with riparian, trees and other losses. ** See Report 164 Woldwide 5 for the sheep unit budget details and apportionment of areas and losses as seen below.

Sheep Block (Brax_4a.1)	Pastoral	72.80	38.50	34.30
Sheep Block (Tuap_6b.2)	Pastoral	55.50	23.50	32.00
Sheep Block (Upuk_8a.1)	Pastoral	3.80		3.80
Swedes	Fodder Crop	-	***4.65***	***4.35***
Non prod		4.20	1.30	2.90
Totals		136.3	WW4 (63.3)	WW5 (73.0)

Discussion on Whole Farm Nutrient Loss Indicators

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

Current Farm System

- The N loss from the root zone from the farm system modelled was calculated using OVERSEER® (v6.3.0) to be **30 kg N/ha/year or 10,558 kg N/year.**
- The P loss risk from the farm system modelled was calculated using OVERSEER® (v6.3.0) to be **0.9 kg P/ha/year or 312 kg P/year.**

Combined Current Farm System

- The N loss from the root zone from the combined farm system modelled was calculated using OVERSEER® (v6.3.0) to be **30 kg N/ha/year or 11,678 kg N/year.**
- The P loss risk from the farm system modelled was calculated using OVERSEER® (v6.3.0) to be **0.9 kg P/ha/year or 338 kg P/year.**

Proposed Farm System

- The N loss from the root zone from the farm system modelled was calculated using OVERSEER® (v6.3.0) to be **27 kg N/ha/year or 11,298 kg N/year.**
- The P loss risk from the farm system modelled was calculated using OVERSEER® (v6.3.0) to be **0.8 kg P/ha/year or 343 kg P/year.**

Winter barn Example Farm System

- The N loss from the root zone from the farm system modelled was calculated using OVERSEER® (v6.3.0) to be **27 kg N/ha/year or 11,142 kg N/year.**
- The P loss risk from the farm system modelled was calculated using OVERSEER® (v6.3.0) to be **0.9 kg P/ha/year or 368 kg P/year.**

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Key factors influencing Nutrient Loss include:

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

  The soil type has a large impact on N leached. The soils on the property are all poorly drained silt loams over clay. Plant Available Water (PAW) values would be considered 'high' at 148.7 mm (0-60cm). The Plant Available Water is described as "the amount of water potentially available to plant growth that can be stored in the soil to specific soil depths". It therefore makes sense that the soils with high PAW will have lower N leaching as there will be less drainage from these soils. Soils with lower PAW are less able to buffer against changes in nitrogen losses to the bottom of the root zone (from stocking rates, crop yields, irrigation volumes) as the soils have larger pores and are flushed frequently as compared to a poorer draining soil with a higher PAW (see N report in Appendix where the Tuatapere soil in the proposal loses 54 kg N/ha/year compared to the Braxton soils, losing 30 kg N/ha/year respectively on the Non effluent pastoral blocks under the proposed system).

  These heavier soils are often tile drained (artificially drained, and are here) to remove water from the profile and enable higher productivity. The risk is that these drains also provide a conduit to nutrient flows and effluent discharges direct to water ways. Ensuring the nutrients are captured by plant growth and minimising effluent applications when soil PAW are near capacity will reduce this. This is evident with the tiled effluent area which has loses 2 kg N/ha/year higher than the non-tiled effluent block under the current system.

- Pastoral productivity

  The higher the pastoral productivity from dairy land and the associated higher stocking, the higher the risk of N losses on dairy farms, especially under the climatic, rainfall and evapotranspiration rates for Southland. The current system has a higher production per ha (1,574 kg MS/ha) at a high stocking rate of 3.1 cows/ha platform grazed; (cf. to 2.73 cows/ha & 1056 kg MS/ha, NZ Southland Dairy statistics 2015-16) with a high amount (4,815 kg DM/ha) of supplement imported (including only 30 T DM of the stored supplement from the support block), which supports the stocking and consequently the pasture production required at 15,194 kg DM/ha/year as seen in table 2, page 25. This leads to the high amount of urine deposition on pastures from the resulting cow intakes, resulting in increased risk from N leaching. The results point to a similar influence from urinary deposition in the proposal, with the amount of N loss attributed to urine decreasing as a percentage from 53 % to 50 % for the proposal, the rest due to N losses from cropping and effluent applications (other sources) and direct (tiles).

- Cropping

The crop blocks for the current system contribute 1273 kg N/ha or 35 kg N/ha/year on average (12.1 % of total N losses and yet accounts for 6.9 % of the total land area). (Figures as in Block Nitrogen reports, pages 32, 33 and 37). It is the higher concentration of stock in a smaller area and thus the greater urine deposition which leads to this increased risk of losses. This is also exacerbated by these crops being grazed at a time when drainage events are most likely to occur. The losses are similar between the current and proposed scenarios (2,169 kg N/year), however, it is the crop losses on the sheep block which on a proportionate basis contributes 38 % of total losses from 6.9 % of the total 63.3 ha which lifts the sheep losses to the overall N loss of 18 kg N/ha/year (refer to Report 164 Woldwide 5 current and scenario report).

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

The other environmental risk indices are the current P losses to surface water at 0.9 kg P/ha/year as seen in the Phosphate reports pages 31 & 36, which are low to moderate risk in their impact. The P risk is mostly influenced by losses from other sources (160 kg or 51.3 % of total of 312 kg, refer Phosphorous block reports, pages 31 & 36) which is run off from tracks and yards into drains and ditches from the farm. Riparian strip planting and vegetation buffer zones for crops and lane ways can reduce this and have been implemented on this farm. Olsen P levels are within or above the optimum agronomic ranges, with the areas at above receiving reduced maintenance rates to mitigate this and the topography where the all of the fertiliser is applied is flat, which also helps to minimise P losses. Any new Effluent storage plus low volume applications will help to mitigate this risk and allow applications to be reduced on tiled soils at "at risk" times also. The proposed P losses are only 336 kg P/year, 2 kg P/year lower than the combined P losses and due mostly to the losses on the non-effluent dairy blocks, being mitigated by the above.

The current scenario is rated 10.0, the upper side of category 1 under the Soil versatility rating system (Landcare Research, 2002), as calculated in the table 4 below. The farm already uses a number of effective Nitrogen mitigation strategies to minimise losses for the proposal culminating in the results above. The proposal also is rated 10 as well with the addition of the Tuatapere soil.

Soil Vulnerability Land Management Rating: Table 4

Soil Type (proposal)	Soil Vulnerability	Vulnerability rating	% Farm	Rating score
Braxt_4a.1	Moderate	10	100.0 (94.0)	10.0 (9.4)
(Tuap_6b.2)	Moderate	10	(6.0)	(0.6)
Total			**100.0**	**10.0 (10.0)**

The property is situated in the Waimatuku and Aparima River sub catchments, and the Coastal and Aparima catchment of the proposed Environment Southland Regional Water and Land Plan. It is 100 % on a Central plain physiographic zone, with no variants. (See map, page 16 and table above), meaning the farm must attach significance to this zone in its environmental management. The farm is within zones having influence in the high nitrate levels in ground water and is at risk from summer shrinking of soils, this would be reduced as the soil develops a higher topsoil depth and more organic matter. Water quality is characterised by lowland hard bed, with quaternary gravel upon tertiary sediment in the Waimatuku groundwater management zones. Implications of this information are unknown at present but some catchment areas will be required to reduce their impacts. The zonal information would point to the presence of nitrate leaching; and nitrogen accumulation as key risk factors for the zone. An additional key risk factor for the Braxton soil is the losses of nitrogen through tiles which is the case here. No effluent applications to the highest risk soil during the highest risk periods would be helpful. This and the created Riparian strips and wetlands would be the activities which would be required to mitigate any overland flows.

Mitigations current and modelled:

A summary of current good practice modelled are summarised from the discussions and report;

1. The stocking intensity for the current system is high, but is reduced on pasture due to the additional supplements used to achieve the high production from the cows, resulting in a moderate level of pastoral production of 15.2 T DM/ha. In the proposal, the stocking intensity is reduced, and with the additional land the level of pastoral production is reduced to 14.2 T DM/ha and there is little need for any additional nitrogen fertiliser from modelling, with a reduction in nitrogen made on both the effluent and non-effluent areas.
2. Effluent is stored and able to be applied at appropriate times. As well the area applied is adequate, given 58 ha is required to apply 150 kg of N/ha from all effluent sources, with the current area modelled as 57 ha including crops, only receiving liquid effluent and the sludge and solids applied to all non-effluent areas, barring the small calf grazed blocks identified.

3. The decision was made to keep the cropping to the Braxton run off given the lighter nature of the new Tuatapere soils.

Summary of Mitigations re winter barn:

	Mitigations modelled:	Reason/Rationale:	Effect:
Winter Barn Farm System	1. Effluent mitigations (area maintained and targeted applications)	Ensure effluent only applied to appropriate areas and spread as widely as possible, with Nitrogen applications taking into account the additional effluent nutrients.	Increase effluent area by 23.1 ha (not tiled) Increase Nitrogen applications by 35 kg N/ha/year over October January period on Effluent spray blocks, and apply 1.2 times annually the imported slurry to Braxton Non effluent area, meaning no additional fertiliser required for this block. Other blocks have additional fertiliser applied. The Cut and Carry block has two applications of the winter barn slurry to return nutrients to the block where the nutrients are being taken.
	2. Alter cropping regime with the Winter Barn	With the winter barn, no crop area is required.	No crop area over winter reduces Nitrogen losses in cut and carry block from 1,542 to 449 kg N/ha, plus the risk of P losses is also reduced.
	3. Winter Barn	With the additional milking cows, the use of the barn over May and August gives the farm system an ability to reduce risk of pugging to pastures over spring and at autumn as required.	The risk of pugging reduces infiltration of soils and increases overland flow of nutrients. Also nutrients are held and spread onto soil by effluent applications when pastures more able to receive the nutrients and thus lowers risk of losses.
	4. Supplementary feed	Additional feed is able to be used for the extended lactation and for the wintering of cattle, with an ability to lower losses and ensure higher utilisation	Higher amounts of grain and PKE can mean one can reduce the pastoral productivity further, and so with a lower pastoral productivity and higher supplement use overall N losses will reduce. It was decided to use more N fertiliser to equate pastoral productivity and the example still shows an equal amount of losses for the system when compared to the interim stage of more cows and added area.

The sum effect from the wintering barn is to maintain the level of environmental losses from the increased farming system intensity (more cows and longer lactation with higher milk production) required to provide an added return on the additional capital invested.

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

OVERSEER v6.3.0 onwards has a new irrigation module to better reflect the management practices of irrigators. The Best Practice Data Input Standards give some guidance on what is now required. The model requires more information from users about their irrigation system and how water application decisions are made on farm. The extra data needed includes depth of water per application; return time and depending on how soil water is

monitored what are the trigger points and targets (mm deficit). Ideally, this data needs to be actual long term average data as OVERSEER uses 30 year average climate data. Best estimates of these data will generally generate more drainage, and hence N loss to water, than has been the case with previous OVERSEER versions.

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

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

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Appendices

Current farm System Whole Farm Nutrient Budget

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Version 6.3.0, on 2018-06-08 11:35:37

Abe and Anita De Wolde
WoldWide 4 plus Gladfiled Run Off
Client reference: 60877676
Farm name: Woldwide 4 Current (16/17)

Mark Crawford
Ravensdown
Dunedin

Farm Nutrient Budget - Whole farm

	N	P	K	S	Ca	Mg	Na
	(kg/ha/yr)						
Nutrients added							
Fertiliser, lime & other	195	26	49	37	0	0	1
Rain/clover N fixation	41	0	2	4	2	5	21
Irrigation	0	0	0	0	0	0	0
Supplements imported	83	15	37	11	8	7	4
Nutrients removed							
As products	87	15	21	5	19	2	6
Exported effluent	0	0	0	0	0	0	0
As supplements	0	0	0	0	0	0	0
To atmospheric	78	0	0	0	0	0	0
To water	30	0.9	17	59	74	2	9
Change in internal pools							
Plant material	23	2	11	2	2	1	1
Organic pool	96	12	3	-13	1	0	0
Inorganic mineral	0	4	-13	0	-2	-3	-4
Inorganic soil pool	4	8	49	0	-82	11	15

Sheep Farm

Abe and Anita De Wolde
New Sheep Farm
Client reference:
Farm name: Purchased Sheep Farm Current - copy 1 (17/18)

Mark Crawford
Ravensdown
Ravensbourne

Farm Nutrient Budget - Whole farm

	N	P	K	S	Ca	Mg	Na
	(kg/ha/yr)						
Nutrients added							
Fertiliser, lime & other	30	21	8	39	47	0	0
Rain/clover N fixation	106	0	2	4	2	5	23
Irrigation	0	0	0	0	0	0	0
Supplements imported	0	0	0	0	0	0	0
Nutrients removed							
As products	21	2	1	3	4	0	1
Exported effluent	0	0	0	0	0	0	0
As supplements	0	0	0	0	0	0	0
To atmospheric	47	0	0	0	0	0	0
To water	18	0.4	8	42	23	3	15
Change in internal pools							
Plant material	-8	-1	-9	0	-1	-1	0
Organic pool	49	10	0	-2	0	0	0
Inorganic mineral	0	2	-21	0	-2	-4	-4
Inorganic soil pool	8	8	33	0	26	7	12

Current Farm System Nutrient Loss Indicators

P report

Block P

Abe and Anita De Wolde
WoldWide 4 plus Gladfiled Run Off
Client reference: 60877676
Farm name: Woldwide 4 Current (16/17)

Mark Crawford
Ravensdown
Dunedin

Block Phosphorus

Block name	Total P lost (kg P/yr)	P lost (kg P/ha/yr)	P loss categories		
			Soil	Fertiliser	Effluent
Brax_4a.1 Effluent	12	0.5	Low	Low	Low
Brax_4a.1 Eff Tile	27	0.7	Low	Low	Medium
Brax_4a.1 Non Eff	47	0.4	Low	Low	Low
Brax_4a.1 Non Eff Tile	37	0.5	Low	Low	Low
Brax_4a.1 Non Eff Grzng	2	0.4	Low	Low	n/a
Brax_4a.1 Cut&Carry	7	0.2	n/a	n/a	n/a
Brax_4a.1 Past>FBt	7	0.6	n/a	n/a	n/a
Brax_4a.1 FBt>FBt	7	0.6	n/a	n/a	n/a
Brax_4a.1 FBt>Past	5	0.4	n/a	n/a	n/a
Brax_4a.1 RO	0	0.2	Low	n/a	n/a
Riparian 1	0	0.1	n/a	n/a	n/a
Other farm sources	160				
Whole farm	312	0.9			

Sheep Farm

Abe and Anita De Wolde
New Sheep Farm
Client reference:
Farm name: Purchased Sheep Farm Current - copy 1 (17/18)

Mark Crawford
Ravensdown
Ravensbourne

Block Phosphorus

Block name	Total P lost (kg P/yr)	P lost (kg P/ha/yr)	P loss categories		
			Soil	Fertiliser	Effluent
Sheep Block (Brax_4a.1) ##	30	0.4	Low	Low	n/a
Sheep Block (Tuap_6b.2) ##	6	0.1	Low	Low	n/a
Swedes	2	0.2	n/a	n/a	n/a
Sheep Block (Upuk_8a.1)	1	0.3	Low	Low	n/a
Other farm sources	18				
Whole farm	56	0.4			

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

N report

Farm N

Abe and Anita De Wolde
WoldWide 4 plus Gladfiled Run Off
Client reference: 60877676
Farm name: Woldwide 4 Current (16/17)

Mark Crawford
Ravensdown
Dunedin

Farm Nitrogen

	Units	Benchmark farm	Current farm
Inputs (farm average)			
Clover N	kg N/ha/yr		39
Fertiliser N	kg N/ha/yr		195
Other N added	kg N/ha/yr		85
Indices			
Average N loss to water	kg N/ha/yr		30
includes N lost as effluent	kg N/ha/yr		0
N_2O emissions	kg N/ha/yr		29.1
For pastoral area of farm:			
Farm N surplus	kg N/ha/yr		228
N conversion efficiency	%		28

The Sheep Farm

Abe and Anita De Wolde
New Sheep Farm
Client reference:
Farm name: Purchased Sheep Farm Current - copy 1 (17/18)

Mark Crawford
Ravensdown
Ravensbourne

Farm Nitrogen

	Units	Benchmark farm	Current farm
Inputs (farm average)			
Clover N	kg N/ha/yr		104
Fertiliser N	kg N/ha/yr		30
Other N added	kg N/ha/yr		2
Indices			
Average N loss to water	kg N/ha/yr		18
includes N lost as effluent	kg N/ha/yr		0
N_2O emissions	kg N/ha/yr		14.2
For pastoral area of farm:			
Farm N surplus	kg N/ha/yr		113
N conversion efficiency	%		17

Block N

Abe and Anita De Wolde
WoldWide 4 plus Gladfiled Run Off
Client reference: 60877676
Farm name: Woldwide 4 Current (16/17)

Mark Crawford
Ravensdown
Dunedin

Block Nitrogen

Block name	Total N lost (kg N/yr)	N lost to water (kg N/ha/yr)	N in drainage * (ppm)	N surplus (kg N/ha/yr)	Added N ** (kg N/ha/yr)
Brax_4a.1 Effluent	947	37	**11.8**	284	279
Brax_4a.1 Eff Tile	1424	39	**11.8**	285	279
Brax_4a.1 Non Eff	3838	32	10.2	231	232
Brax_4a.1 Non Eff Tile	2276	32	10.3	231	232
Brax_4a.1 Non Eff Grzng	143	27	8.8	274	222
Brax_4a.1 Cut&Carry	204	5	1.8	14	219
Brax_4a.1 Past>FBt	426	35	**11.6**	182	94
Brax_4a.1 FBt>FBt	616	51	**16.2**	168	94
Brax_4a.1 FBt>Past	231	19	6.1	122	219
Brax_4a.1 RO	23	15	5.5	139	0
Riparian 1	11	3	N/A		
Other farm sources	418				
Whole farm	10558	30			
Less N removed in wetlands	0				
Farm output	10558	30			

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

** Sum of fertiliser and external factory effluent inputs.

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

The Sheep Farm

Farm name: Purchased Sheep Farm Current - copy 1 (17/18)

Block Nitrogen

Block name	Total N lost (kg N/yr)	N lost to water (kg N/ha/yr)	N in drainage * (ppm)	N surplus (kg N/ha/yr)	Added N ** (kg N/ha/yr)
Sheep Block (Brax_4a.1) ##	669	10	3.1	120	28
Sheep Block (Tuap_6b.2) ##	761	15	4.1	118	28
Swedes	891	99	**23.9**	59	71
Sheep Block (Upuk_8a.1)	143	38	9.2	115	28
Other farm sources	45				
Whole farm	2509	18			
Less N removed in wetlands	0				
Farm output	2509	18			

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

** Sum of fertiliser and external factory effluent inputs.

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

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

Current System Pasture Production, Other Values and Effluent Report

Abe and Anita De Wolde
WoldWide 4 plus Gladfiled Run Off
Client reference: 60877676
Farm name: Woldwide 4 Current (16/17)

Mark Crawford
Ravensdown
Dunedin

Block Pasture

Block name	On-farm fresh pasture intake (kg DM/ha/yr)	Estimated utilisation (%)	Supplements removed (kg DM/ha/yr)	Pasture growth (kg DM/ha/yr)
Brax_4a.1 Effluent	12915	85	0	15194
Brax_4a.1 Eff Tile	12915	85	0	15194
Brax_4a.1 Non Eff	12915	85	0	15194
Brax_4a.1 Non Eff Tile	12915	85	0	15194
Brax_4a.1 Non Eff Grzng	9420	77	0	12155
Brax_4a.1 Cut&Carry	0	0	12255	12255
Brax_4a.1 Past>FBt	0	0	0	0
Brax_4a.1 FBt>FBt	0	0	0	0
Brax_4a.1 FBt>Past	0	70	2500	2500
Brax_4a.1 RO	5546	73	0	7597
Riparian 1	0	0	0	0

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

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

Abe and Anita De Wolde
WoldWide 4 plus Gladfiled Run Off
Client reference: 60877676
Farm name: Woldwide 4 Current (16/17)

Mark Crawford
Ravensdown
Dunedin

Other values for farm - Woldwide 4 Current

Milking herd size (peak cows/ha grazed)	3.1
Milk solids (kg/ha grazed)	1574
Milk production per cow (kg milk solids / cow)	509.9
Default calving data	06 August
Total liveweight brought (kg/ha grazed)	3276
Total liveweight reared (kg/ha grazed)	86
Total liveweight sold (kg/ha grazed)	3303
No fertiliser costs entered	
GHG: Allocation to milk	0.84
Dairy stock rate (RSU)	8502
Dairy replacements stock rate (RSU)	0
Beef / dairy grazing stock rate (RSU)	902
Sows per ha	NaN

Abe and Anita De Wolde
WoldWide 4 plus Gladfiled Run Off
Client reference: 60877676
Farm name: Woldwide 4 Current (16/17)

Mark Crawford
Ravensdown
Dunedin

Effluent Report

	Units	Current farm
Current effluent area		
Area of effluent blocks	ha	57
% of pastoral farm area	%	22
Area of farm to apply effluent to achieve rates of:		
150 kg N/ha/yr	ha	58
Maintenance K	ha	0
100 kg K/ha/yr	ha	92
Source of N applied to effluent blocks		
Average of N applied to effluent blocks	kg N/ha/yr	120
Effluent from farm dairy	%	85
Effluent from wintering pad	%	0
Effluent from feed pad	%	0
Average fertiliser N	kg N/ha/yr	169
Average other elements	kg N/ha/yr	0

The Sheep Farm

Abe and Anita De Wolde
New Sheep Farm
Client reference:
Farm name: Purchased Sheep Farm Current - copy 1 (17/18)

Mark Crawford
Ravensdown
Ravensbourne

Block Pasture

Block name	On-farm fresh pasture intake (kg DM/ha/yr)	Estimated utilisation (%)	Supplements removed (kg DM/ha/yr)	Pasture growth (kg DM/ha/yr)
Sheep Block (Brax_4a.1)	10848	70	117	15614
Sheep Block (Tuap_6b.2)	10832	70	140	15614
Swedes	0	0	0	0
Sheep Block (Upuk_8a.1)	8744	70	0	12491

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

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

Abe and Anita De Wolde
New Sheep Farm
Client reference:
Farm name: Purchased Sheep Farm Current - copy 1 (17/18)

Mark Crawford
Ravensdown
Ravensbourne

Other values for farm - Purchased Sheep Farı

Total liveweight brought (kg/ha grazed)	831
Total liveweight reared (kg/ha grazed)	424
Total liveweight sold (kg/ha grazed)	1117
No fertiliser costs entered	
GHG: Allocation to wool - breeding mob	0.25
GHG: Allocation to wool - trading mob	0.02
Sheep stock rate (RSU)	2642
Sows per ha	NaN

Current System Parameter Report
Available on request.

Proposed farm System Whole Farm Nutrient Budget

Abe and Anita De Wolde
WoldWide 4 plus Gladfiled Run Off
Client reference: 60877676
Farm name: Woldwide 4 Proposed -consent#- copy (16/17)

Mark Crawford
Ravensdown
Dunedin

Farm Nutrient Budget - Whole farm

	N	P	K	S	Ca	Mg	Na
	(kg/ha/yr)						
Nutrients added							
Fertiliser, lime & other	194	26	48	38	0	0	1
Rain/clover N fixation	49	0	2	4	2	5	21
Irrigation	0	0	0	0	0	0	0
Supplements imported	50	9	19	7	4	4	2
Nutrients removed							
As products	79	13	19	4	17	2	6
Exported effluent	0	0	0	0	0	0	0
As supplements	0	0	0	0	0	0	0
To atmospheric	77	0	0	0	0	0	0
To water	30	0.9	17	56	74	2	9
Change in internal pools							
Plant material	21	2	9	2	1	1	1
Organic pool	84	12	1	-13	0	0	0
Inorganic mineral	0	4	-15	0	-2	-3	-4
Inorganic soil pool	4	3	37	0	-84	8	14

Proposed Farm System Nutrient Loss Indicators

P report

Block P

Abe and Anita De Wolde
WoldWide 4 plus Gladfiled Run Off
Client reference: 60877676
Farm name: Woldwide 4 Proposed -consent#- copy (16/17)

Mark Crawford
Ravensdown
Dunedin

Block Phosphorus

Block name	Total P lost (kg P/yr)	P lost (kg P/ha/yr)	P loss categories		
			Soil	Fertiliser	Effluent
Brax_4a.1 Effluent	12	0.5	Low	Low	Low
Brax_4a.1 Eff Tile	26	0.7	Low	Low	Medium
Brax_4a.1 Non Eff	40	0.4	Low	Low	Low
Brax_4a.1 Non Eff Tile	57	0.5	Low	Low	Low
Brax_4a.1 Non Eff Grzng	2	0.4	Low	Low	n/a
Brax_4a.1 Cut&Carry	7	0.2	n/a	n/a	n/a
Brax_4a.1 Past>FBt	7	0.6	n/a	n/a	n/a
Brax_4a.1 FBt>FBt	7	0.6	n/a	n/a	n/a
Brax_4a.1 FBt>Past	5	0.4	n/a	n/a	n/a
Brax_4a.1 RO	0	0.2	Low	n/a	n/a
Riparian 1	0	0.1	n/a	n/a	n/a
Tuap_6b.2 Non Eff	4	0.2	Low	Low	n/a
Other farm sources	168				
Whole farm	336	0.9			

N report

Farm N

Abe and Anita De Wolde
WoldWide 4 plus Gladfiled Run Off
Client reference: 60877676
Farm name: Woldwide 4 Proposed -consent#- copy (16/17)

Mark Crawford
Ravensdown
Dunedin

Farm Nitrogen

	Units	Benchmark farm	Current farm
Inputs (farm average)			
Clover N	kg N/ha/yr		47
Fertiliser N	kg N/ha/yr		194
Other N added	kg N/ha/yr		52
Indices			
Average N loss to water	kg N/ha/yr		30
includes N lost as effluent	kg N/ha/yr		0
N_2O emissions	kg N/ha/yr		27.1
For pastoral area of farm:			
Farm N surplus	kg N/ha/yr		212
N conversion efficiency	%		28

Block N

Abe and Anita De Wolde
WoldWide 4 plus Gladfiled Run Off
Client reference: 60877676
Farm name: Woldwide 4 Proposed -consent#- copy (16/17)

Mark Crawford
Ravensdown
Dunedin

Block Nitrogen

Block name	Total N lost (kg N/yr)	N lost to water (kg N/ha/yr)	N in drainage * (ppm)	N surplus (kg N/ha/yr)	Added N ** (kg N/ha/yr)
Brax_4a.1 Effluent	837	33	10.4	259	268
Brax_4a.1 Eff Tile	1258	35	10.4	260	268
Brax_4a.1 Non Eff	3025	30	9.5	209	230
Brax_4a.1 Non Eff Tile	3261	30	9.5	209	230
Brax_4a.1 Non Eff Grzng	105	20	6.5	277	222
Brax_4a.1 Cut&Carry	204	5	1.8	14	219
Brax_4a.1 Past>FBt	424	35	**11.5**	182	94
Brax_4a.1 FBt>FBt	614	51	**16.1**	168	94
Brax_4a.1 FBt>Past	231	19	6.1	122	219
Brax_4a.1 RO	22	15	5.4	90	0
Riparian 1	12	3	N/A		
Tuap_6b.2 Non Eff	1267	54	**15.4**	217	230
Other farm sources	460				
Whole farm	11719	30			
Less N removed in wetlands	0				
Farm output	11719	30			

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

** Sum of fertiliser and external factory effluent inputs.

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

Proposed System Pasture Production, Other Values and Effluent Report

Abe and Anita De Wolde
WoldWide 4 plus Gladfiled Run Off
Client reference: 60877676
Farm name: Woldwide 4 Proposed -consent#- copy (16/17)

Mark Crawford
Ravensdown
Dunedin

Block Pasture

Block name	On-farm fresh pasture intake (kg DM/ha/yr)	Estimated utilisation (%)	Supplements removed (kg DM/ha/yr)	Pasture growth (kg DM/ha/yr)
Brax_4a.1 Effluent	12773	85	0	15027
Brax_4a.1 Eff Tile	12773	85	0	15027
Brax_4a.1 Non Eff	12773	85	0	15027
Brax_4a.1 Non Eff Tile	12773	85	0	15027
Brax_4a.1 Non Eff Grzng	8776	73	0	12021
Brax_4a.1 Cut&Carry	0	0	12255	12255
Brax_4a.1 Past>FBt	0	0	0	0
Brax_4a.1 FBt>FBt	0	0	0	0
Brax_4a.1 FBt>Past	0	70	2500	2500
Brax_4a.1 RO	5823	77	0	7513
Riparian 1	0	0	0	0
Tuap_6b.2 Non Eff	12773	85	0	15027

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

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

Abe and Anita De Wolde
WoldWide 4 plus Gladfiled Run Off
Client reference: 60877676
Farm name: Woldwide 4 Proposed -consent#- copy (16/17)

Mark Crawford
Ravensdown
Dunedin

Other values for farm - Woldwide 4 Proposed

Milking herd size (peak cows/ha grazed)	2.8
Milk solids (kg/ha grazed)	1384
Milk production per cow (kg milk solids / cow)	495.3
Default calving data	06 August
Total liveweight brought (kg/ha grazed)	2948
Total liveweight reared (kg/ha grazed)	79
Total liveweight sold (kg/ha grazed)	2973
No fertiliser costs entered	
GHG: Allocation to milk	0.84
Dairy stock rate (RSU)	8802
Dairy replacements stock rate (RSU)	0
Beef / dairy grazing stock rate (RSU)	953
Sows per ha	NaN

Abe and Anita De Wolde
WoldWide 4 plus Gladfiled Run Off
Client reference: 60877676
Farm name: Woldwide 4 Proposed -consent#- copy (16/17)

Mark Crawford
Ravensdown
Dunedin

Effluent Report

	Units	Current farm
Current effluent area		
Area of effluent blocks	ha	57
% of pastoral farm area	%	19
Area of farm to apply effluent to achieve rates of:		
150 kg N/ha/yr	ha	62
Maintenance K	ha	2664
100 kg K/ha/yr	ha	101
Source of N applied to effluent blocks		
Average of N applied to effluent blocks	kg N/ha/yr	127
Effluent from farm dairy	%	85
Effluent from wintering pad	%	0
Effluent from feed pad	%	0
Average fertiliser N	kg N/ha/yr	151
Average other elements	kg N/ha/yr	0

Proposed System Parameter Report

Available on request.

Woldwide Five Limited

Farm Environmental Management Plan

March 2019

FARM ENVIRONMENT MANAGEMENT PLAN

A: PROPERTY OVERVIEW

Contact Person(s)	Abe and Anita de Wolde	**Plan Prepared By**	Landpro Ltd
Contact Phone	02 227 2537	**Date**	28 March 2019
Email Address	abe@woldwide.nz	**Date of Next Review**	28 March 2020
Physical Address	104 Shaws Trees Road		
Consent Numbers and Expiry Dates	TBC		
Farm Area	335 ha Includes WW5 dairy platform and Woldwide Runoff	**Peak Milked Herd Size**	930
Legal Descriptions	Lot 1 Deposited Plan 344176, Lot 2 Deposited Plan 344176, Lot 1 Deposited Plan 310140, Part Lot 12 Deposited Plan 238 and Lot 2-3 Deposited Plan 478843, Lot 1 Deposited Plan 12253 Lot 1 DP 478843 (new block called Collies Block) Lot 7 DP 238 (new block from Cochrans) Lot 2 DP 310140 (new block from Cochrans) Merrivale Block: Part Section 7 Block XII Waiau SD Part Section 7 Block XII Waiau SD Part Section 7 Block XII Waiau SD Lot 1 DP 3537 Merriburn Lease Block: Lot 1 DP 302409 Sec 26 Merrivale Settlement No. 1 Sec 27 Merrivale Settlement No. 1		

This FEMP sets out the management practices that will be implemented and adopted to actively manage the operation of the property to ensure that environmental risks are managed appropriately, and resource consent conditions complied with.

Objectives of this plan:

- Comply with all legal requirements related to land use and discharge.
- Take all practicable steps to minimise the risk of harm to onsite and nearby water resources.
- Take all practicable steps to ensure that there is an adequate supply of soil nutrients to meet plant needs.
- Take all practicable steps to minimise the risk of harm to significant vegetation and/or wildlife habitat.

This will be achieved through;

- Identifying and documenting contaminant pathways for the property (based on Physiographic Zones);
- Identifying relevant good management practices (GMP) and where they are required to be implemented to minimise environmental risks; and
- Documenting evidence to be provided to show adherence with consent conditions.

As the person responsible for implementing this plan, I confirm that the information provided is correct:

Name:..... Signed:..... Date:.....

B: SITE PLANS

This FEMP contains various site plans identifying key features of the subject property in accordance with Part B(3) of Appendix N of the proposed Southland Water and Land Plan, 2018. The following table can be used as a reference point for locating these features.

KEY FEATURES	PLAN(S) WHERE KEY FEATURES ARE MAPPED
Site boundary	All site plans in this FEMP
Physiographic zones, variants and soil types	Figure 1 and 2: Physiographic Plan Figure 3 and 4: Soil map
Lakes, rivers, streams ponds, artificial watercourses, modified watercourses and natural wetlands	Appendix A: Existing Waterways and Critical Source Areas
Other critical source areas (gullies, swales etc)	Appendix A: Existing Waterways and Critical Source Areas
Land with a slope greater than 20 degrees	N/A
Existing and proposed riparian vegetation and fences (or other stock exclusion methods) adjacent to waterbodies	Appendix A: Waterway location, most have riparian planting
Places where stock access or cross water bodies (including bridges, culverts and fords)	Appendix A: crossings labelled
Known subsurface drainage system(s) and the location of drain outlets	TBC
All land that may be cultivated over the next 12 months	TBC – once consent granted
All land that may be intensively winter grazed over the next 12 months	TBC – once consent granted

C: PHYSIOGRAPHIC ZONES AND KEY CONTAMINANT PATHWAYS

This section of the FEMP documents the physiographic zones and key contaminant pathways present across the property.

The physiographic plans shows the spatial distribution of the physiographic zones on the entire property according to the Environment Southland Proposed Water and Land Plan 2018 (PSWLP) as mapped by Beacon Mapping Service. The mapping system also details the key contaminant pathways present for each physiographic zone and any variants for the location.

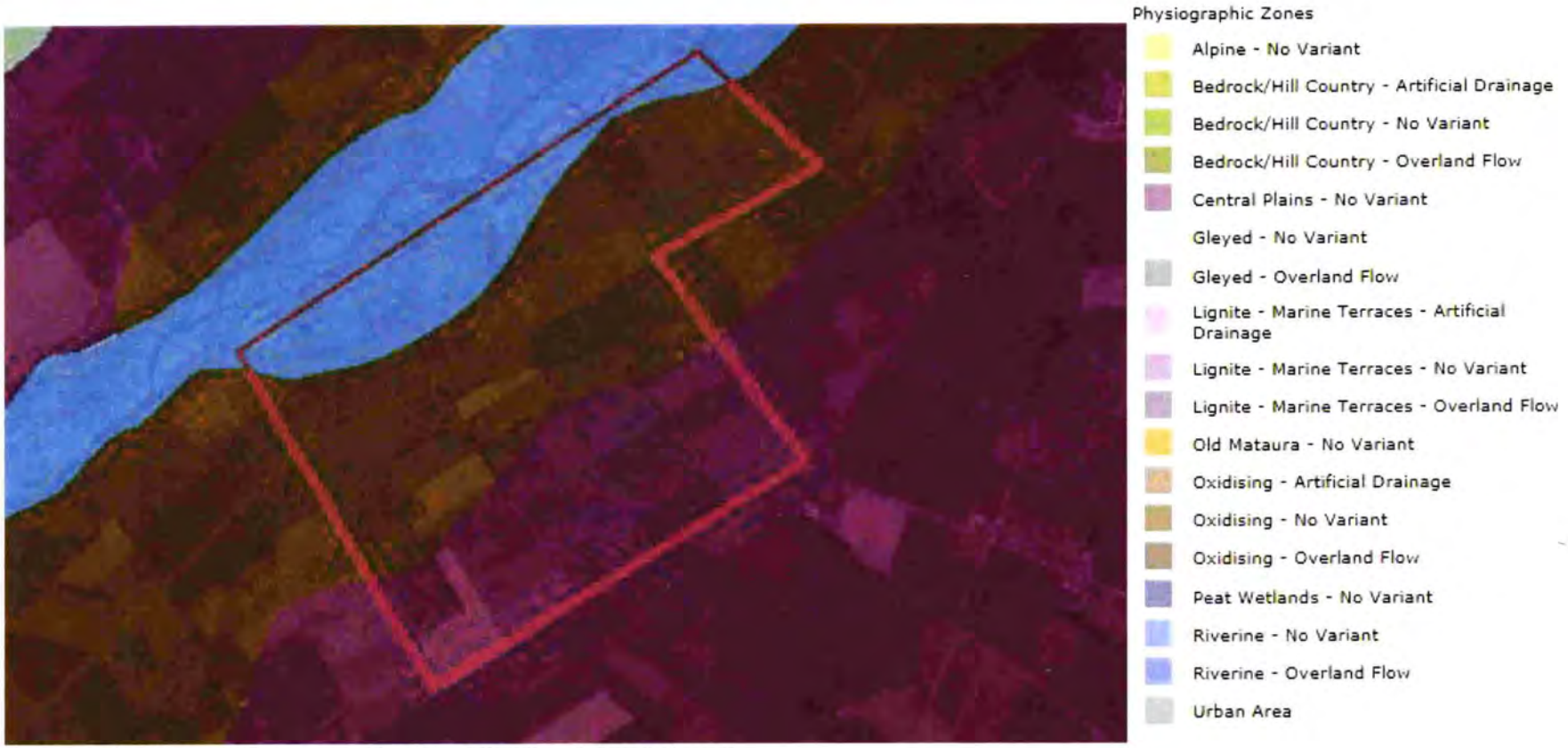


Figure 1: Physiographic Zones on the farm (showing dairy platform)

Figure 2: Physiographic zones at Woldwide Runoff

D: SOIL TYPES

This section of the FEMP documents the soil types present across the property. The Soil Maps below shows the spatial distribution of the soil types across entire property according to the Environment Southland Beacon Mapping Service.

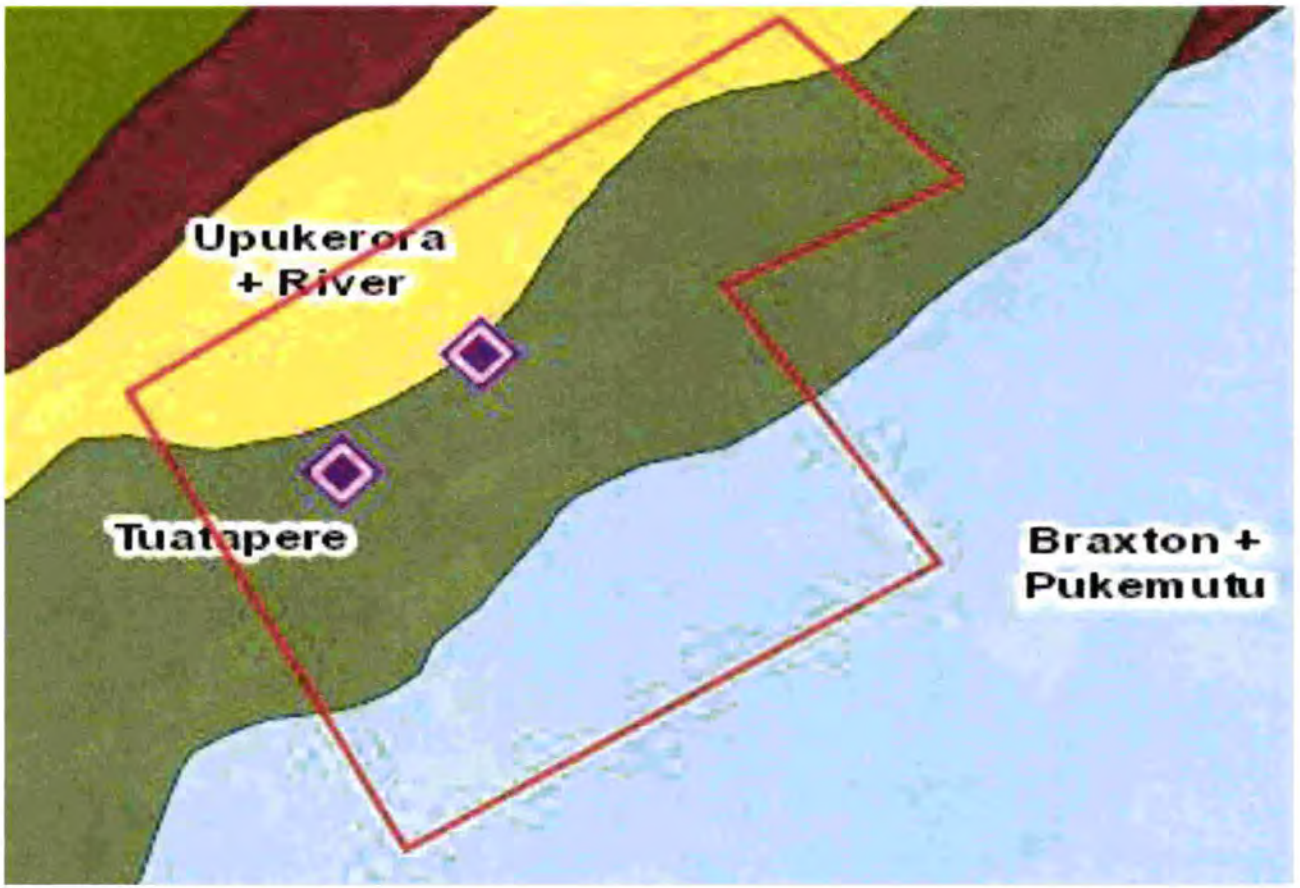


Figure 3: Soil types found on the dairy platform

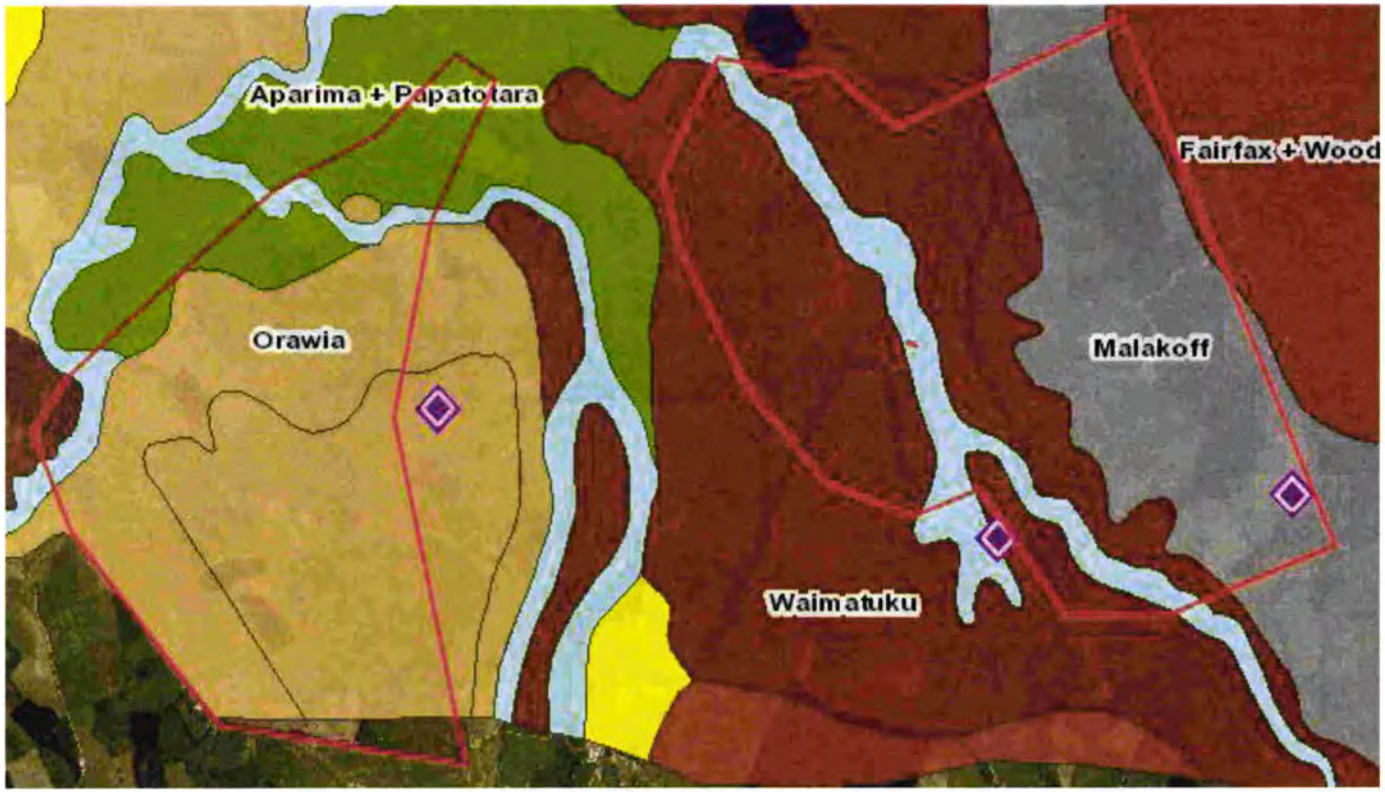


Figure 4: Soil types at Woldwide Runoff

E: GOOD MANAGEMENT PRACTICES - GENERAL

Mitigation	Good Management Practice	Review notes
Protect soil structure (will also help with P and N loss	Wintering the milking herd on fodder beet on the dairy platform or W on appropriate soil types	
	Re-sow bare soils as soon as possible	
	Use of selective grazing to avoid grazing very wet paddocks and open the breaks up to avoid pugging and treading damage.	
Manage Critical Source Areas (CSA)	Avoid working CSAs and their margins	
	Leave grassed areas (or native vegetation) around CSAs especially when grazing winter forage crop and/or graze as "last bite". Grazing direction should be down the slope or towards CSA.	
	All riparian margins to be fenced and left to establish with grasses to enable filtration of contaminants that may be transported via overland flow processes.	
Additional P loss reduction	Reduce use of P fertilizer where Olsen P values are above agronomic optimum. Maintain Olsen P levels at around 40	
	Reduce the risk of run-off to laneways and other sources by ensuring crossings are adequately maintained and maintain gradients of laneways to direct runoff to pasture.	
Reduce accumulation of N in the soil	Use nutrient budgeting to manage nutrient inputs and outputs	
	Time N fertilizer application to meet crop and pasture demand using split applications and avoid high risk times of the year i.e when soil temperature is low or during drought periods	
Avoid preferential flow of FDE through soil profile and artificial drains	Defer effluent application when soil conditions are unsuitable especially when applying effluent to high risk paddocks	
	Apply effluent at low rates and depths and utilize entire effluent discharge area	

F: RIPARIAN MANAGEMENT

The dairy farm is mapped to drain to Waimatuku Stream and Aparima River. Woldwide Runoff drains to the Orauea River.

All waterways are already fenced to exclude stock as required by the supplier on the dairy platform. Any other waterways on the support land are fenced. All riparian margins are left to establish with grasses and native vegetation in the first instance or as a minimum. Some waterways contain riparian planting.

Where appropriate and as part of good grazing management, temporary fencing will also be erected to prevent any point source discharges occurring. This includes fencing off swale areas where they may directly discharge to surface water. Such practices will be adopted as set out elsewhere in this plan as part of the management of CSAs, and as set out in the Environment Southland Factsheet on *Critical Source Areas,* and *Dairy NZ Wintering in Southland and South Otago Guide.*

Appendix A maps the waterways present on the property, any stock crossings and/or CSA's for riparian management.

The photos below show existing riparian planting and fencing

Photos of artificial drainage channels on the farm (CSAs) with stock exclusion and riparian vegetation.

G: INTENSIVE WINTER GRAZING

Intensive winter grazing is defined in the PSWLP as the *"Grazing of stock between May and September (inclusive) on forage crops (including brassica, beet and root vegetable crops), excluding pasture and cereal crops."*

Appendix C includes a farm map of winter grazing paddocks for 2018/2019 season. Full cultivation is undertaken and crop type is fodder beet. Cropping on Woldwide Runoff TBC

The table below outlines the good management practices which will be adopted on site for the intensive winter grazing activity.

Mitigation	Good Management Practice	Review notes
Protect soil structure and reduce N and P loss from intensive winter grazing activities	Grazing direction top of slope to bottom of slope. Use break or block feeding and ensure a last bite of 5-20m is left from CSA's	
	Back fencing to prevent stock from entering previously grazed areas	
	Use of portable water troughs to prevent stock from entering previously grazed areas	
	Use portable feed containers for supplementary feed to avoid feed wastage (From May 2019)	

H: NUTRIENT MANAGEMENT

Nutrient management is a key component to ensuring good on farm environmental practice. The farm utilizes nutrient budgeting through their supplier (Fonterra) as well as via their fertilizer representative (Ravensdown) and will append full nutrient budgets by May 2019 in accordance with the PSWLP. Any resulting nutrient budgets are reviewed and updated as required especially if farm system changes are proposed, but not less than on an annual basis. Any budget reviews are guided by a fertiliser representative and nutrient management advisor.

Regular soil tests will be undertaken to establish the nutrient status of the soils. Soils should be at nutrient levels which avoid any adverse effects on the environment but maintain good pasture production and animal health, by ensuring that the soils are suitable for optimal plant nutrient uptake.

Areas which are receiving FDE will be carefully managed to ensure nitrogen loadings are at acceptable levels and are compliant with conditions imposed by resource consents. The annual effluent nitrogen loading rate shall not exceed 150kg/N/ha. Effluent will be applied utilising low rate application. Effluent management is discussed in Section H of this FEMP.

The table below describes the good management practices which will be adopted in relation to nutrient management.

Mitigation	Good Management Practice	Review notes
Minimise nutrient losses from farming activities to ground and surface water by utilizing nutrient budgeting	Whole farm nutrient modelling using OVERSEER budget (or equivalent model) prepared by a suitably qualified person	
	Whole farm nutrient budget reviewed annually and updated in accordance with significant farm system changes	
	Minimise N losses by using soil testing to guide fertilizer recommendations and match fertilizer application with plant and animal requirements.	
	Use of a fertilizer representative to advise on fertilizer type, timing and application rates. Split applications where application rates exceed 100kg P/ha	
	Limit P application between June and August	
	Crop rotations adjusted to maximise the use of residual N in the soil	

	Stock wintering practices adjusted to minimise nutrient losses	

The following table sets out the evidence which needs to be collected for nutrient budgeting purposes:

Record	Nature of information/person	Collated (Y or N)
Production	Fonterra App, dockets	
Soil test results	Lab results, Ravensdown rep	
Fertiliser application records	MINDA land & feed, Ravensdown rep	
Proof of placement	MINDA land & feed	
Effluent application records	Dairy diary	
Crop rotation records	Farm map with total hectares	
Stock numbers	Culling timeframes Young stock grazed on farm Breeding bulls	
Record of supplements purchased	Invoices/Cash manager, MINDA	
Records of supplements made on farm	Invoices/Cash manager	
Farm map/effective hectares	Farm manager	

I: FARM DAIRY EFFLUENT

This section of this plan documents the methods that will be employed in the operation of the Farm Dairy Effluent (FDE) System to ensure that the discharge of effluent occurs in accordance with conditions of consent. Appendix D includes a full FDE Management Plan, monthly check sheets and staff training record.

Total effluent discharge area:	126 ha liquid effluent discharge area, 133ha slurry effluent discharge area
Available storage volume:	335m^3 for liquid, 7,955m^3 for slurry
Storage Type:	Effluent tanks, concrete bunker, slurry effluent storage pond
Effluent application method:	Low rate pods Slurry tanker/muck spreader/umbillical
Maximum application rate and depth of application:	10mm/hr 25mm depth per application. 2.5mm depth for slurry/muck spreader/umbillical

Mitigation	Good Management Practice	Monitoring
Reduction in effluent generation	• Reduce water use in shed by reusing clean water where possible • Treat the herd gently to avoid upset	N/A
Effluent applied only when soil conditions are appropriate	• Sufficient storage provided so that when soils are at or above field capacity and/or during adverse weather conditions, effluent can be stored in the effluent storage pond until conditions are suitable for application • Monitoring of soil moisture using the ES website. • Paddocks will be inspected before effluent application to check that soil water deficit exists. • Low rate application will be preferentially used during higher risk periods of the year with the slurry tanker used mainly in summer when a greater soil moisture deficit occurs	N/A

Avoidance of direct effluent disposal or runoff to sensitive areas	• Effluent discharge will observe a range of buffers from sensitive receiving environments as shown on the Appendix I plan attached to the discharge permit • Low rate effluent discharge will avoid ponding and/or runoff • Effluent will not be discharged onto any land areas that have been grazed within the previous 5 days • Effluent discharge will be to the entire effluent discharge area	Record irrigation dates, times and areas in the DAIRY DIARY
Avoidance of effluent contamination in tile drains	• Low rate effluent discharge to reduce the risk of through-drainage and associated risk of effluent entering water • Mapping of tile drains	N/A
Efficient and effective collection, storage and delivery of effluent from infrastructure at all times	• Monthly/frequent system checks will be undertaken using the Monthly Effluent Check Sheet attached • All parts of the effluent system will be checked and maintained regularly • Leaks will be repaired immediately • Fail safe systems will be kept in place and kept in good working order i.e. automatic alarm and shut off system	Record all repairs and maintenance (invoices, cash manager) Monthly Effluent Check Sheets filled out and signed
Staff appropriately trained in operation and understand the effluent system	• All staff involved in the management of the effluent system are fully trained in its use • All staff are familiar with and understand the conditions of consent • All new staff will be taken through the "Staff Training Guide" (attached) • Staff to take immediate action if incident or breakdowns occur including; - Rectifying the problem - Cleaning up if possible	Keep signed training record in the back off this FEMP Ensure both farm manager and employee sign to confirm training
Application that is not offensive to neighbours	• Wind conditions will be checked to ensure the effluent can be discharged without resulting in spray drift and odour beyond the property boundary • Observation of buffers to dwellings not located on the property (200 m) and property boundaries (20 m)	Complaints received by Environment Southland

J: COMPLIANCE AND REPORTING

This section sets out the records which are required to be kept which will enable the Consent Holder to demonstrate compliance, as well as detailing the reporting requirements of the consents. The Consent Holder will also participate in annual compliance monitoring inspection programs that are to be implemented by Environment Southland.

Record	Kept	Date of most recent version
Nutrient budget		
Fertilizer application records		
Soil sampling results		
Water meter certification		
Water abstraction records		
Effluent system training record		
Effluent system monthly maintenance checks		
Effluent proof of placement		
Effluent application depth test results		

Annual reporting requirements are set out in the conditions of resource consent and include;

- Prior to the first exercise of the Effluent Discharge Consent the Consent Holder shall notify Environment Southland of the operator of the effluent system
- The Farm Environmental Management Plan shall be reviewed annually, and any amendments reported to Environment Southland by 31 June each year
- The Consent Holder shall provide records from the Water Permit to ES by 31 May each year

K: ANNUAL REVIEW AND AUDIT OF FEMP

This FEMP shall be reviewed on an at least annual basis. The review shall include (but not be limited to) an assessment of;

- Verification of compliance with conditions of consent
- Details of the implementation of GMPs and identification of any new GMPs that would be appropriate to employ on the farm to manage risks identified
- Review of the data obtained from the monitoring undertaken in accordance with this FEMP and any changes to farming practice required as a consequence
- A report detailing items above shall be submitted to the consent authority each year including an updated version of the FEMP if any amendments made
- Updated maps of winter crop paddocks and CSA's if applicable

L: INDUSTRY GUIDELINES

A complete list of the industry guidelines which have been referenced in the development of this FEMP are listed below. The Consent Holder is also referred to the following general sources for guidance in respect to the operation and management of their property.

Environment Southland www.es.govt.nz **Dairy NZ** www.dairynz.co.nz **Fonterra** www.fonterra.com

Dairy NZ – A staff guide to operating your effluent irrigation system – Low Rate System
Dairy NZ – A farmer's guide to managing farm dairy effluent – A good practice guide for land application systems
Dairy NZ – Wintering in Southland and South Otago – A land management guide to good environmental practice
Dairy NZ – Land management on Canterbury Dairy Farms – Managing land to reduce sediment and phosphorous loss
Environment Southland Factsheet – Critical Source Areas
Environment Canterbury – Information Sheet for Farmers on OVERSEER®
Sustainable Dairying: Water Accord

Attachment A – Waterways and CSAs

The location of the waterways are mapped in this section for WW5 and Woldwide Runoff. Photographs are included of the CSA's present on WW5 platform.

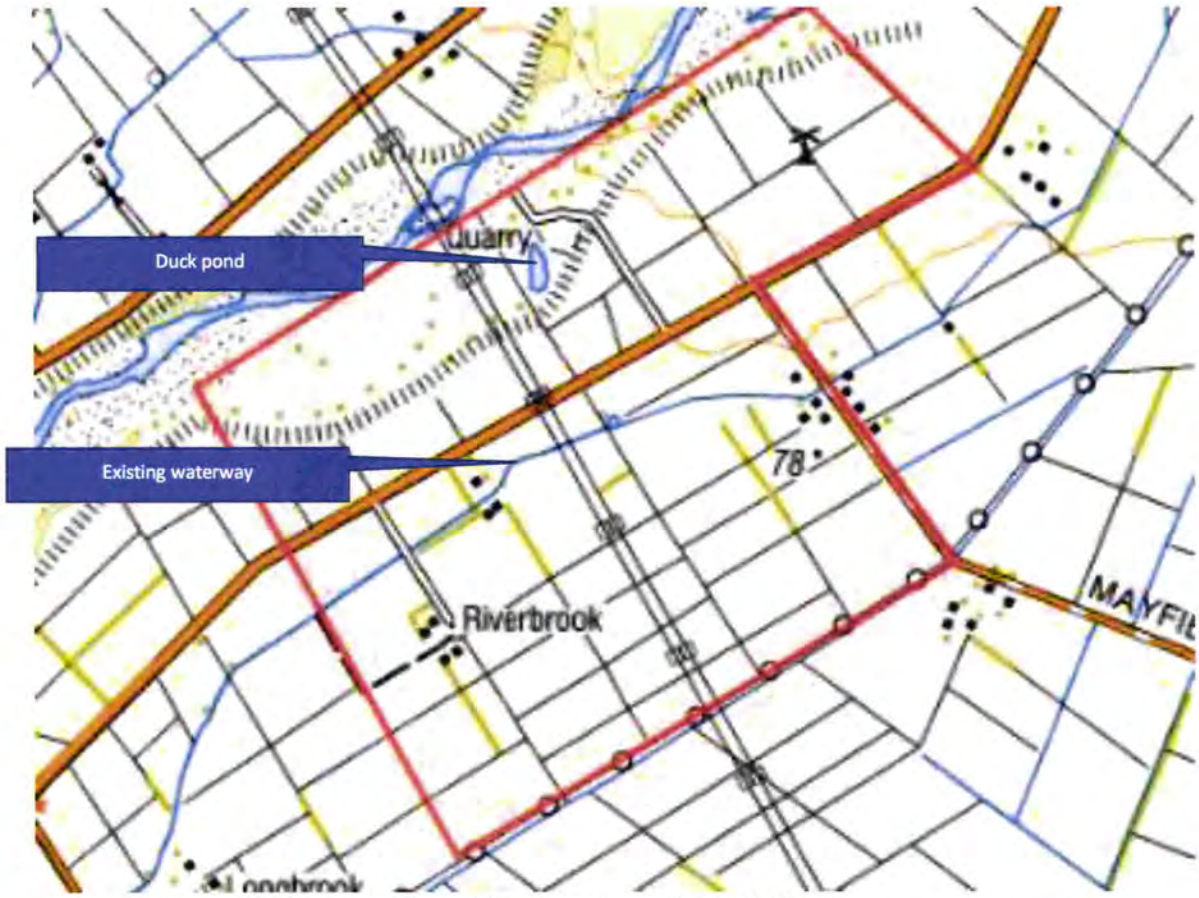
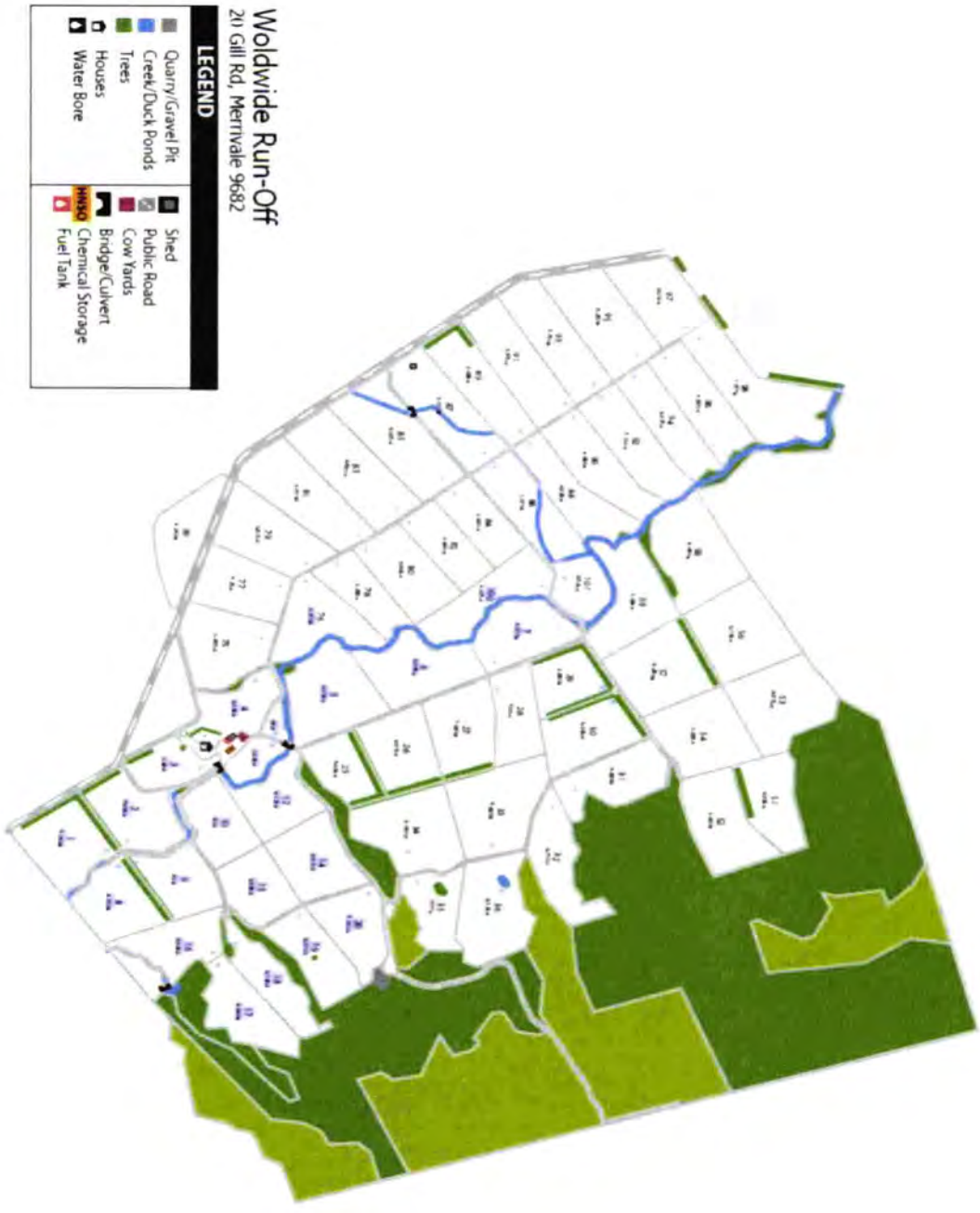
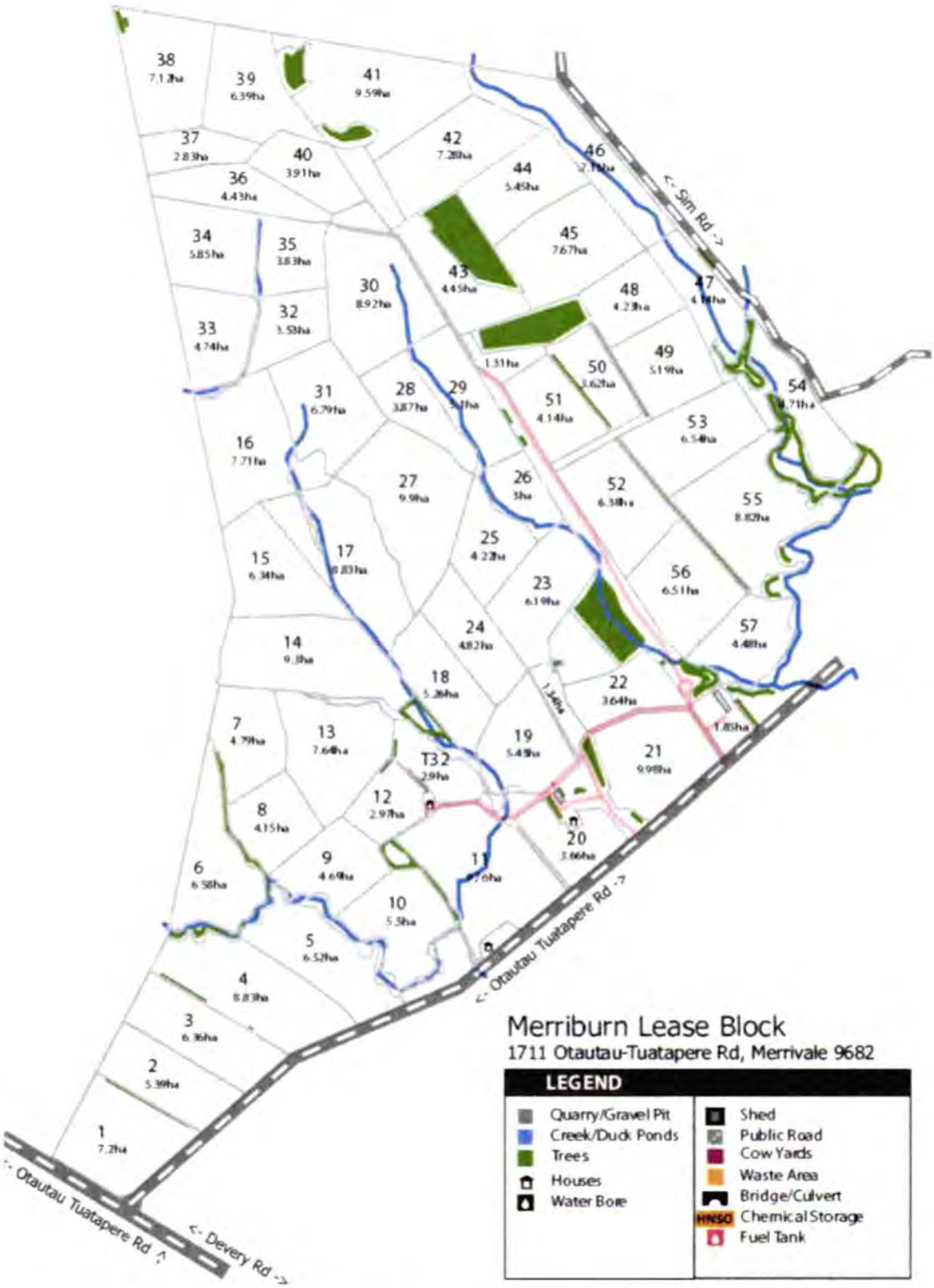


Figure: Waterways on dairy platform



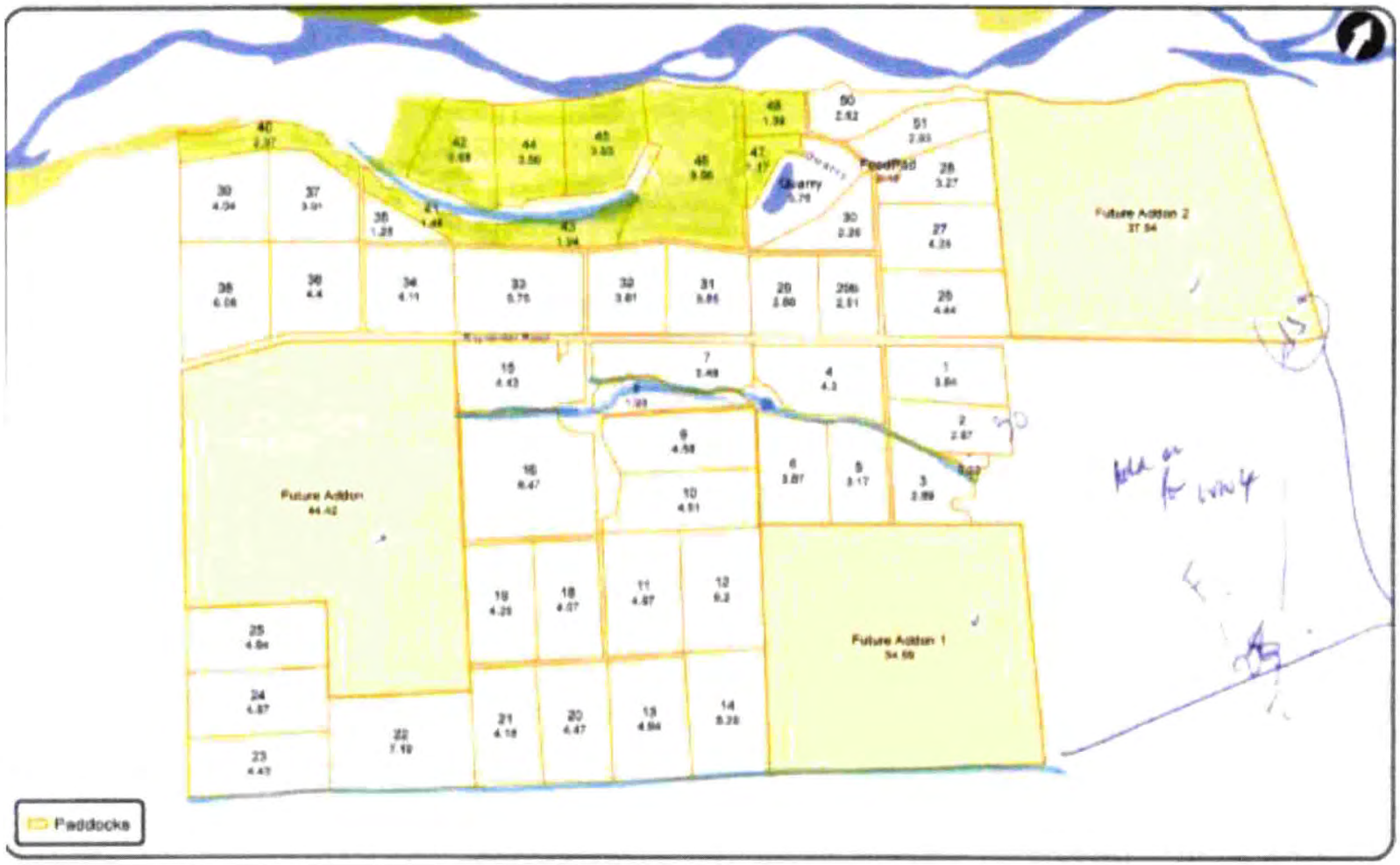
Farm map for Woldwide Runoff original block (Merrivale Block)



Farm map for Woldwide Runoff lease block (Merriburn)

Appendix B – Tile drain map (Dairy platform)

Appendix C – Crop paddocks 2018/2019 marked in Green



Appendix D: Effluent Management

Effluent Orientation and Training Record

Season___/___

Effluent Competencies	Employee name	Employee name	Employee name
General			
Understands the regional council rules and farm policies for effluent management			
Understands health and safety around the effluent system			
Understands record keeping for irrigator runs and maintenance			
At the Dairy			
Use of stormwater diversion system			
Good hosing practice and water management			
Animal handling to minimise effluent volume			
Cleaning the stone trap			
Sump, pump & pond monitoring and management (including float switches)			
In the Paddock			
When to irrigate: assessing soil and weather conditions			
Where to irrigate: runs, paddock rotations, high risk vs low risk soils etc (mark on farm map)			
Where not to irrigate: near waterways, drains, boundaries, slopes etc (mark on farm map)			
How the irrigator works, how to use it, set up, hose layout and performance checks			
Measuring the depth of effluent application			
Irrigator, pump maintenance/cleaning			
Greasing and general maintenance requirements (how and when)			
How to check and replace rubber nozzles and seals (same time as dairy rubber ware)			
Tyre pressure and condition			
Pipe-work, hose and hydrant condition			
Wire-rope, cam and ratchet condition			
Other			

Trainer signature			
Employee signature			
Date			

Date when staff become competent in each skill. If all training provided in one day, tick and date at the bottom.

DairyNZ

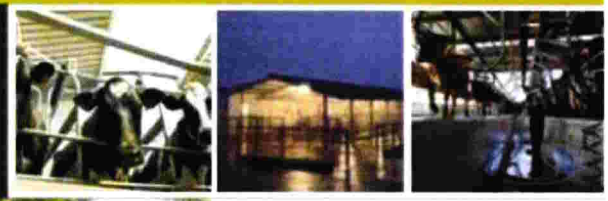
Irrigator run sheet

- ☑ Check the records to ensure effluent is due to be applied to that particular area
- ☑ Allow a minimum interval of 10 days between applications and grazing for animal health
- ☑ Ensure irrigator will be applying effluent to short pasture.

Date	Paddock	Run	Name	Comments

Smart Water Use in the Farm Dairy

This guide looks at water use in and around the farm dairy, and whether there's potential for greater efficiency. Use it to evaluate your options for improvement.



Efficient use of water can help:

- control power use and costs
- manage effluent in a cost-effective manner
- get the most out of staff time
- reduce water costs if you pay for it by volume
- meet regulatory obligations that may apply in your region.

smartwateruse® on dairy farms

DairyNZ

Profitability. Sustainability. Competitiveness.

Smart Water Use in the Farm Dairy

Milk cooling

Use source water from Tank 1.

Aim for the recommended ratio of 2½ water : 1 milk.

For example,

2.5 litres (water) x peak daily litres (milk)
÷ 1,000 = m³/day water use

To measure milk cooling efficiency

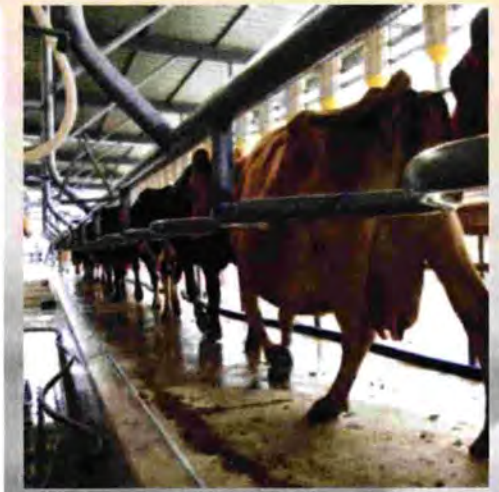
Measure exit flow into a 200 litre drum during milking.
Flow rate in litres/min x total daily milking time (clock this) ÷ 1,000 = m³/day water use

Alternatively, install a meter on the line delivering water to the plate cooler.

Efficiency options

Things to consider if improved cooling efficiency is warranted:

- use of correct flow rates
- optimal plate spacing to increase flow
- pre-cool water source
- ice banks/heat exchangers (can be costly)



Return milk cooling water to Tank 2 for use in yard wash down.

Ensure adequate storage space remains to take all milk cooling water (use float ball or probes).

Capture roof water for reuse or at least exclude it from the yard to prevent increasing effluent volumes.

As a measure of efficiency, yard wash water use should not exceed milk cooling water.

Yard wash down

To measure yard wash down water use

Follow the steps and calculations in the accompanying *Worksheet* to estimate water use.

Efficiency options

For manual yard washing, here are some ways to improve water-use efficiency.

- Pre-wet the yard on warm, sunny days with a yard hose or sprinkler.
- Use a scraper or a chain (inside an old yard hose) on the backing gate to break up dung before hosing.
- Wash the yard after each milking.
- Work actively and close to the effluent.
- Hose the yard with high water volume under low pressure.
- Include a timer setting on the yard wash down pump (set a time standard for wash down and train staff to achieve it).
- Consider capturing excess cooler water (that would otherwise go to waste) in tipper drums for yard wash.
- Flood wash with water recycled from the effluent pond (refer to conditions of use from your milk processor).

Plant/vat wash

Use water from Tank 1.

To track plant/vat water use

Wash tubs and hot water cylinders use set amounts of water. Refer to washing routine instructions supplied by the detergent companies.

Efficiency options

Here are some steps you can take to reduce plant/vat wash water use:

- Seek advice from your detergent rep on litres required for hot/cold wash options.
- Refill tanks/cylinder with automatic shut-off (to avoid overflows). Use a toilet cistern and trough floats as proven refill/shut-off options.
- Consider heat exchange or pre-heating to improve energy efficiency.

Milking routines

Procedures and practices during milking affect water-use efficiency. Below are some ways to cut water use:

- Pre wet bail and yard.
- Minimise sprinkler/spray washing.
- Hose little and often (as required) in pit area.
- Put cups on dry, clean udders (see DairyNZ's SmartSAMM – www.smartsamm.co.nz).
- Implement a calm, consistent routine to reduce stress in animals and, in turn, effluent in the dairy (see DairyNZ's Milksmart – www.milksmart.co.nz).
- Maintain the dairy (paint/surfaces) to minimise the need for continual wetting.
- For rotaries, use air jet or other methods instead of water to back cows off.

Efficiency options

Here are a few more tips for efficient water use and to reduce water loss:

- Ensure high standard of water quality (if treatment is required).
- Do regular checks for pump pressure, line restrictions and possible leaks.
- Reduce the number of hand-held hoses in use throughout the dairy.

Woldwide Four Limited

Farm Environmental Management Plan

March 2019

FARM ENVIRONMENT MANAGEMENT PLAN

A: PROPERTY OVERVIEW

Contact Person(s)	Abe and Anita de Wolde	**Plan Prepared By**	Landpro Ltd
Contact Phone	02 227 2537	**Date**	28 March 2019
Email Address	abe@woldwide.nz	**Date of Next Review**	28 March 2020
Physical Address	104 Shaws Trees Road		
Consent Numbers and Expiry Dates	TBC		
Farm Area	394 ha Includes WW4 dairy platform, Gladfield support block and Woldwide Runoff	**Peak Milked Herd Size**	1000
Legal Descriptions	Lot 7 DP 152 Lot 11 DP 152 Lot 12 DP 152 Lot 26 BLK III DP 210 (Gladfield) Lot 7 DP 238 (new block from Cochran's) Merrivale Block: Part Section 7 Block XII Waiau SD Part Section 7 Block XII Waiau SD Part Section 7 Block XII Waiau SD Lot 1 DP 3537 Merriburn Lease Block: Lot 1 DP 302409 Sec 26 Merrivale Settlement No. 1 Sec 27 Merrivale Settlement No. 1	Lot 10 DP 152 Lot 11 A DP 152 Pt Lot 2 DP 4262	

This FEMP sets out the management practices that will be implemented and adopted to actively manage the operation of the property to ensure that environmental risks are managed appropriately, and resource consent conditions complied with.

Objectives of this plan:

- Comply with all legal requirements related to land use and discharge.
- Take all practicable steps to minimise the risk of harm to onsite and nearby water resources.
- Take all practicable steps to ensure that there is an adequate supply of soil nutrients to meet plant needs.
- Take all practicable steps to minimise the risk of harm to significant vegetation and/or wildlife habitat.

This will be achieved through;

- Identifying and documenting contaminant pathways for the property (based on Physiographic Zones);
- Identifying relevant good management practices (GMP) and where they are required to be implemented to minimise environmental risks; and
- Documenting evidence to be provided to show adherence with consent conditions.

As the person responsible for implementing this plan, I confirm that the information provided is correct:

Name:..... Signed:..... Date:.....

B: SITE PLANS

This FEMP contains various site plans identifying key features of the subject property in accordance with Part B(3) of Appendix N of the proposed Southland Water and Land Plan, 2018. The following table can be used as a reference point for locating these features.

KEY FEATURES	PLAN(S) WHERE KEY FEATURES ARE MAPPED
Site boundary	All site plans in this FEMP
Physiographic zones, variants and soil types	Figure 1 and 2: Physiographic Plan Figure 3 and 4: Soil map
Lakes, rivers, streams ponds, artificial watercourses, modified watercourses and natural wetlands	Appendix A: Existing Waterways and Critical Source Areas
Other critical source areas (gullies, swales etc)	Appendix A: Existing Waterways and Critical Source Areas
Land with a slope greater than 20 degrees	N/A
Existing and proposed riparian vegetation and fences (or other stock exclusion methods) adjacent to waterbodies	Appendix A: Waterway location, most have riparian planting
Places where stock access or cross water bodies (including bridges, culverts and fords)	Appendix A: crossings labelled
Known subsurface drainage system(s) and the location of drain outlets	Appendix B
All land that may be cultivated over the next 12 months	TBC – once consent granted
All land that may be intensively winter grazed over the next 12 months	TBC – once consent granted

C: PHYSIOGRAPHIC ZONES AND KEY CONTAMINANT PATHWAYS

This section of the FEMP documents the physiographic zones and key contaminant pathways present across the property.

The physiographic plans shows the spatial distribution of the physiographic zones on the entire property according to the Environment Southland Proposed Water and Land Plan 2018 (PSWLP) as mapped by Beacon Mapping Service. The mapping system also details the key contaminant pathways present for each physiographic zone and any variants for the location.

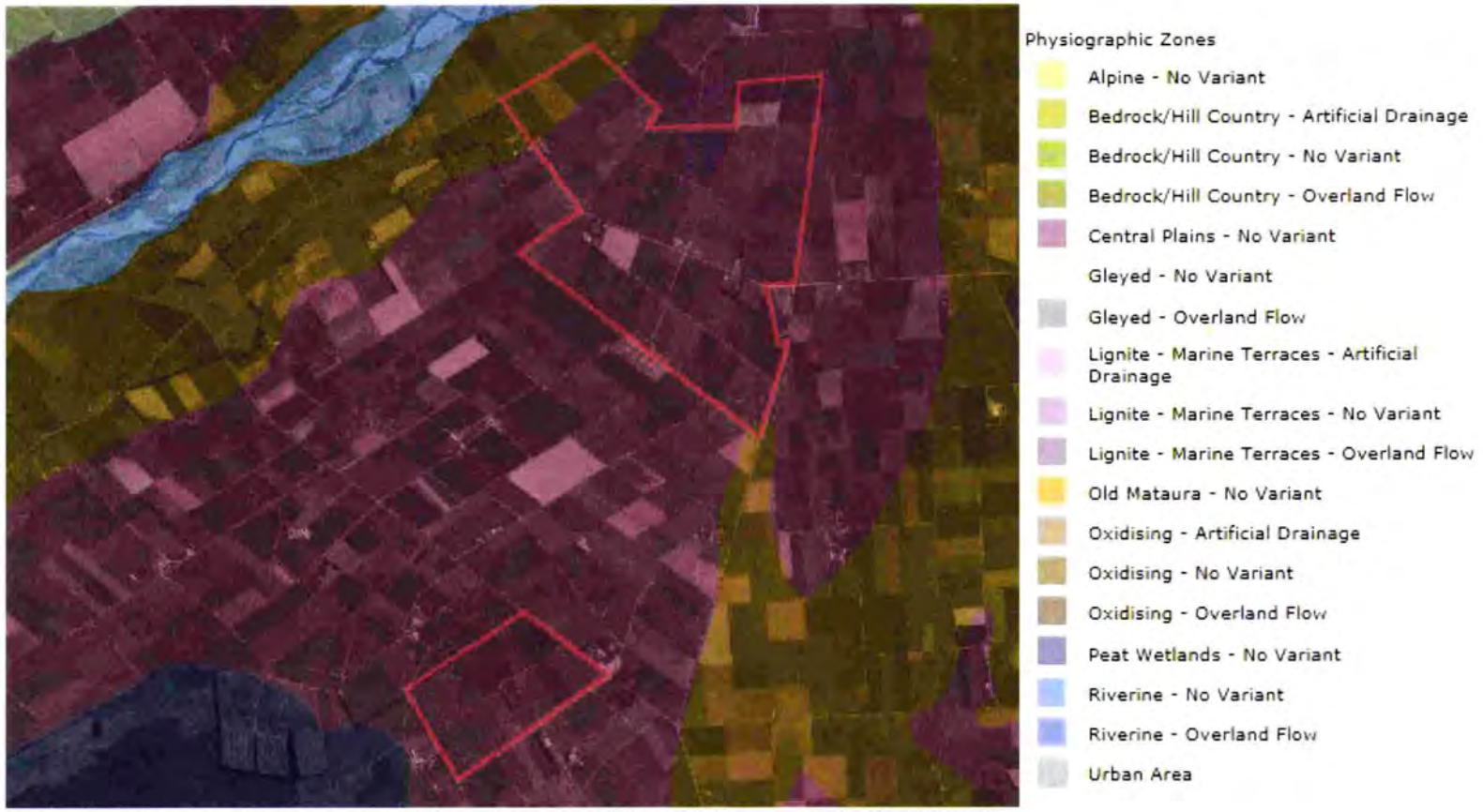


Figure 1: Physiographic Zones on the farm (showing dairy platform and Gladfield block)

Figure 2: Physiographic zones at Woldwide Runoff

D: SOIL TYPES

This section of the FEMP documents the soil types present across the property. The Soil Maps below shows the spatial distribution of the soil types across entire property according to the Environment Southland Beacon Mapping Service.

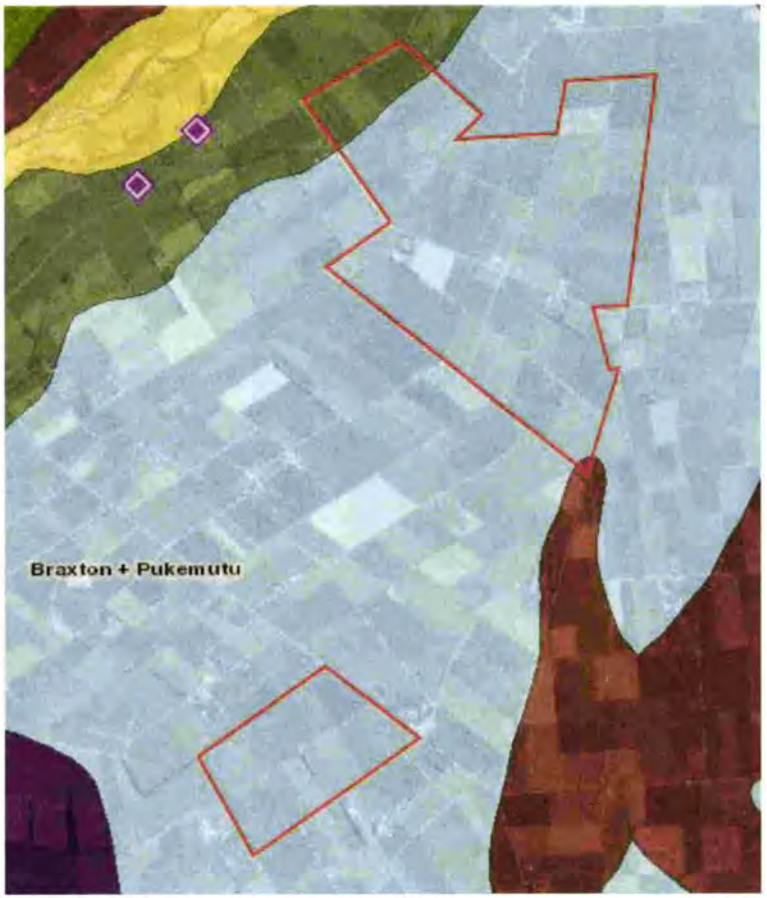


Figure 3: Soil types found on the farm (Blue = Braxton, Green= Tuatapere)

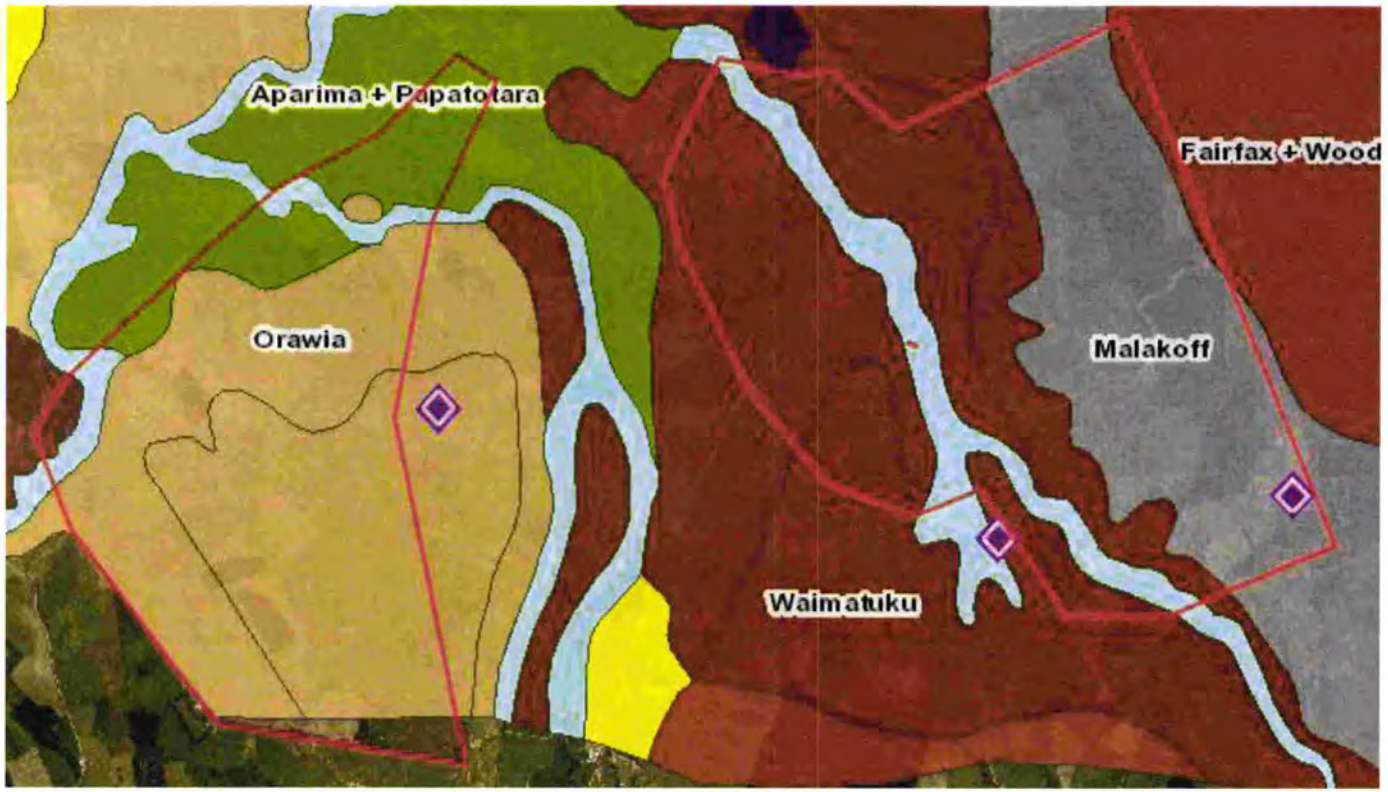


Figure 4: Soil types at Woldwide Runoff

E: GOOD MANAGEMENT PRACTICES - GENERAL

Mitigation	Good Management Practice	Review notes
Protect soil structure (will also help with P and N loss	Wintering the milking herd on fodder beet on the support block (Gladfield and WRO)	
	Re-sow bare soils as soon as possible	
	Use of selective grazing to avoid grazing very wet paddocks and open the breaks up to avoid pugging and treading damage.	
Manage Critical Source Areas (CSA)	Avoid working CSAs and their margins	
	Leave grassed areas (or native vegetation) around CSAs especially when grazing winter forage crop and/or graze as "last bite". Grazing direction should be down the slope or towards CSA.	
	All riparian margins to be fenced and left to establish with grasses to enable filtration of contaminants that may be transported via overland flow processes.	
Additional P loss reduction	Reduce use of P fertilizer where Olsen P values are above agronomic optimum. Maintain Olsen P levels at around 40	
	Reduce the risk of run-off to laneways and other sources by ensuring crossings are adequately maintained and maintain gradients of laneways to direct runoff to pasture.	
Reduce accumulation of N in the soil	Use nutrient budgeting to manage nutrient inputs and outputs	
	Time N fertilizer application to meet crop and pasture demand using split applications and avoid high risk times of the year i.e when soil temperature is low or during drought periods	
Avoid preferential flow of FDE through soil	Defer effluent application when soil conditions are unsuitable especially when applying effluent to high risk paddocks	

profile and artificial drains	Apply effluent at low rates and depths and utilize entire effluent discharge area	

F: RIPARIAN MANAGEMENT

The dairy farm and Gladfield are mapped to drain to Waimatuku Stream and Aparima River. Woldwide Runoff drains to the Orauea River.

All waterways are already fenced to exclude stock as required by the supplier on the dairy platform. Any other waterways on the support land are fenced. All riparian margins are left to establish with grasses and native vegetation in the first instance or as a minimum. Some waterways contain riparian planting.

Where appropriate and as part of good grazing management, temporary fencing will also be erected to prevent any point source discharges occurring. This includes fencing off swale areas where they may directly discharge to surface water. Such practices will be adopted as set out elsewhere in this plan as part of the management of CSAs, and as set out in the Environment Southland Factsheet on *Critical Source Areas*, and *Dairy NZ Wintering in Southland and South Otago Guide*.

Appendix A maps the waterways present on the property, any stock crossings and/or CSA's for riparian management.

Figure 5: Photos of artificial drainage channels on the farm with stock exclusion and riparian vegetation. Photo on the right shows artificial drain disappearing underground

G: INTENSIVE WINTER GRAZING

Intensive winter grazing is defined in the PSWLP as the *"Grazing of stock between May and September (inclusive) on forage crops (including brassica, beet and root vegetable crops), excluding pasture and cereal crops."*

Appendix C includes a farm map of winter grazing paddocks for 2018/2019 and 2019/2020 seasons for the Gladfield block. Full cultivation is undertaken and crop type is fodder beet. Cropping on Woldwide Runoff TBC

The table below outlines the good management practices which will be adopted on site for the intensive winter grazing activity.

Mitigation	Good Management Practice	Review notes
Protect soil structure and reduce N and P loss from intensive winter grazing activities	Grazing direction top of slope to bottom of slope. Use break or block feeding and ensure a last bite of 5-20m is left from CSA's	
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	Use of a fertilizer representative to advise on fertilizer type, timing and application rates. Split applications where application rates exceed 100kg P/ha	
	Limit P application between June and August	
	Crop rotations adjusted to maximise the use of residual N in the soil	

	Stock wintering practices adjusted to minimise nutrient losses	

The following table sets out the evidence which needs to be collected for nutrient budgeting purposes:

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Crop rotation records	Farm map with total hectares	
Stock numbers	Culling timeframes Young stock grazed on farm Breeding bulls	
Record of supplements purchased	Invoices/Cash manager, MINDA	
Records of supplements made on farm	Invoices/Cash manager	
Farm map/effective hectares	Farm manager	

I: FARM DAIRY EFFLUENT

This section of this plan documents the methods that will be employed in the operation of the Farm Dairy Effluent (FDE) System to ensure that the discharge of effluent occurs in accordance with conditions of consent. Appendix D includes a full FDE Management Plan, monthly check sheets and staff training record.

Total effluent discharge area:	78 ha liquid effluent discharge area, 320 ha slurry discharge area
Available storage volume:	3,801m^3
Storage Type:	Effluent storage pond, concrete bunker, slurry effluent pond
Effluent application method:	Low rate pods Slurry tanker/muck spreader/umbillical Travelling irrigator
Maximum application rate and depth of application:	10mm/hr 25mm depth per application. 2.5mm depth for slurry/muck spreader/umbillical

Mitigation	Good Management Practice	Monitoring
Reduction in effluent generation	• Reduce water use in shed by reusing clean water where possible • Treat the herd gently to avoid upset	N/A
Effluent applied only when soil conditions are appropriate	• Sufficient storage provided so that when soils are at or above field capacity and/or during adverse weather conditions, effluent can be stored in the effluent storage pond until conditions are suitable for application • Monitoring of soil moisture using the ES website. • Paddocks will be inspected before effluent application to check that soil water deficit exists.	N/A

	• Low rate application will be preferentially used during higher risk periods of the year with the travelling irrigator used mainly in summer when a greater soil moisture deficit occurs	
Avoidance of direct effluent disposal or runoff to sensitive areas	• Effluent discharge will observe a range of buffers from sensitive receiving environments as shown on the Appendix I plan attached to the discharge permit • Low rate effluent discharge will avoid ponding and/or runoff • Effluent will not be discharged onto any land areas that have been grazed within the previous 5 days • Effluent discharge will be to the entire effluent discharge area	Record irrigation dates, times and areas in the DAIRY DIARY
Avoidance of effluent contamination in tile drains	• Low rate effluent discharge to reduce the risk of through-drainage and associated risk of effluent entering water • Mapping of tile drains	N/A
Efficient and effective collection, storage and delivery of effluent from infrastructure at all times	• Monthly/frequent system checks will be undertaken using the Monthly Effluent Check Sheet attached • All parts of the effluent system will be checked and maintained regularly • Leaks will be repaired immediately • Fail safe systems will be kept in place and kept in good working order i.e. automatic alarm and shut off system	Record all repairs and maintenance (invoices, cash manager) Monthly Effluent Check Sheets filled out and signed
Staff appropriately trained in operation and understand the effluent system	• All staff involved in the management of the effluent system are fully trained in its use • All staff are familiar with and understand the conditions of consent • All new staff will be taken through the "Staff Training Guide" (attached) • Staff to take immediate action if incident or breakdowns occur including; - Rectifying the problem - Cleaning up if possible	Keep signed training record in the back off this FEMP Ensure both farm manager and employee sign to confirm training
Application that is not offensive to neighbours	• Wind conditions will be checked to ensure the effluent can be discharged without resulting in spray drift and odour beyond the property boundary	Complaints received by Environment Southland

	• Observation of buffers to dwellings not located on the property (200 m) and property boundaries (20 m)	

J: COMPLIANCE AND REPORTING

This section sets out the records which are required to be kept which will enable the Consent Holder to demonstrate compliance, as well as detailing the reporting requirements of the consents. The Consent Holder will also participate in annual compliance monitoring inspection programs that are to be implemented by Environment Southland.

Record	Kept	Date of most recent version
Nutrient budget		
Fertilizer application records		
Soil sampling results		
Water meter certification		
Water abstraction records		
Effluent system training record		
Effluent system monthly maintenance checks		
Effluent proof of placement		
Effluent application depth test results		

Annual reporting requirements are set out in the conditions of resource consent and include;

- Prior to the first exercise of the Effluent Discharge Consent the Consent Holder shall notify Environment Southland of the operator of the effluent system
- The Farm Environmental Management Plan shall be reviewed annually, and any amendments reported to Environment Southland by 31 June each year
- The Consent Holder shall provide records from the Water Permit to ES by 31 May each year

K: ANNUAL REVIEW AND AUDIT OF FEMP

This FEMP shall be reviewed on an at least annual basis. The review shall include (but not be limited to) an assessment of;

- Verification of compliance with conditions of consent
- Details of the implementation of GMPs and identification of any new GMPs that would be appropriate to employ on the farm to manage risks identified
- Review of the data obtained from the monitoring undertaken in accordance with this FEMP and any changes to farming practice required as a consequence
- A report detailing items above shall be submitted to the consent authority each year including an updated version of the FEMP if any amendments made
- Updated maps of winter crop paddocks and CSA's if applicable

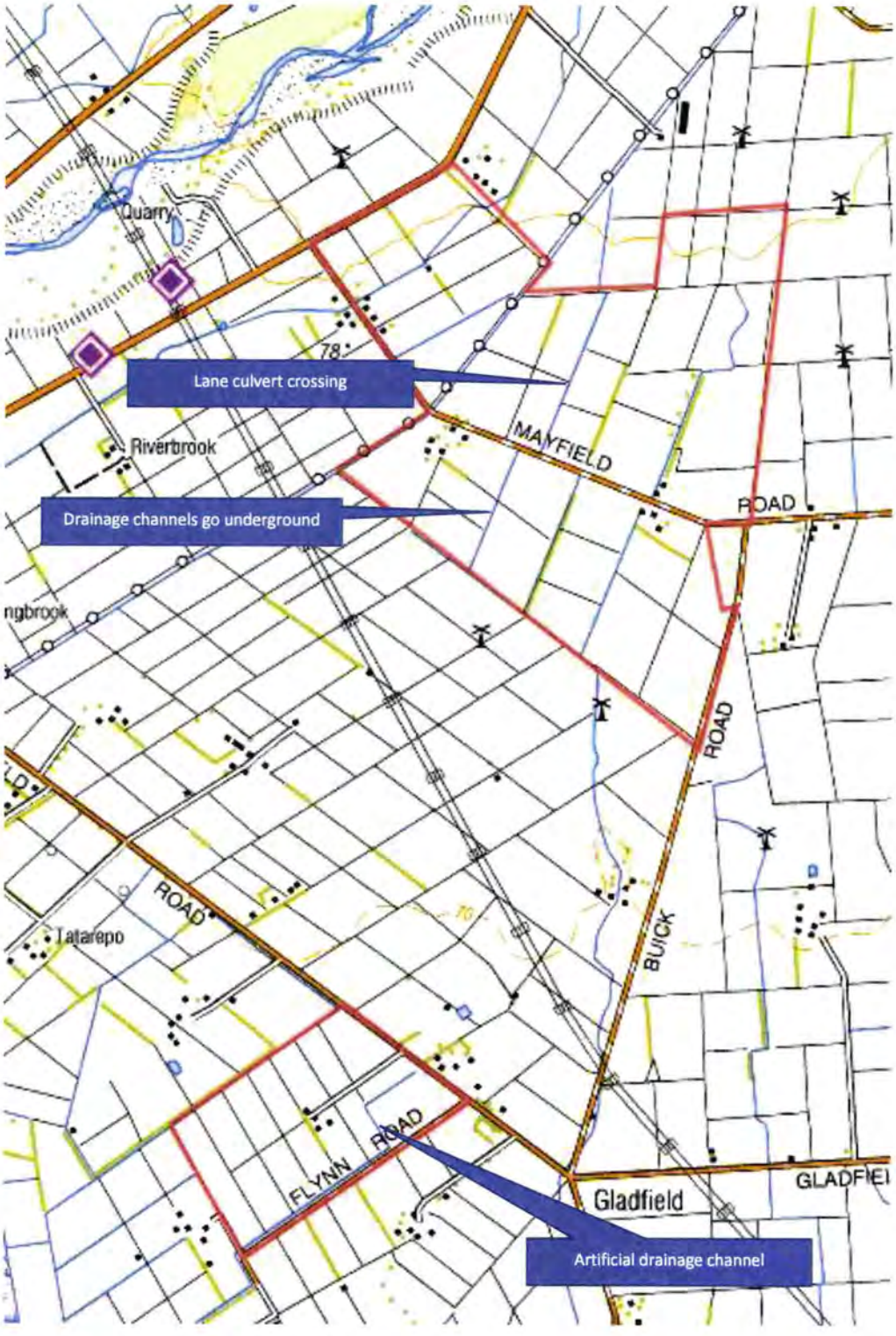
M: INDUSTRY GUIDELINES

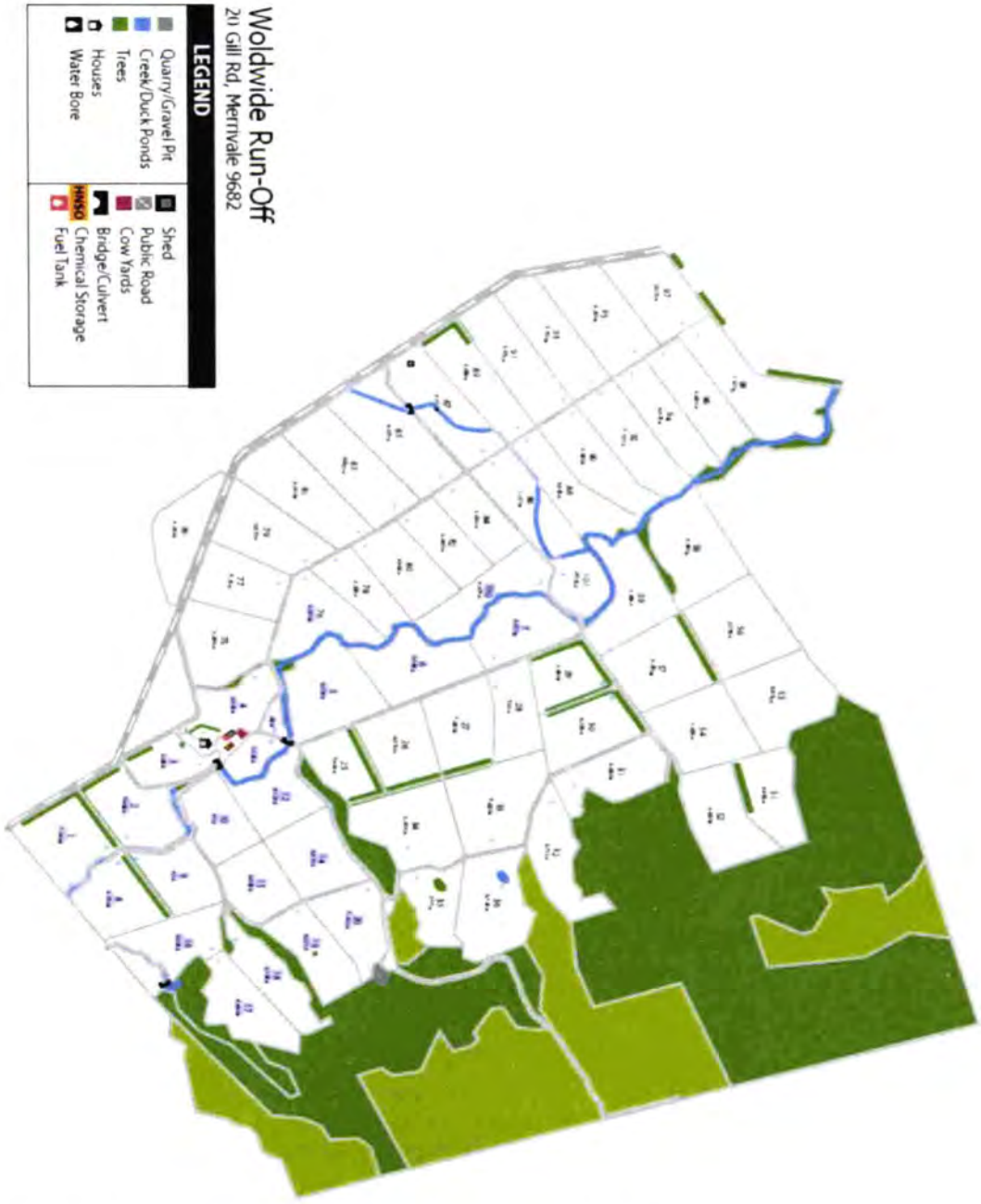
A complete list of the industry guidelines which have been referenced in the development of this FEMP are listed below. The Consent Holder is also referred to the following general sources for guidance in respect to the operation and management of their property.

Environment Southland www.es.govt.nz **Dairy NZ** www.dairynz.co.nz **Fonterra** www.fonterra.com

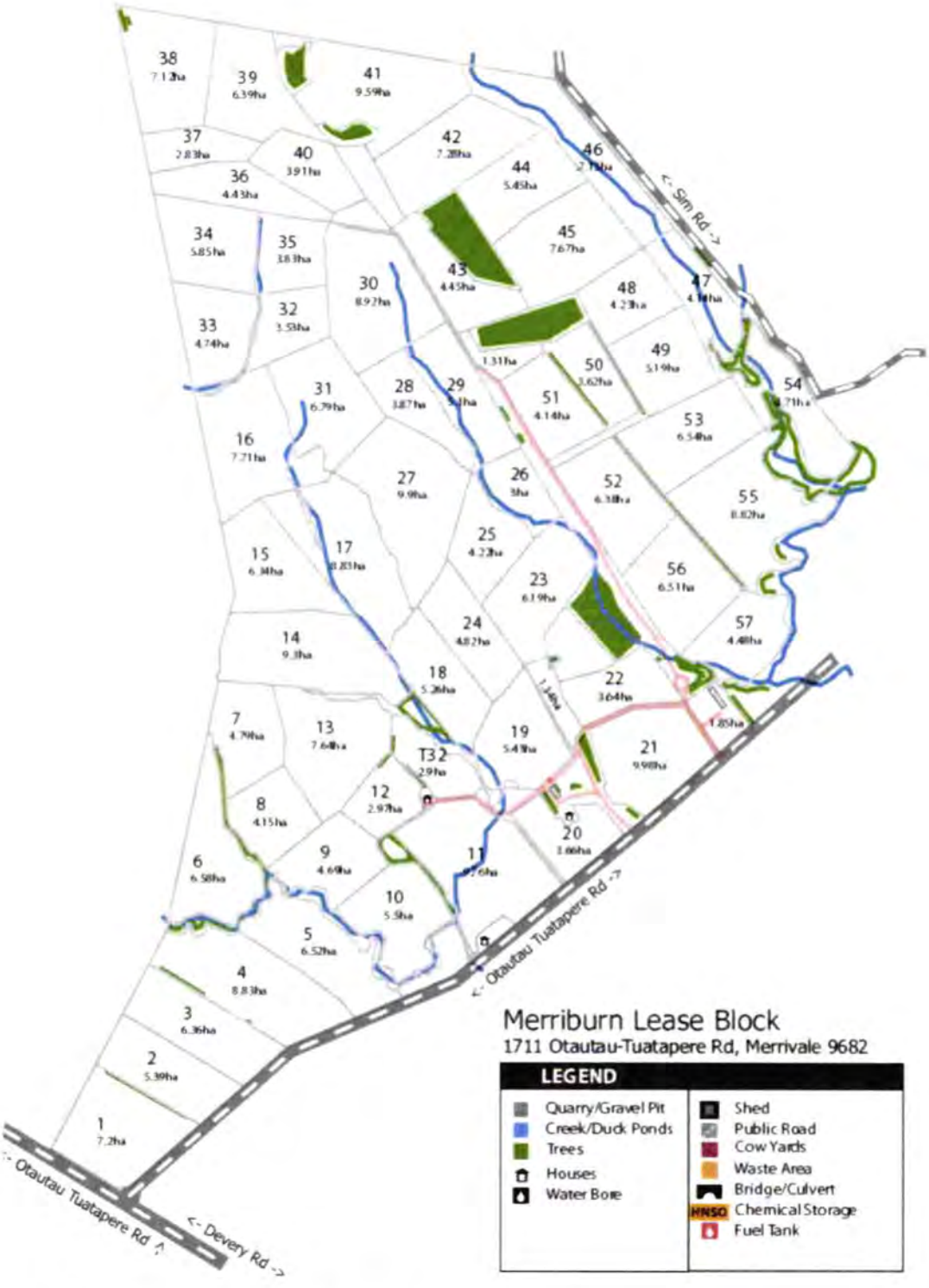
Dairy NZ – A staff guide to operating your effluent irrigation system – Low Rate System
Dairy NZ – A farmer's guide to managing farm dairy effluent – A good practice guide for land application systems
Dairy NZ – Wintering in Southland and South Otago – A land management guide to good environmental practice
Dairy NZ – Land management on Canterbury Dairy Farms – Managing land to reduce sediment and phosphorous loss
Environment Southland Factsheet – Critical Source Areas
Environment Canterbury – Information Sheet for Farmers on OVERSEER®
Sustainable Dairying: Water Accord

Attachment A – Waterways, CSA





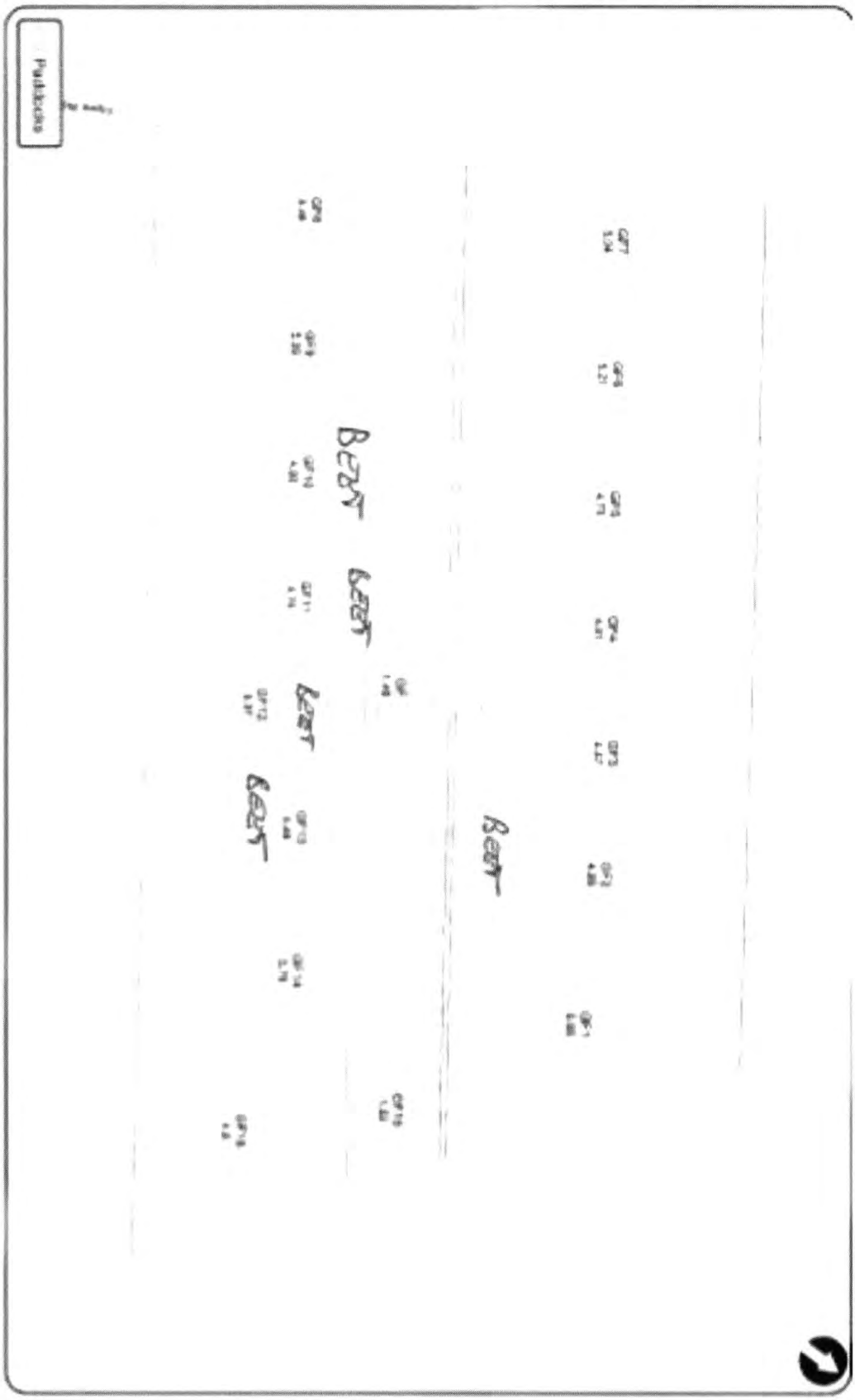
Farm map for Woldwide Runoff original block (Merrivale Block)



Farm map for Woldwide Runoff lease block (Merriburn)

Appendix B – Tile drain map (Dairy platform)

Appendix C – Crop paddocks (Gladfield block)



Appendix D: Effluent Management

Effluent Orientation and Training Record

Season___/___

Effluent Competencies	Employee name	Employee name	Employee name
General			
Understands the regional council rules and farm policies for effluent management			
Understands health and safety around the effluent system			
Understands record keeping for irrigator runs and maintenance			
At the Dairy			
Use of stormwater diversion system			
Good hosing practice and water management			
Animal handling to minimise effluent volume			
Cleaning the stone trap			
Sump, pump & pond monitoring and management (including float switches)			
In the Paddock			
When to irrigate: assessing soil and weather conditions			
Where to irrigate: runs, paddock rotations, high risk vs low risk soils etc (mark on farm map)			
Where not to irrigate: near waterways, drains, boundaries, slopes etc (mark on farm map)			
How the irrigator works, how to use it, set up, hose layout and performance checks			
Measuring the depth of effluent application			
Irrigator, pump maintenance/cleaning			
Greasing and general maintenance requirements (how and when)			
How to check and replace rubber nozzles and seals (same time as dairy rubber ware)			
Tyre pressure and condition			
Pipe-work, hose and hydrant condition			
Wire-rope, cam and ratchet condition			
Other			

Trainer signature			
Employee signature			
Date			

Date when staff become competent in each skill. If all training provided in one day, tick and date at the bottom.

DairyNZ

Irrigator run sheet

- ☑ Check the records to ensure effluent is due to be applied to that particular area
- ☑ Allow a minimum interval of 10 days between applications and grazing for animal health
- ☑ Ensure irrigator will be applying effluent to short pasture.

Date	Paddock	Run	Name	Comments

Smart Water Use in the Farm Dairy

This guide looks at water use in and around the farm dairy, and whether there's potential for greater efficiency. Use it to evaluate your options for improvement.

Efficient use of water can help:

- control power use and costs
- manage effluent in a cost-effective manner
- get the most out of staff time
- reduce water costs if you pay for it by volume
- meet regulatory obligations that may apply in your region.

smartwateruse®
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Profitability. Sustainability. Competitiveness.

Smart Water Use in the Farm Dairy

Milk cooling

Use source water from Tank 1.

Aim for the recommended ratio of 2½ water : 1 milk.

For example,

2.5 litres (water) x peak daily litres (milk)
÷ 1,000 = m³/day water use

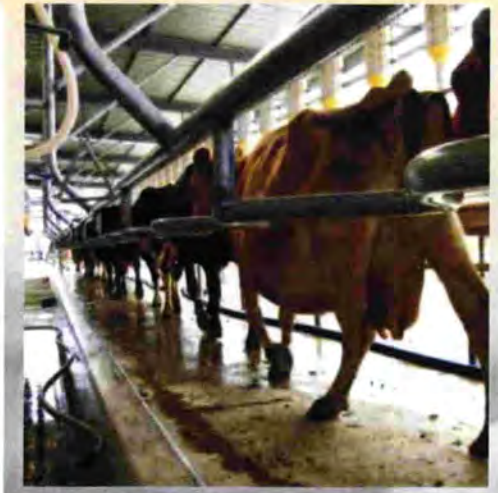
To measure milk cooling efficiency
Measure exit flow into a 200 litre drum during milking.
Flow rate in litres/min x total daily milking time (clock this) ÷ 1,000 = m³/day water use

Alternatively, install a meter on the line delivering water to the plate cooler.

Efficiency options

Things to consider if improved cooling efficiency is warranted:

- use of correct flow rates
- optimal plate spacing to increase flow
- pre-cool water source
- ice banks/heat exchangers (can be costly)



Return milk cooling water to Tank 2 for use in yard wash down.

Ensure adequate storage space remains to take all milk cooling water (use float ball or probes).

Capture roof water for reuse or at least exclude it from the yard to prevent increasing effluent volumes.

As a measure of efficiency, yard wash water use should not exceed milk cooling water.

Yard wash down

To measure yard wash down water use
Follow the steps and calculations in the accompanying *Worksheet* to estimate water use.

Efficiency options

For manual yard washing, here are some ways to improve water-use efficiency:

- Pre-wet the yard on warm, sunny days with a yard hose or sprinkler.
- Use a scraper or a chain (inside an old yard hose) on the backing gate to break up dung before hosing.
- Wash the yard after each milking.
- Work actively and close to the effluent.
- Hose the yard with high water volume under low pressure.
- Include a timer setting on the yard wash down pump (set a time standard for wash down and train staff to achieve it).
- Consider capturing excess cooler water (that would otherwise go to waste) in hopper drums for yard wash.
- Flood wash with water recycled from the effluent pond (refer to conditions of use from your milk processor).

Plant/vat wash

Use water from Tank 1.

To track plant/vat water use
Wash tubs and hot water cylinders use set amounts of water. Refer to washing routine instructions supplied by the detergent companies.

Efficiency options

Here are some steps you can take to reduce plant/vat wash water use:

- Seek advice from your detergent rep on litres required for hot/cold wash options.
- Refill tanks/cylinder with automatic shut-off (to avoid overflows). Use a toilet cistern and trough floats as proven refill/shut-off options.
- Consider heat exchange or pre-heating to improve energy efficiency.

Milking routines

Procedures and practices during milking affect water-use efficiency. Below are some ways to cut water use:

- Pre wet bail and yard.
- Minimise sprinkler/spray washing.
- Hose little and often (as required) in pit area.
- Put cups on dry, clean udders (see DairyNZ's SmartSAMM – www.smartsamm.co.nz).
- Implement a calm, consistent routine to reduce stress in animals and, in turn, effluent in the dairy (see DairyNZ's Milksmart – www.milksmart.co.nz).
- Maintain the dairy (paint/surfaces) to minimise the need for continual wetting.
- For rotaries, use air jet or other methods instead of water to back cows off.

Efficiency options

Here are a few more tips for efficient water use and to reduce water loss:

- Ensure high standard of water quality (if treatment is required).
- Do regular checks for pump pressure, line restrictions and possible leaks.
- Reduce the number of hand-held hoses in use throughout the dairy.

Dairy Effluent Storage Calculator
Summary Report

Regional authority: Environment Southland Regional Council
Authorised agent: Landpro Limited
Client: Woldwide Five Ltd
Program version: 1.50
Report date: Monday, 21 January 2019
General description:

DESC prepared by Tanya Copeland and reviewed by Zen Gerente
1000 cows
Mix of low and high risk soils
Wash down water at 3 L/sec based on scraped yard
Discharge via low rate pods at 1mm/hr restriction and via slurry tanker during summer months
Solid effluent stored and dealt with in a separate system
343 m2 of additional catchment includes underpass effluent
Current storage is 180m3 in above ground tanks

Climate

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

Effluent Block

Area of low risk soil: 59.2 hectares
Minimum area of high risk soil: 70.9 hectares
Surplus area of high risk soil: 0.0 hectares

Wash Water

Yard wash:

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

Month	Number of Cows	Hours in Yard	Wash Volume (cubic metres)
January	1000	4.0	3.0
February	1000	4.0	3.0
March	1000	4.0	3.0
April	1000	4.0	3.0
May	1000	4.0	3.0
June	1000	4.0	3.0
July	0	0.0	0.0
August	500	4.0	3.0
September	750	4.0	3.0
October	1000	4.0	3.0
November	1000	4.0	3.0
December	1000	4.0	3.0

Irrigation

Winter-spring depth: 1 mm

Spring-autumn depth:	2 mm
Winter-spring volume:	40 cubic metres
Spring-autumn volume:	240 cubic metres
Irrigate all year?	Yes

Catchments

Yard Area:	1200 square metres
Diverted?	Yes
- diversion start:	16 June
- diversion end:	31 July
Shed Roof Area:	440 square metres
Diverted?	Yes
Feedpad Area:	0 square metres
Covered?	No
Diverted?	No
Animal Shelter Area:	0 square metres
Covered?	Yes
Diverted?	No
Other Areas:	343 square metres

Storage

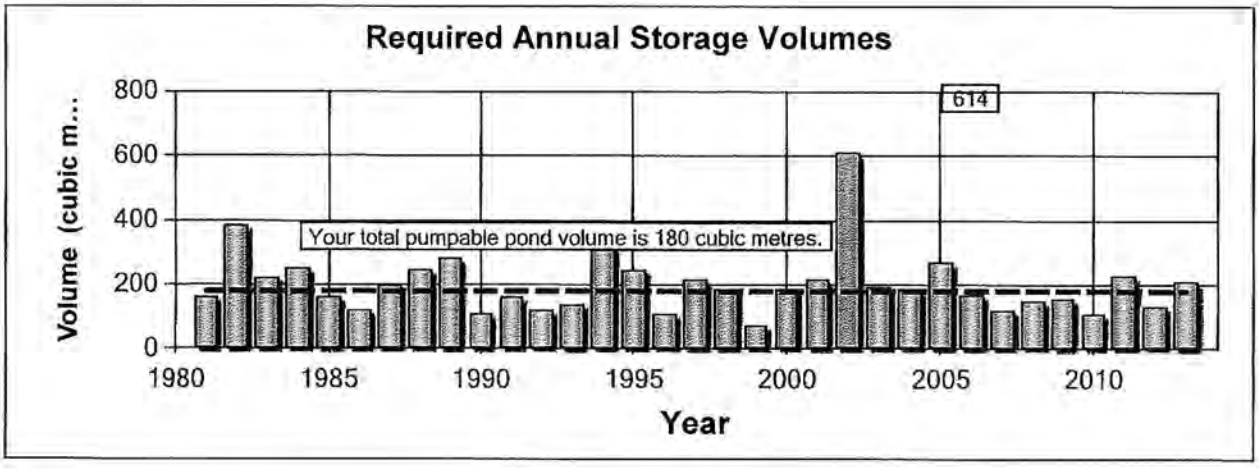
Pond/s present?	No
Tank/s present?	No
Emergency storage period:	0 days

Solids Separation

Solids separator/s present?	No

Outputs

Maximum required storage pond volume:	614 cubic metres
90 % probability storage pond volume:	335 cubic metres
During the period from:	01 July 1980
To:	30 June 2013


Required Annual Storage Volumes
Volume (cubic m...
800
600
400
200
0
614
Your total pumpable pond volume is 180 cubic metres.
1980
1985
1990
1995
2000
2005
2010
Year

Dairy Effluent Storage Calculator
Summary Report

Regional authority:	Environment Southland Regional Council
Authorised agent:	Landpro Limited
Client:	Woldwide Four Ltd
Program version:	1.50
Report date:	Friday, 18 January 2019

General description:

DESC prepared by Tanya Copeland and reviewed by Zen Gerente
1000 cows
78ha effluent area, high risk soils
Wash down water at 3L/cow/day based on a scraped yard.
Discharge via low rate pods, travelling irrigator and slurry tanker
480m2 of additional catchment areas includes underpass effluent.
Current pond dimensions included

Climate

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

Effluent Block

Area of low risk soil:	0.0 hectares
Minimum area of high risk soil:	78.0 hectares
Surplus area of high risk soil:	0.0 hectares

Wash Water

Yard wash:

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

Month	Number of Cows	Hours in Yard	Wash Volume (cubic metres)
January	1000	4.0	25.0
February	1000	4.0	25.0
March	1000	4.0	25.0
April	1000	4.0	25.0
May	1000	4.0	25.0
June	0	0.0	25.0
July	0	0.0	0.0
August	500	4.0	25.0
September	750	4.0	25.0
October	1000	4.0	25.0
November	1000	4.0	25.0
December	1000	4.0	25.0

Irrigation

Winter-spring depth:	4 mm
Spring-autumn depth:	5 mm

Winter-spring volume:	240 cubic metres
Spring-autumn volume:	240 cubic metres
Irrigate all year?	Yes

Catchments

Yard Area:	1100 square metres
Diverted?	Yes
- diversion start:	15 June
- diversion end:	31 July
Shed Roof Area:	440 square metres
Diverted?	Yes
Feedpad Area:	0 square metres
Covered?	No
Diverted?	No
Animal Shelter Area:	0 square metres
Covered?	Yes
Diverted?	No
Other Areas:	480 square metres

Storage

Pond/s present?	Yes
No. of ponds:	1 pond/s
Includes irregular ponds?	No
Pond 1	
- total volume:	4824 cubic metres
- pumpable volume:	3801 cubic metres
- surface area:	2142 square metres
- width:	34.0 metres
- length:	63.0 metres
- batter:	2.0:1
- total height:	3.0 metres
- pumped?	Yes
Tank/s present?	No
Emergency storage period:	0 days

Solids Separation

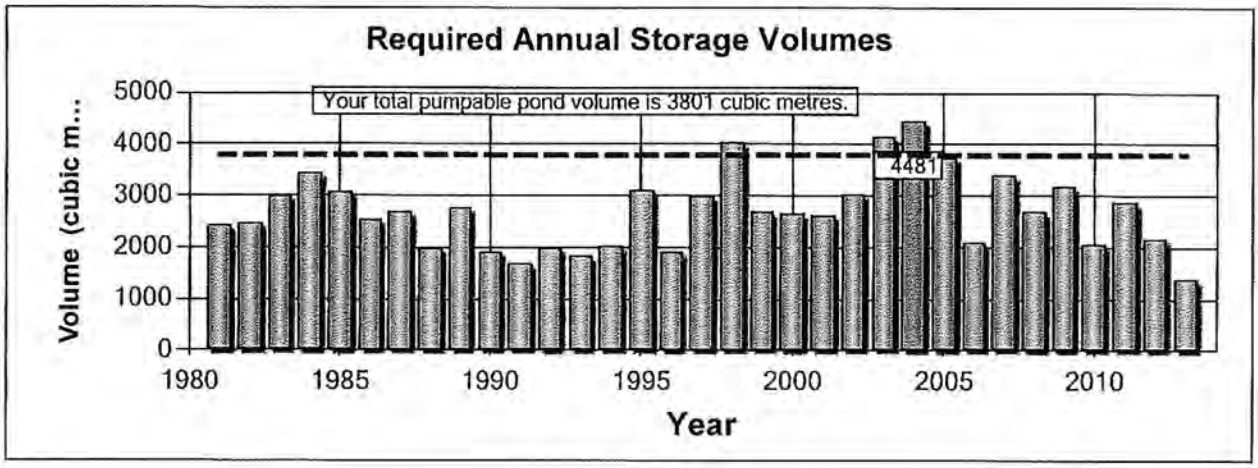
Solids separator/s present?	No

Outputs

Maximum required storage pond volume:	4481 cubic metres
90 % probability storage pond volume:	3660 cubic metres
During the period from:	01 July 1980

To:

30 June 2013



File Note

From:	Alex Erceg
Date:	Friday, 9 August 2019
File Reference:	APP-20191052 & APP-20191140
Subject:	***Woldwide 1, 2, 4 and 5 Application***

Note:

McMurdo Just to introduce, I'm Glen McMurdo, I'm an employee here at Environment Southland, I'm a Senior Investigator but for today's purposes I'm the Chair of the meeting. I don't know anything about the consent that we're discussing today and I haven't been formally introduced to any of the members who are here today that are not from Environment Southland. I'm not sure if everybody knows each other so for the purposes of today this is being recorded and a transcription will be done to provide an accurate record for all parties today, if everybody is in agreement with that, if not let themselves be known. For the purposes of the recording we'll just go round the room and introduce each other.

Present: Mike Freeman (Landpro), Nessa Legg (Dairy Green), Abe de Wolde (Applicant), Alex Erceg (Environment Southland), Jade McCrae (Environment Southland), Aurora Grant (Environment Southland), Michael Durand (*until 11.00am*, (Environment Southland) and Glen McMurdo (Environment Southland and Chair)

McMurdo Just a bit of housekeeping, if any parties need to take a break one will be given, if anyone needs a toilet break there are toilets in the reception area. My role today is purely as Chairperson and if there's no traction on the matter then we'll park it and move on. The reason for today's meeting is to establish a timeline on receiving and considering and responding to proposed amendments relating to applicants Woldwide 1 and 2 and Woldwide 4 and 5 I understand, if I have anything incorrect please correct me. Also to establish a suitable hearing date for the hearing commissioner and to consider the applications today, as I understand it, to identify the scope of the proposed amendments and the hearing date. So, I understand as far as transparency is concerned council wants to raise the matters of interest, I'll leave it over to you Aurora.

Grant It's not on the agenda but like I said to you Mike, if we adopted your agenda it didn't have anything like that to talk about. The other issue up, I will be putting in my Section 42A at this stage so if we're all in agrAEEnce of discussing that at some point today. I think it would be helpful to all parties.

Freeman Definitely. My agenda's got "any other matters".

Grant Ok.

McMurdo Shall we start with, in relation to the applications themselves, the matters, I'm not sure who wants to start?

Grant Probably the applicant, if you can just discuss the changes that have been made to the category, we haven't gotten through all of it yet, but Alex might have identified some changes, so if you could just run us through.

Freeman I could try from my perspective and as you'll appreciate Nessa has virtually gotten back off a plane. In terms of mitigation, obviously, I'm sure you don't want us to go through all the details of what Cain Duncan and Mark Crawford have put together, we can do if needed, they are available if anybody wants more detail, but I think off the top of my head this probably, probably only have a dozen key mitigation measures that are covered in all these detailed reports….

Grant Just to keep this clear can we, are we talking 1 and 2 or 4 and 5? Can we keep them kind of separate because that's how I've assessed, so there's two separate 42A's.

Legg Maybe if you do 4 and 5 and Woldwide runoff then I can…

Freeman Ok, yep.

Grant Ok thank you.

Freeman But there are basic similarities between them in terms of how the winter barns are managed, how fertiliser is managed, lane way management, riparian management, grazing management, cropping management. Management in terms of different soils and characteristics of the soils and physiographic zones.

Grant Has that been included in an updated FEMP?

Freeman Ah, I don't think so that all the FEMP's have caught up with all the mitigation measures yet, cause as you'll appreciate the priority has been put in to getting these detailed and into modelling and the FEMP's would have to follow. But I agree that it's very clear in my mind that the FEMP's would have to lock in what's specified here and our expectation I'm sure would be that the FEMP's would be locked in their conditions. So from my perspective that's an outline of 4 and 5 and Woldwide runoff.

Grant So that will be a further change to come?

Freeman How do you mean a further change to come.

Grant So you will be making changes to the FEMP in light of what's been modelled in the supplementary?

Freeman Yes we will need to.

Erceg And is that aimed to be submitted prior to the finalisation of the 42s or prior to hearing…

Legg I was thinking it would be with evidence coming in, would most suit us since essentially the FEMPs are, the basic documents as they currently are, they just need to be updated which they will be anyway each and every year. But we can, if you think, they need to come in before that it is something we could look at doing.

Grant It would be helpful if the FEMPs along with an updated AEE for each application would be incredibly useful because now, at the moment, I've got almost half a puzzle piece which I'm trying to put together with your older stuff but every change influences the further farm change which may influence my report, and at the moment the report that I've written for both of these application is not going to be helpful for anyone making a decision because it doesn't actually reflect what is happening on the ground now, in light of these changes.

Freeman It's obviously relatively straightforward to transfer all the detailed mitigation measures into an FEMP, it's quite a bigger job to write an AEE.

Grant It is. Yes.

Freeman …when the information…I appreciate what you're saying, that you want as much information in front of you to enable you to write up your 42A reports.

Grant Well to write up a helpful 42A report. I can write one on what information I have in front of me but at the end of the day is that going to be helpful to anyone. Because what we want out of this is a new decision for all parties, so…

Durand The commissioners will expect that of us, our role is to advise them on what we think is the right thing to do so that requires us to be able to assess, adequately assess what you propose to do and what the effects of it will be, so that assessment of effects is a critical part in that, to enable us to advise the panel constructively and effectively.

Freeman Obviously from my perspective I'm just looking at dates and how to achieve that working back from a proposed 16 September hearing week, that brings it back to 26 August, to have 42A reports finished doesn't it, then we, if we then try and produce a comprehensive AEE that covers every aspect, to get that to you in time for you to finalise a 42A report, yeah.

de Wolde I'm just looking at cost to be honest like after you guys stuffed up this thing in December you said you were going to make it easy and we're like a $57,000 bill from you guys for the month of July. I mean the costs are just loading and loading and loading, how big a mountain of information do you need, would it not be possible ?????

Grant I do appreciate that. We did agree on some timeframes for that application to be lodged early January and it wasn't and it wasn't received until the end of March early April.

de Wolde Then May, June, July because Environment Southland couldn't make, I mean we can go through the whole story, you said you were going to make it easy for us to re-lodge. You Michael and you Aurora were at our place apologising for the stuff up and committing to an easy process from here on in and it's been anything but easy and I would just really ask you can you please not have

like an unnecessary mountain of information. Can you please just try to join the dots wherever possible and keep the cost acceptable to us. It will well go over a million dollars seriously.

Grant I do appreciate ??? invoices but unfortunately we were ready to go, we were ready to go to hearing. The reports were written on the application that was put in from that and I assessed it and then all the changes came in which is going to put the cost up because all of this new information has to be assessed and somebody has to pay for that and that is what, that's why we're having this meeting.

de Wolde Yep. Well my question is would it be possible for you to join the dots without any, an extra amount of information that we to write and you have to process because it would just flow out of the changes that we have made anyway. It would be the same.

Grant No it won't. It's going to result in an unhelpful 42A report being put into the commissioners and I'm not prepared to put myself up in a professional sense joining the dots without doing it properly I'm sorry.

Durand And also we've got submitters who are part of this process, they aren't here today, but we've got submitters in opposition to what you want to do. They would expect and the community expects that decisions are made on the basis of good advice, good information. So I totally appreciate the amount in costs and the, what's kind of complete information, how far do you have to go, but the council has got to be comfortable that they are putting up useful advice because we've got a duty to the community to do that and we've got a duty to the council to do that. So yeah, changes are proposed to be made and have been made and we need to be able to assess those so we can fulfil our obligation there.

de Wolde For any submitters that are voting I mean, it all flows out of a further reduction to our increment losses doesn't it.

Grant Well at the moment some of us suggest that that may have been but I think I've updated an AEE at the moment the current AEEs are all based on your old losses and like, I mean, I can appreciate you looking at it and saying well common sense says that that's going to have. you know, but unfortunately this is a legal process and the evidence has to be there for me to be able to assess it. And, at the moment I'm trying to join conclusions with things that don't match up because I don't have that missing puzzle piece so it's difficult for me.

Freeman One issue from my perspective, is balancing what, I think you're right, it makes your job easier and more appropriate if you're giving advice to commissioners, if you've got all the information in front of you, but in my mind there are possibly two routes you go down. You sort of put the whole thing on hold while Nessa goes back to square one and completely rewrites that, we go back to square one and completely rewrite that, or you essentially say right, this part has been changed by this much and the part of this that could potentially be properly updated, arguably from our perspective which we need to do anyway for the evidence, for our evidence that would be coming at say the 2 of September, if we were solely looking at assessing the actual effects side of it and not going through, you know, every sentence and every paragraph in this part, which would take a lot of time to make sure that everything is absolutely kosher, if we were focused on this side of it, I don't know, my instinct is for if, for example, if we were aiming to update the existing…..

Grant Like what, like the science….

Legg Just the assessment of the facts and nothing else in the remaining application.

Freeman Yeah, yeah, if we were focused on that from my perspective I think I \'d have a chance, a fighting chance of having that completed by the 19th, which would then give you a full week to finish a 42A report. But that's just off the top of my head for 4 and 5, I don't know what Nessa….

Legg If it was purely limited to Section 7, the assessment of effects, and nothing else, it's something I could do but it wouldn't involve you know, rewriting the whole of Section 7. It would be using what's there and amending it where appropriate based on these changes.

Grant Yes. I'm happy to take the information that's here and say these are the changes, what I really need to know is "so what does that mean". And that should be reflected in an updated AEE because….

Legg So are we agreeing, when you say AEE, is what we've provided and for me it would be that Section 7 of Woldwide 1 and 2's application.

de Wolde I mean from my perspective, I mean the costs are one thing but like I've been forced to intensive winter graze now for three years and any further delays will force me to do it another year. This puts me right past the sewing date for the crops for next year, and it's just like in 2016 we identified we wanted to end intensive winter grazing and we are forced to keep doing it by dilly dallying and more information and added cost and that is just my frustration. I really, really would not like any further slippage in the dates because that's just unmanageable for me to do another year of intensive winter grazing.

McMurdo I think discussing the information leading to the 16th of September is one thing and perhaps we understand what everybody is talking about now, it seems we need to have the discussion already before we actually make it by the 16th of September for the hearing because that might clarify for you as well.

de Wolde That's, from ,my perspective its really important.

Freeman Yes, so is it realistic and if not why not and if so, why.

Grant Ok, so this is what we have put together with everyone around those dates where they are not available. So, I can appreciate….

Freeman You'll have to explain it to us.

Grant Yes I'll do a bit of an explanation. Down the right had side we've got the initials with the people that are involved and if their name's on a date they are not available on that date so immediately on the 16th of September, that date is completely out for me, the whole week.

Freeman Can we ask why?

Grant Yes I am not here. I am not in Invercargill.

Freeman Alright. And there's nobody else.

Grant No. Alex is away but working remotely the entire of September. So this is when the hearing was moved at your guys request from the 5th of August to the 19th of August.

de Wolde No I object to that, that was not our request.

Grant Ok.

de Wolde That's not true.

Grant Ok. It came from your consultants but, it came from Tanya…

Legg I wasn't here.

de Wolde From the 5th.

Legg Yeah, not from the, the 19th.

de Wolde Then It was moved to the 19th of August, yes.

Grant Yes so that, I said that, that we were out for September. September we also have two other hearings on, the 16th of September, that week.

de Wolde From the 19th of August, it was not moved at our request. We were locked in for the 19th of August.

Grant Yes. And then I was given a whole lot of changes to your application.

de Wolde I'm just saying that we were locked in for the 19th of August and we did not request that to be changed.

Grant I made that request Abe because I wasn't in a position to make a helpful assessment of your updated application, so this is unfortunately what happens when people choose to change their application at the very last minute.

Legg I mean Aurora, that's true but the background to that is that there was a big decision in June which we have to take on board what came out of that, you know, it's only reasonable for us to also use that information which you would no doubt have used. It wasn't as if we sat back and just decided hell we're going to change. You know, we have done our best, it was done in…

Grant I'm not even going to answer this.

Durand For the record, just for the transcript, the decision, the Adams decision I think came out 4 weeks before we were told by Mike in his email changes were made, were proposed to be made to the application, and sorry I don't have that email in front of me but I think it said something along the lines of "significant changes to the application" or something that sounded like quite a change. Something new to assess. Subsequent to that I had a letter from Hans van der Wal, from you lawyer saying that actually these were relatively minor changes. But so, the Adams decision, yes

that came out some time before this and I mean, I wrote to Mike about this and said that that decision essentially confirmed what we had said for more than a year, it confirmed the plan says what it says about the policy direction. It didn't change anything from our perspective anyway, it confirmed how the policy is to be interpreted and it confirmed how consents can and cannot be granted, so we don't consider, it's pretty academic, we don't really consider whether it changes anything, we don't consider that it actually changes anything. If you think it does, sweet, that's fine. You saw that decision and took several weeks to tell us what you were going to do about it, and that was two days before our 42A report was to be released and it was couched on that day, as something that looked like potentially major changes to the proposal. We sought direction from the commissioners, we received this information, what should we do about it, and they directed that we meet and that the hearing be postponed so we could understand the scale of these changes. And that's where we are now. It's taken that time to come together here. So we sought direction from them, what do you want us to do, cause we didn't want to throw two reports that had taken, like Abe said, a considerable cost and expense, our time and Abe's money, to produce, to advise commissioners. We don't want to put those up to the panel and have them be of no use, or questionable use, because of changes that have been made that haven't been assessed. That's why we asked for direction from the commissioners – what they want us to do about this because we want to be helpful. And that's where we are now. I take it that the Adams decision was an important decision, I think we were all waiting to see what was said but actually it didn't change anything, and it took you some time to tell us, to respond to us about what it meant for you, and you did at the very last possible moment.

Grant And there is until and Act that would have allowed, you could have used Section 91A to say hold up, we need to assess what this decision means for us, but you didn't use that, so I felt like I was in a position where I had to say we've received all this additional information, I have no time to take it into account, and what you're going receive from the commissioners is an unhelpful 42A report. And in seeing the information that has been provided, the reports in their current form will be not relevant.

Freeman But anyway, there's 10,000 books written on the causes of the First World War so people don't even agree on what caused the First World War or whatever, so we ,may not….

McMurdo So apparently the date is the 16th of September.

Freeman Well it is at the moment but presumably….

de Wolde Is it true, you cannot make it.

Grant I can't make it and also like, I would be happy to cancel that but we also have two other hearings booked in that week and doing three, and especially one of your size, is not possible with the council resources that we have. So who's not on here is Lacey (Bragg) as in from here, but she's obviously taken out for these other two hearings. So the week of the 16th of September is not achievable from the council's side, sorry.

Freeman But obviously what we don't have on this calendar is…

Grant Is the commissioiners.

Freeman Yes.

Grant Yes, I know. Which is not very helpful.

Freeman If it would help we could spend half an hour working out something that we're all sort of grumpily happy with and put it to the commissioners and they say "sorry, we're not available".

Grant Yes, I agree.

Durand Well they've asked us to agree on a date, I suggest that maybe it's better if we agree on preferred dates, or maybe a series of options and put that to them and say well here's what we've got, which of those work.

McMurdo How often do they sit?

Durand They're all involved in other things, environmental court stuff, mediation and who knows what, they've got busy calendars as well.

de Wolde Thinking outside the square is it possible to pull us forward or is it not possible.

Grant Not with this statutory timeframe. Legal requirements for securing evidence with this because there's submitters involved and because now I've got to rewrite some….

Freeman Absolute bottom line the commissioners will want at least a full three weeks clear prior to the hearing starting then bang, bang, bang, 42A report, applicant's evidence, submitters evidence, week, week, week.

de Wolde Why have you not communicated that you are unavailable that week? Why have you not communicated that?

Grant I have communicated it.

de Wolde To who?

Grant To the commissioners.

de Wolde Yeah but us…

Grant Pardon?

de Wold Why have you not communicated it to us? I mean you are all working on this potential 16 September date and you're not even available.

Grant No, I…

de Wolde So why have you not communicated prior?

Durand Can we just remind ourselves of the purpose of this meeting which is to look at the availability dates.

de Wolde No, no, you are not chairing. I'm asking because, no, I'm asking I think it's a valid question, like we're all working towards a date which is the 16th of September and you're not even available so why have you not communicated it.

Grant So, I understand you're upset about it but actually we were all working towards the 5th of August. Then your consultants changed it and we were working towards the 19th of August…

de Wolde No, no, no. The 19th of August….

McMurdo It's probably not helpful for anybody to talk about that really because it doesn't….

de Wolde When it was shifted on the 19th of August, we shifted it to the potential date of 16th of September. We have all been working towards hat day and no worries you aren't even available so I think we should have been entitled to know that that we're all working towards a deadline that's not even valid.

McMurdo Whether you're entitled to or not the date is the 16th, was the 16th so…

de Wolde Well no it's not because Aurora is not available.

McMurdo That's not, the understanding I have from all the information today was based on the new information coming in from the applicants.

de Wolde We are being made aware now of the fact that Aurora is not available the week of the 16th of September. I think we should have been made aware of that earlier. Before we were all working towards that deadline.

McMurdo Ok.

de Wolde My people are working towards it, they're working towards it, the whole farm is working towards it, I think it's upsetting that it's not even an option.

McMurdo Ok. That's noted.

de Wolde We're working towards a potential peaceful outcome and like to get it through here across as sort of as smoothly as Aurora indicated in writing, I don't think this is helpful.

Freeman Ok well Plan B then, Plan B I suppose is a question maybe for yourself Abe, and for you guys Aurora, is the week starting the 7th of October. Can we….

Legg What about the week before it.

Freeman Then, I presume there's nothing down for the week starting the 2nd of September because…

Grant The timeframes are too tight.

Freeman Ok, but Aurora is not available that week if I'm reading it right. So that week starts the 13th of September. But the week starting the 7th of October, then it sort of, well, nobody is indispensable

but, are lawyer's less indispensable than everybody else, is Nicole Phillips personal presence essential?

Grant I would be happy to proceed without Nicole and just use her documented evidence.

Freeman And sometimes commissioners might say well we've got a question for her but if she's not available then they may, they may just say right we'll run the rest of the hearing when she is available, gosh she's not available for much at all is she. If she's not available thought, would she be available to say, for example, answer a written question?

Grant I'd have to check with her, but she is one, again not making anyone sound indispensable, but she is one that I would be happy to proceed without.

Freeman She might have a colleague like Nicky Watt or someone like that that might be able to answer a question, if there was you know, some debate about whether the proper protocol was followed in Overseer FM subsection (iii)(5)(a) or whatever.

Grant The other issue here is Cain Duncan is away that first and second week. Unfortunately Cain and I have obviously decided to go to Fiji in the same month but we didn't line up our holidays because I'm off the 21st.

Freeman I just don't understand…

Grant Why people need holidays.

Freeman No I just don't understand why people would go somewhere like Fiji in winter when there's all this snow on the mountains. I just don't understand it.

Grant It's October though.

Freeman Anyway. Seriously, that's an issue for you then, if that's a Plan B week, then Hans said he wasn't available that week. I can't recall exactly what his limitation was, whether it was Court of Appeal, or leave, or another case, I don't know.

de Wolde Like the whole thing, it puts my farming plans out of scope. I mean this was the last deadline, this week was the last deadline for me to base my future decisions for next winter on, my cows will be intensive winter grazed again next winter. I don't think I should be put in the position not having our people there because Aurora can't make it, I think ??? should be there.

Grant For the record, for the recording, it's not just because I'm not available, it's because council is unavailable. We do not have enough resources that week to hold another hearing of this size. We already have two rather large hearings on that week. And, it's not just me that's not available, Alex is also working remotely. He is available to fly down for it but there will be additional costs.

Freeman Because what will happen Abe is, in most respects we can't make decisions on this, all we can do is provide submissions if you like to the commissioners. So if the council makes a submission to the commissioners and says Aurora is not available, Alex is not available for these reasons and for these reasons, and if those reasons sound reasonable to the commissioners, they will not

schedule the hearing in that week. That's what will happen in terms of….but by the same token the commissioners will be concerned to meet their duty to avoid unreasonable delay etc etc, so by the same token I very much doubt whether the commissioners would just say, oh gosh, ok, that's all really tricky lets plonk somewhere in December, they won't do that. Well that's my personal view, they won't do that either because that would not be meeting their duty to avoid unreasonable delay, and then they ,might put the heavy word back on yourself Michael, and others, and say something like well, get more resources or whatever. So, somewhere between those two extremes I think we have to come up with a proposal that might not be our preference but there's not much point putting something to the commissioners that we know in advance that they're not going to fly with. So if we, if we…

de Wolde So what proposal are we offereing ???...

Freeman Well, all I'm saying I suppose Abe is, if we just stood our ground and I don't know, told Hans send them a strongly worded letter that says we have to proceed on the 16th…

de Wolde The thing is for my cropping decision it's too late. This was the last deadline. I do remember you guys coming and saying it was going to be painless, and it's been anything but. And the whole August thing, the 5th of August thing, that was because the whole winter was out, on behalf of Environment Southland ??? the very end of the whole window. So, it has been anything but trouble free or cheap or whatever. I just really think if there's three people, why cannot someone else miss out.

Grant Abe sorry I'm going to refuse to shoulder the blame for the 5th of August. Nessa and I had a number of phone conversations about when that ??? would be coming in and that the longer it was delayed in being put in, that it would mean that the hearing would start to clash with Environment Court things going on, people's holidays, consultants who were on holiday, and that was why it was shifted, and, I'd just like to remind you that this is a huge application, it has been processed as we said it would be with no holds, and that is quire outstanding work from the council.

de Wolde I did not experience, I do not know you resource or whatever. All I'm saying is that it puts me in trouble on the farm, I've been living and breathing this stuff for the last three years, I just want to get on with my life.

Grant I absolutely understand.

de Wolde Please, please don't make me suffer any more.

Grant I completely understand.

de Wolde It's like 20 or 30 hours out of my week and I'm a farmer, I'm not like some ??? farm. Please be conscious of that.

McMurdo Is it possible to provide the commission with maybe a couple of different possible dates?

Freeman We'll have to. We'll have to. Just trying to get clear on that week starting the 7th which possibly might be duplicated…

Grant October?

Freeman Yeah. The October months shows that Cain is not available that week as well, whereas in that September one it's just got…

Legg Is he available on the Monday?

Freeman Ahhh, looks like it. That's the same week isn't it, that sort of final week on the September print out and the sort of first full week on the October print out, it's just put in manually.

Grant Just to make sure, if we include Saturday's and Sunday's and the council is prepared to proceed without Nicole being there in person, the 16th to the 20th of October looks like it could be.

Freeman Will you pay my divorce lawyers fees?

Grant Mate, I'll have my own to pay from this. I'm not even joking. Um, but, like that is an option there, where I can see some space/.

Freeman There're not many commissioners that work on weekends.

Grant I know but, they said put forward options so I'm just trying to look at potential options.

Freeman If we, and we probably don't have much choice Abe to a point in terms of looking at a couple of these other options, like the week starting the 7th, but then operationally, would that mean that we would have to go back and look at the dates of when things are happening, because as you say, you'll be making operational decisions.

de Wolde I just want to make sure that we have a proper team on our side. Aurora has going to have a lot of work to do. We have to have our people there as well. So I don't want to sort of go like oh sorry we still have to make it happen or whatever sort of thing. I want to make sure our team is there as well. I mean, why would we sort of be kneecapped before we start because we can't have the proper people on the ground, because the date is bumped at last notice.

Freeman Yeah. Well that sort of points to the week starting the 14th doesn't it. That, that's Cain, only Cain and Nicole Phillips not available but Cain might be available, or by the look of it, would be available towards the end of the week, so if they did want, they will always rearrange people so you know, even an applicant witness might come later in the week or a council expert might come first, they'll shuffle things around.

Legg Woldwide 1 and 2, could be moved second and 4 and 5's could come first, the opposite way around.

Grant Yep, it's just Cain's done the budgets for ???.

Durand Can I just ask a question about the calendar sorry, if you go to the 1st of October, I'm just looking at that box, it looks like Cain Duncan and Nicole Phillips are not available on the 1st, is that correct?

Grant Yes.

Durand Even though their names are quite close to the 8. Oh I see, it's not the names that are adjacent to the dates it's actually, the names are in the boxes, are in the bottom of the date box.

Freeman Shit. Right. Ok.

Durand So the 1st of October, it's Cain Duncan not Nicole Phillips who are not available. On Monday the 30th it's only Nicole Phillips that's not available. As an example. On the 27th of October, everyone is available.

Freeman That's not how I was interpreting it but ok.

Durand I think there are boxes there, they're so faint. So if you're looking at September 16th, the dates we can't do, it's Alex Erceg, AE and AG underneath the 16th.

Grant And also our expert.

Durand Whereas, like the 3rd and 4th of September, everyone is free, those two dates. Just to help understand the table.

Freeman That's very useful.

Durand So that suggests the last week in October is free. Correct? 27th to the 1st.

Grant Yep.

Freeman But also, with some juggling of experts, the week starting the 30th of September or the week starting the 7th of October.

Legg Yeah. the week of the 30th of September, Cain is here on Monday. That week works doesn't it, Cain can be here on the Monday.

Freeman So it's option sort of 1, 2, 3 isn't it. starting the 30th, starting the 7th, starting the 28thg.

Grant What would your preferred option be given that one of those weeks your experts….

Freeman I just turn my calendar off.

de Wolde One question I have and it's sort of peripheral, would we be affected by changes in legislation in between now and then, there's so much moving at the moment with all sorts of wintering, like we sort of put back by nearly a year, it will be affected by the changes that happen in the meantime.

Durand We're not sure when those documents are going to be released. If you're looking at the week of 30th of October I could say probably not, or more likely than not, it looks to me like it's going to be late in the year or maybe next year. I think there's going to be a series of opportunities for submissions to be made and various other things.

de Wolde (OVERTOP) Yea but Nicol Horrell rung me and said stuff was coming out of central government we should be very afraid of, there seems to be a monster coming our way that ??? around for. Is it going to affect me because it's going to be bump back, bump back, bump back, out of my control. I'll be very sad at the end of the day if I would sort of get hammered. Will I be affected by legislation or will my case be considered under current legislation?

Freeman Nobody can give you an absolute guarantee Abe.

de Wolde That's why I would really suggest getting to it as soon as possible.

Freeman Yes.

de Wolde I think I deserve that. Cause it's my risk at the end of the day and the risk of all the people and the cows in my possession.

Freeman If it's any consolation Abe, my understanding is generally, central government, the jargon that they use is, it's, quote, repugnant to drop new rules and have them applied retrospectively, but it's not repugnant to have new rules applied immediately. So, they won't backdate things and if I had $5 I'd put it on the table that said what will probably come out will be rules that effectively apply probably something very similar to your own standard rules for intensive winter grazing and say those are the minimum standards for the whole country.

de Wolde …the right thing but I think it would be really frustrating and painful if I will be worse off because every time ??? pump for three years I end up intensive winter grazing, my facilities fall to bits because we can't make the improvements and then at the end I'm hammered by legislation that changes in the meantime.

Freeman To me it sounds, I get a sense of de ja vous like water metering. All the regional councils used to bicker about what was appropriate water metering rules and eventually central government came in and said stop bickering, these are the minimum rules, you will have to comply with them, end of story. To me it sounds like the same sort of thing coming.

Durand We don't really know. We know that there are going to be announcements this side of Christmas, we're pretty sure of that, but what is meant by announcement we don't know, like it might be here's a draft for consultation, it might be here's the rule and it commences immediately.

de Wolde The ??? said August, that's not happening.

Durand These things seem to usually slip out of central government. But, Dave Parker's been saying this year is the year of action, next year is the election.

de Wolde I don't really feel, I really think as soon as possible.

Durand So that week, the 30th of October, that is possible.

Legg 30th of September.

Durand Sorry 30th of September to 4th of October.

Legg Yes, Cain can be here on the Monday and the 7th of October. He's available Thursday, Friday.

McMurdo Do we need to phone Cain?

Freeman So I suppose it raises another question which I was going to raise later, but, in terms of communicating back to the commissioners, obviously the want advice sooner rather than later, otherwise they're going to order us all to a teleconference…

Grant Today I think is their direction.

Freeman So, if we agree in principle on those dates with a preference, at least from our perspective, earlier than later.

McMurdo So preference 1 is obviously the earliest 1, 2, 3 just in the order of the dates.

Freeman Yes. Council?

Grant I can make that work.

Durand So let's just look at the pre-circulation dates and go backwards from there. Let's say it's the 30th of September, let's say for arguments sake, which means that the submitters evidence is the 23rd of September, which means that applicants evidence is the 16th of September and council's report is the 9th of September. We talked before about our desire to have a revised assessment of effects to us so that we can update our 42A report, so that gives us a bit more. So we've got to have our report done, circulated on the 9th.

Freeman On that scenario my suggestion would be as we discussed earlier but an updated but focused on the actual AEE, part of the AEE by about the 26th and that would give you two weeks.

Grant I'm fine with the updated AEE, yep, those timeframes are achievable.

Legg So by what date?

Durand 23rd. End of the day Friday the 23rd and then council has two weeks.

Freeman Now you've screwed up my Monday's. Monday, Monday, Monday and Monday.

Grant That's when my thesis is due, a week before my thesis, but that's fine.

Durand Well maybe, Mike and Nessa how much work is that going to be?

Legg It's just Section 7, part of the AEE. I think we would need that time because we need to look at Woldwide runoff and that may take a bit more time, the AEE part.

Durand I'm not sure if it's equitable, but it's equal, right, that gives you two weeks and that gives us two weeks.

Legg Yes, that's fair.

Durand Does that work for you Aurora?

Grant No it doesn't but I'll make it work.

Durand What about then if it wasn't the 30th of September but the 7th of October so that shifts the whole thing by a week.

Freeman No, I think from Abe's perspective he needs things to start earlier if it absolutely makes it work better then I think the onus should more be on Nessa and me to get an updated AEE to you earlier. Because otherwise we'd be preparing our evidence to be ready by the 2nd of September anyway, on the old schedule.

Durand Also, I guess for your information, say the hearing was held that first week…

de Wolde The 7th of October?

Durand No sorry, the 30th of September to the 4th of October and say the commissioners closed the hearing at the end, like literally say thanks we've got everything we need, so close the hearing on the 4th, that's going to be the 25th of October before you get your decision, and then you've got three weeks of appeal period. You can't exercise the consent until…

de Wolde As I said before, it puts my cows into another year of intensive winter grazing.

Durand So you're looking at 15th November before you can be sure what the decision is, and if somebody appeals then you can't exercise it until the appeal settles.

de Wolde That's as we said before, the week of the 16th was the last week that it could possibly have made it work.

Freeman Just to clarify you've got no absolute guarantee that they'd take 15 working days. They might grant themselves an extension presumably.

Durand That's true.

de Wolde They can't put off sunny days, they can't put off sunshine.

Durand No but just for the interests of transparency we're focusing on the week of the hearing but you won't get an answer until…

de Wolde I have calculated….

Durand Sure.

de Wolde Full clarity around what the outcome is for me to decide whether to put fodder beet in the ground or grass, that's the guts of it.

Grant Just on timeframe extensions as well, the statutory timeframe is 30th of August, so we've got two options, we can either do a timeframe extension special circumstances or we can do an agreed

one. It's very easy to do one with the applicants agreement otherwise there's more administration time to write one up for special circumstances. So if you guys can have a think about that, whether you agree to a timeframe extension until the hearing date that would be helpful too. Again I'm just thinking cost and time.

Durand Just so we can give the commissioners a couple of options, we've got the 30th of September and 4th of October, which is tight for council but we could do it, especially if you could get your revised documents to us sooner rather than later. 7th to the 11th is the second option. Not sure of the second preference but that is another option, 7th to the 11th of October and by reckoning we've also got the 28th October to the 1st of November. Is that right? That's another one. Those are the three soonest.

Freeman Yes but obviously from the applicant's perspective we were saying that our strong preference would be earlier, as early as possible.

Durand Yes of course. I guess what don't want to do is convene like this, focus on that one date then go back to them and they say no, we can't do it. Then we have to reconvene.

McMurdo I don't know how the commission works but do we need November dates or is this…

Grant While we are all here should we look at it just in case the commissioners say well actually we're in Tahiti that whole time.

Freeman Do you want to say anything more?

Durand No, no thanks you. Thanks for your patience in working through this.

(*Michael Durand left at this time*)

Freeman Thanks.

Legg The week of the 18th of November is….

Freeman Yes although to be frank from my perspective if the currently appointed commissioners can't make any of those dates I'd almost be suggesting we talk to Hans about asking for different commissioners.

de Wolde No I don't think I want to do that.

Freeman No?

de Wolde No, I think I like the way they handled the Adams case and I think I've got faith in the way they handle it and I'm quite happy with this choice.

Legg So that's the 18th of November as a very very last resort.

Grant Ok.

Legg We don't want that week but…

Grant I understand.

Freeman So, 1, 2, 3, 4. It may then pay to just to outline that we, for their information as much as anything else but then we've got it in writing as references to us all in terms of what we talked about saying right, an updated AE part of the AEE two weeks before your 42A report is required. So whatever that schedule ends up being we know that that would be "the schedule".

Grant So if you guys are in agreeance, what I can do after this meeting is put down what we've discussed, obviously it will take a wee while to get the transcript, but if I just put the main points down because we need to get back to the commissioners today. And, I will send a draft email through to you to check that you are in agreeance with what we've come up with today. If you could check that before I send a request through to them.

Freeman Sounds good. In terms of the notes I had as a draft agenda, there's still a couple of items there and then you wanted to cover a couple of other as well.

Grant No, have a discussion on where I'm at with my 42 report.

McMurdo Ok so we're happy with the dates obviously and we're going to move on to the next point.

Freeman Happy's not the right word. Yep. So, I suppose from my perspective in terms of any additional mitigation measures the key things that stood out for me was are we all clear whether there was any or those proposed mitigations would either trigger the need for an additional consent or change the activity status of anything.

Erceg So the culverts will need to be assessed against the culvert rule. There's not enough in here to determine whether they do meet that permitted activity requirement.

de Wolde Today…

Legg At the runoff.

Erceg There's 1, 2, so the changes to the widening of the culverts and so they just wanted to check against the, should the consent be required, they're generally a controlled activity.

de Wolde What culvert were we going to widen?

Freeman Off the top of my head I can't…

Erceg The one by the, there's one where one of your paddocks and dairy lanes has flooded, can flood, and you mentioned that it's due to the culvert not being wide enough.

Grant Yeah yeah, it's page, critical source area.

Freeman Where's this?

Grant 14/15.

Erceg 1 and 2.

Grant It says that it's recommended the culvert size be enlarged.

de Wolde Oh yeah but that is actually, it was blocked I pulled the weeds out, it's between 14 and 15. It is a 90cm culvert and it's as big as all the other ones so it does not need to be enlarged.

Erceg So you're not enlarging it?

de Wolde We're not enlarging it no.

Erceg Ok.

de Wolde It's been unblocked and there's no requirement to enlarge it.

Erceg Ok. It's just implied that that was going to be a mitigation but that's alright, we'll take that out.

Legg I'll confirm that was cleaned.

Grant If we could, cause the option of the wording in this is should and suggests so just, if you're putting this forward, expect us to write conditions on what's in here.

Erceg So where they say could or should it would be better to clarify that these are or are not happening instead of like, this could be done because it sounds like, putting this forward makes it sound like it will be done but the wording kind of suggests that it may not be.

Grant And there's a couple of different options in there right so ones just like maintain riparian margin and the other one says it will be planted out in native species. So decide which one you're going to go for and if you could put that forward in the updated document that would be much appreciated. Because the last thing we want is the close of hearing being put off because of draft consent conditions that we've pulled out of this, but the wording is suggested. I'm just trying to think of streamlining ways.

Freeman Ok, good point.

Erceg It will be likely that everything mentioned in these will be a specific consent condition as they were proposed after the application.

de Wolde We'll check them, it was two culverts that were enlarged you said or it'll make things longer.

Erceg No I think the rest are just to do with the culvert crossing run…

de Wolde ??? consent does it?

Erceg No. If possible can we have GPS coordinates for all of these? All the critical source areas and stuff.

de Wolde Can't you do it on the map?

Erceg Yep it will show up on the map we just need something to show exactly where they are.

de Wolde There's farm maps included anyway.

Grant Yes but if you could just mark on…

Erceg Cause when we, if a consent condition is written it will need to have an exact location otherwise if we just used t make the GPS coordinates and compliance comes out, and the actual GPS is different then that could result in non-compliances.

de Wolde So does compliance not have the map, they can't read maps. What's wrong with maps when compliance…

Erceg It doesn't show exactly, like that's a very zoomed out high scale…

de Wolde It's A4, what's the problem.

Erceg I'm just trying to…

de Wolde Is it a requirement for us to have GPS coordinates, I mean cause it's easy like you can palm more and more information off.

Erceg I'm just trying to avoid any future compliance issues so…

de Wolde We'll give them a map with the numbers on and that should be fine.

Erceg Ok.

Freeman We can talk to Cain as well, he may already have that.

de Wolde It's so easy, like one hiccup and another person racing around doing this and this and this and the other thing adds costs. A map should be fine.

Legg I could get the GPS coordinates from Cain's map just on the desktop. He actually may well have them already.

de Wolde Maybe but I'm not promising anything. If there's no GPS coordinates we should ask the compliance office just to read the maps.

Freeman But as a standard, these are Fonterra templates aren't they so is there a bigger issue possibly to talk to Fonterra and Ravensdown and Balance about their template needs GPS coordinates.

Grant …address that but I'd prefer not to do that on Abe's money.

Erceg The other thing is the mitigations on the lease runoff block, um, just some type of agreement to show that these can actually go ahead since that property's not owned by the applicant.

Legg Yes.

Erceg We need to actually be sure that you can legally go ahead and do all the fencing and riparian planting on that block.

Freeman But if there is a consent condition that requires it, isn't it almost a bit irrelevant to you as to what agreements may I not be hovering around here.

Erceg We can't grant a consent for something that he can't actually do and is automatically non-compliant with it. If he's got no legal obligation to go and fence waterways on a property he doesn't own and we issue a consent saying you must fence this waterway…

Freeman It still has to be done.

Erceg Yep but then either he breaches the lease agreement he's got with the owner, the person who owns that block of land or Abe is then non-compliant with his consent because he can't do the fencing and the riparian planting.

Freeman But what level of detail would you expect to see, do you want the signed lease agreement with all the financial detail in there?

Erceg Just confirmation from the owner of that block, that Abe can go ahead with these mitigations that have been proposed to occur on that piece of land.

Grant So some people just give us the lease agreement and redact out any financial stuff, I don't care about that, if that's the easiest way to do it or if it's easier to get a signed statement for the leasee.

Freeman Are you happy with that?

de Wolde Yeah yeah I think it's just very funny because they're sort of saying landholding because it's the same ownership structure like how do you manage that, like it's a big nonsense but if like we have to do that I'll have to. This actually contradicts the whole ownership argument, the whole landholding argument really in my mind.

Grant …anything else?

Erceg And just that email I sent last night about the overseer budgets, get confirmation of that cause at the moment…

Legg It will just be one nutrient budget though because…

Erceg We will need, to compare the effectiveness of these mitigations all the previous nutrient budgets need to go into Overseer.

Legg So the previous nutrient budgets are all exactly the same because they are pre-expansion so it's only the proposed nutrient budget from the March application, it's the only one that's actually changed.

Erceg Yep but when it goes into the new Overseer the losses…

Legg So it's just one that you need to see.

Erceg …the losses can change from, they can be different.

Legg They're already there so the 13/14, 14/15, 15/16, they're already there in FM, and they're the same as you know, nothing has changed, it's just the proposed nutrient budget for Woldwide 1 and 2 has been changed slightly, so I'll get the one from March and get it put into FM, so that's the only one, the slightly new version.

Erceg Yep.

Legg Ok.

Grant Just the other point that I had Nessa in 1, is that one of those mitigations says the reconfiguration of Woldwide 1 platform, the application doesn't discuss that at all. What, because that potentially, is quite a major change. I consider it would still be in the scope but it would just be helpful if that was addressed.

Legg I need to follow up on that, yeah.

Grant Because our understanding was that the two farms would be run operationally so there was going to be no changes with land between the two. So I've either missed something completely but I looked right through the application last night and couldn't find anything.

Legg Could you just say that again?

Grant On page 17, the phosphorus mitigation plan, the reconfiguration of the farm will result in a number of these paddocks being assigned to the Woldwide 1 dairy platform.

Legg Yes.

Grant That's not in the application.

Legg I guess the application treats it all as one though.

Grant It does but….

de Wolde We might just rephrase that and change the cow flow.

Legg Yes it's just that there are no reconfigure, major reconfigurations for either unit but just…

Grant Like, we obviously assess all effects and losses.

Erceg So, operationally, how do you propose to operate the dairy platforms 1 and 2? Are they being combined and they'll be operated as one platform?

Legg No, they're still two units.

de Wolde We put the wording like something like a difference in cow, changes in cow flow and cow traffic in the new scenario sort of thing if the consent would be granted blah, blah, blah, something like that. Wold that be acceptable.

Grant It's good to know what you're doing on the ground.

de Wolde So basically this means that the cow, there's not as many cows walking along the creek if we get the consent going forward.

Grant Ok, well this is probably a good time to head into my issues, like what I think of…

Freeman Go for it.

Grant Is that ok?

Freeman Yeah, yeah, go for it.

Grant So just on that, the landholding, where I've arrived at in ??? as it currently stands, is that I've treated the two applications as separate application because that's what has been put in front of me but I was not able to treat the farms as separate landholdings. So I've arrived at the conclusion that your entire operation is one landholding. So I just want to make that very clear that is in my report and it does bring Woldwide 3 into the mix. I can explain my thinking a little bit more behind that if that would be helpful.

de Wolde What would the implications of that be.

Grant Because you, as I dug into it and I processed and wrote my report, there were so many transfers of effects between property's that it was impossible for me to not consider them when looking at the definition of landholding as one entire farm operation. And, then, I realised that Woldwide 1 and 2 have combined into one landholding even though they are being treated still, as operationally different, but 4 and 5 are still being treated at different farms and you're telling me that they are separate landholdings, there's a complete contradiction there. So in my professional opinion through the ??? that actually it's all one landholding. I do know that Cain came to the same conclusion with the Horner block being in the landholding for 1 and 2 for its nutrient budgets and that's been removed, that's fine, but just note that the farming permit or 2 does include the Horner block as part of the landholding and that was proposed. So where I've arrived at, I tried to write it as they were all separate landholdings and I couldn't do it.

de Wolde What if you would go way back to 2016 when the whole thing started, our very first application, Woldwide 1 and Woldwide 2, Environment Southland muddled it all up ,they got separated and then you said let's combine it to make it easier so there's the reason 1 and 2 are combined.

Grant I did go right back.

de Wolde Yeah but that's the reason they are combined, that's the only reason because you guys muddled the original one, they were separate, you guys couldn't understand that and then it had to be re-lodged again.

Grant So I've just, this is just me trying to be helpful and letting you know what's going to be in my evidence so you can address it and do some further thinking, I'm not going to debate it here sorry.

de Wolde But my question to you is what in your mind are the implications of Woldwide 3.

Grant So for me, this comes on to my second point that is a key issue for me in my 42A, is that currently as we discussed on the site visit your intensive winter grazing on the new Cochrane's block currently, from what we understand, what we were told at the site visit, is not in line iwht the permitted activity rules, it's illegal currently. And that means that Woldwide 3 no longer has Section 20(a) rights because those cows now ??? rule 20.

de Wolde What is Section 20 anyway?

Grant Mike would you like to explain?

Freeman 20(a) is just the Resource Management Act that says basically if something was legally authorised either for a rule ??? effect, it can carry on doing what it was legally authorised to do even though a rule might require it to do something different, it can carry on doing what it was doing until 6 months after that rule finally becomes operative. So, even if a rule comes in that says, think about it in this respect, if it said that portable water troughs are required, if portable water troughs weren't required beforehand you can carry on without them until the rule becomes operative.

Grant So because Cochrane's block was a sheep block and then by putting 3000 cows, I think you said at the start, on that block, there's a definite change, so there's a thing in case law that says the scale, scope or intensity and the intensity of that land use has definitely changed so you don't have Section 20(a) rights. There's something else that came out of the Adams decision was that actually, council needs to recognise that somebody does have Section 20(a) rights and you haven't got that permission from council so currently you're winter grazing on there illegally. So, that pulls Woldwide 3 into the mix and they need a consent for farming.

de Wolde Woldwide 3 does not winter the Cochrane block.

Grant You've got cows from 3 on there, you told me at the site visit.

de Wolde As like a ??? yes so I can graze Woldwide 3's cows somewhere else.

Grant You would need a farming consent for that unless they went to…

de Wolde To graze them off? I could send them to Wanaka or McKenzie Basin.

Grant You absolutely could, I really don't recommend that.

de Wolde Why not?

Grant I just want to let you know what my issues are without getting into a debate so if we could just…

de Wolde Ok but what I'm saying if you're pulling Woldwide 3 in because we went to the Woldwide 3 cows on the ???, I said that's fine I won't do that again, that's fine. Because the cows were just there because there was more crop than we needed.

Grant But it's been done now so there's a breach ??? for consent. And also, that's not the only reason why I consider that Woldwide 3 is part of your entire landholding. That's one factor, I'm going to tell you the other ones because the last thing I want to do is for my report to come out and there be, and you have to have further delays because you need to address what I put in. So what I tell you now is for transparency just to say this is what I'm thinking about it. And at the moment, I've done a lot of thinking about it and that's where I've arrived at. I'm not into debating it but I want to give you guys a fair chance to address it just cause this thing is so big and I don't think that it's fair for you to only have a week once my report comes out.

Freeman Can we go back one step just so I'm clear on what you're saying, that clearly anybody could have a specific issue as you say if they are undertaking say new intensive winter grazing in a location where it wasn't carried out previously and then not complying with the provisions specified in Rule 20, they could be doing something that is not authorised. Ok, so that could happen anywhere. What I'm just struggling with, almost park that, there's the potential for someone to be undertaking intensive winter grazing that is not authorised. Then we've got the issue about landholding. what I'm just trying to be clear about in my mind is are both those things absolutely intricately connected or is there a distinction between intensive winter grazing that may not be authorised that either needs to stop and be authorised and the definition of landholding.

Grant There is, it is connected but can be treated separately as well. I'm not sure I completely understand your question sorry.

Freeman Well I'm just trying to, I can understand and certainly I can see…

Grant Should I discuss maybe the other reasons why I think Woldwide 3 is part of the landholding?

Freeman Yeah that might help because in my mind I'm thinking, like with any client, ok, need to ensure that whatever you're doing is properly authorised, now how do we understand the definition of landholding.

Grant Ok. So the definition of landholding is set out in the plan.

Freeman Yes and I've got a copy of it in front of me now.

Grant That's great. So the other reasons that it is all, that I have arrived at the position of treating it all as one landholding is that what wasn't identified when the original legal opinion on landholding came out is that Woldwide 2's farming consent includes the Horner block in its entirety as part of use for farming there and I'm sorry I'm explaining this in kind of a cleaners language but I'll just get it out and we can explore a little bit, and Woldwide 3 puts effluent on Woldwide, on the Horner block so on Woldwide 2 and on 5, this is all from memory, and effluent goes onto 5. So 5 uses nutrients from 3 to grow the grass needed for the cows there and it's all connected. That's where I've arrived at. And the ownership structure is something that I couldn't escape either.

de Wolde Yeah but you're just weaving all that of so many complications because the reason that Woldwide 5's application area is Woldwide 3 is because Environment Southland couldn't deal to

making the changes, we tried 3 times to get it removed and we could not. Like Tania has been trying twice to get it removed. So the reason that Woldwide 5 is linked to Woldwide 3 is because Environment Southland could not handle making the changes.

Grant I'm sorry there is no…

de Wolde I can dig it out, I can dig up the email train, you can ask Tania, we tried twice to get Woldwide 5 removed from Woldwide 3 because initially we bought it as a slurry block, then we bought more land and we converted it into a dairy farm and on two occasions we tried to change that. So don't throw it back in our face now and say it's linked, don't try to change that. It's the same with the bore on Woldwide 5, I think it's Environment Southland's muck up and we pay the price. If you use the fact that Woldwide 5 and 3 are linked that is not fair because Woldwide 5 and 3 are linked because Environment Southland could not handle to make the changes that were needed. Nowhere ever has any slurry gone from Woldwide3 to Woldwide 5. We said we'll just leave it at nil.

Grant So it's been budgeted as that occurring in your budgets.

de Wolde Because you guys could not change to make the difference. We tried that, seriously. Ask Tania, we'll dig it up. We've bene trying to make the changes but you could not deal with it.

Grant I'm really sorry and I understand how frustrating it is and I have gone back through and I've found all of that backwards and forwards, and I looked, and there is no variation to remove that that I can see. You were told that, that removing that would mean that you would need an application in and there's no application in the system. So if you can find something please out it forward and I'll consider it.

de Wolde And the Horner block is actually split in two 28 hectare blocks and ??? and that's not allocated to Woldwide 2. It's split up into allocated effluent areas, ignoring the fact that there's slurry and effluent and you guys cannot deal with the difference between effluent and slurry but it all has its individual areas allocated to the property so it's not that the slurry of Woldwide 3goes to Woldwide 2, no it goes to the Woldwide 3 allocated area of the Horner block.

Erceg The entire area of the Horner block though is included in our farming consent for Woldwide 2 so it's got nothing to do with the discharge of slurry it's to do with it being…

Legg That would've been under the previous version of the Water and Land Plan where there's no definition of a landholding.

Grant That's right.

Legg And that's something that we would need to look at. Because it is listed as you know, in the legal description but when that consent went through there was no definition of a landholding, so that's not, you know, one thing may not equal the other.

Grant But it was offered as almost an offset would balance the losses of what was occurring, so that's like a key part of that farming consent that's already in place.

Legg I guess that comes back to that legal opinion from Wynn Williams that said that's one activity in a much bigger…

Grant But unfortunately they didn't have all of the information at that time because it wasn't until I sat down and started, and I had them both, that was the difference, but I mean that will all be, there'll be legal submissions on that point. Just on Woldwide 2's farming permit as well, that farming permit obviously makes it part of the permitted base one to say that there's you know, there's cows allowed to be on there because it's permitted. But unfortunately the permit, the farming permit, they put forward a mitigation saying that there would be no more intensive winter grazing or cropping done on those land blocks, it's in the application for farming, but your nutrient budget relies on that winter cropping being removed so essentially you're doubling up for something that's not legally allowed to be there, so this is moving on to my second issue.

Legg But I guess what we have had to model the actual use of land and we can't get away from that. we have to provide nutrient budgets based on the actual use of that land and that's exactly what we've done.

Grant Yes except the likes of the Gladfield block which I understand has already been converted to a cut and carry block, that has been budgeted as proposed to be intensively winter grazed for several years to come until the winter barns are in place. The main issue I have here is the budgets are not aligning with what makes it with permitted or existing base lines at the moment because of those crossovers between farming consents. So those are the two key issues in my report that will, that I didn't want to surprise you with. On a different note though I can…

Legg Could we just go back to when you say the entire operation is one landholding, so what is that going to look like? How is that going to be in a land use consent permit?

Grant I don't think that's worth debating here.

Legg I think it's quite important, it's hugely important to Abe. In a general sense even, what are you proposing.

Freeman Well the implication as I understand it is that you're implying then that a lot of this information would be inadequate because you'd expect the whole Woldwide 3 would be included.

Grant So how I would approach that is I have, in my report I have a separate section on landholding but I've specifically said that I respect your right to apply for as you would lie your proposal to be, so I have assessed them separately, the landholding section is the same in both reports, and I've said that I consider, that from a planning opinion that the whole thing is one landholding. We've been playing with how conditions would look under that but I can't give you a ???

Freeman And just in terms of saying if you're right, whether you are right or not, it may be by the sounds of it advantageous to Abe for us to properly put an application in to change the discharge permits associated with WW3 and WW5 so that it's clear that WW# does not have authorisation to apply effluent on 5.

Grant It would have to be the Horner block as well, would need to be in that.

Freeman Ok but what you're saying from your perspective, if that were separated then presumably you wouldn't define…

Grant No because the Woldwide 3 still uses Woldwide runoff which I consider part of the landholding for the young stock and dry stock.

Freeman That's a stretch.

Erceg And Woldwide 1 owns Woldwide 3's dairy platform according to our system.

Freeman Owns it.

Erceg Yes so Woldwide 1 Limited, the company, is the owner of the land that Woldwide 3 Limited's dairy platform sits on, from what I can see.

de Wolde You guys still don't get it. I hope the commissioners can see through all this incompetence. I just, no, that is not true. That is not true.

Grant This is the Woldwide runoff and we got a bit of a decision from Adams on what's part of the landholding and I think that does apply in this case as well.

de Wolde Just to rectify this, Woldwide Farm is an independent limited company, Woldwide 1 is an independent limited company, 2 is, they are all independent limited companies. So Woldwide 1 owns the land that the farm is on.

Erceg What I can see on our system is that it appears that Woldwide 1 Limited, the company, also owns the land that Woldwide 3 Limited farms on.

de Wolde No this isn't correct.

Grant The rates are paid…

Erceg It does look like that on our system.

Freeman Mike just something else to mention as well, the budgets for the Collies block have essentially budgeted cows being on those blocks because it talks at length both in the old budget and the revised one, that there is a consent for that block, that's the one that was surrendered, so that's just another planning question mark over that that came up while I was doing my reports.

Freeman Sorry when you say it was surrendered…

Grant Yes 2016, the conversion permit for 5.

de Wolde Just taking a step back, and being conscious of the fact that you are aware of the anguish that you put us through, is there any way that we can backtrack so that we can sever the link between Woldwide 3 and the rest.

Grant No, not now.

de Wolde Because these cows are just there because there was crop left over like they could have been the cows of the neighbour or any other farm like they are just independent differnet companies, and it's not going to happen again.

Grant But Woldwide 3 relies on Woldwide runoff and that's what pulls it in. I know this is incredibly frustrating for you.

de Wolde So will it be like effluent ??? again and drop tests on the and all that again.

Grant For 3? If you choose to make an application for it today.

Freeman I think we probably need to have some discussion Abe I think it would be worth getting Hans' input in terms of whether that…

de Wolde It's got a 20 year consent of something I mean everything is tickety boo on that.

Grant If I can, look I've spoken to you about this, I would be happy, if it is helpful for you, to lift out my discussion on landholding that I've done because I don't think it's going to change anything in light of these changes, if you're wanting to get legal advice on it, but I'm happy to release that section to you early if I am able to and I'll take some advice on that.

Freeman That would be useful otherwise I can imagine going into the hearing and the commissioners are just getting…

Grant And that's exactly what I want to avoid. So, I'll take some advice on that and I consider that would be useful for you to see.

Freeman I suppose just as an aside, as I look at my definition, am I right, I assume I must be that the definition hasn't been appealed by anybody.

Grant I will check that.

Freeman It doesn't look like it, my copy of the appeals version and it's not greyed out so like a number of things about this plan, people don't seem to be too concerned about the detail, so nobody's even, none of the submitters have actually looked in detail at that definition.

Erceg Or they agreed with it.

Freeman Yes of course.

Grant I just want to put, if I do release part of my report, it's not something that's done normally and I am not releasing it for it to be picked apart. It's my opinion and that's what a hearing is for ok. It would be a heads up for you guys because I want to be as helpful as possible. So you can take what I've put and hopefully it explains it in a concise way but I'm really not open to having a debate about it before we get to the hearing.

de Wolde Is there any way we could have a constructive talk about the effluent pond and slurry.

Grant 2, or 3.

de Wolde Or 3, I mean that's going to be the next thing coming up, the rules across the new effluent pond – no it's slurry, no it should be effluent blah blah blah, it doesn't work. Like, we'll get the same issues there, like, I'm going to line it completely, proof pond like we did a drop test and it didn't drop. I'm going to line it out of the goodness of my own heart and it means that we have to spend another half million dollars to do another pond because your rules don't fit. Is there any way we can address this crust on the slurry ponds because slurry is thicker than effluent. Ok you can see this coming a mile away for Woldwide 3 now.

Freeman My understanding of that is people, Nessa you'll know better than I, is that people have got methods now to try and force slurry ponds to fit the dairy shed effluent pond requirements. Even if that means putting some sort of floating device on push the crust aside and measure levels of that instead of trying to measure levels of the crust or something.

Grant Alex is all over the farm ones.

Erceg No, it would have to be free from curst.

de Wolde That's not possible.

Erceg And it would have to be de-sludged within the last 12 months for it to meet Appendix P So, we're not worried about the fact that there's sludge being stored in the pond, when it comes to the testing of that pond it needs to be liquid.

de Wolde I mean that's the thing, it's 60 times as thick as effluent, like it is poos and piss, it's not effluent, it's different material. So your rules don't fit. Like, if Woldewide 3 is going to pulled into it the first thing we're going to come across is this effluent pond because it is a crust yes because it's slurry, it's not effluent, it's thicker and you guys won't handle it, and before I know it I'm relining another perfectly good pond because you're silly rules don't fit.

Erceg But obviously it's in the rule, we didn't write it, it was written by the Environment Court, they've put this out. It's going through the appeals process at the moment, the public has had the chance to appeal on it, these issues can be submitted on through the public process but now that it's a rule, we can't just go round in circles constantly arguing that your pond doesn't fit into the rule, the rule is there and it needs to fit that rule. We can't go round in circles and there's no point going round in circles because no one is going to get anywhere.

Freeman But operationally Alex, that means these types of ponds basically have to be emptied and filled with liquid to do the text.

Erceg Yes, the same as the sludge beds. And we've acknowledged that this rule is not the best and it's not functional and we have approached our planning team to change that, and it just hasn't been done yet and at the end of the day we have to live with that, you guys have to live with that.

de Wolde That's funny, what are you towards it.

Erceg We can't sit here and argue…

de Wolde We have to live with it, you have to live with it, what are you doing towards it.

Freeman Alex can only do so much.

de Wolde That's not a fair way to describe it.

Erceg We have to have this conversation with everyone every time, and we have tried to get through this. We've made attempts to make things simpler for people where we can but there's just no way that that pond can be filled with slurry during its testing.

de Wolde Stone silence.

Freeman I mean at least we know then that one approach if necessary is, and I don't know how practical it will be, to basically ensure it's empty, de-sludge, filled with liquid and then tested. Alternatively it's…

Legg …from the dairy sheds. Those steps would just take a hell of a lot of time to make happen. In a practical sense it's extremely challenging.

Erceg Yes we acknowledge that and we always have acknowledged that. And, this rule has been out for a while now so everyone is aware that that has been the case since this rule was released. Instead of just accepting that that's the rule and trying to do this stuff in advance we get to an application and we argue that we can't go and drop test it every time.

McMurdo Can we park that a wee while?

Freeman Yeah we probably need to. But it's all based I suppose, the concern about the extent to which WW3 might get pulled into all of this.

Grant Yes. Well as it stands and if we consider that every one of Abe's farms bar 1 and 2 which is one land-holding, like as per that got forward Woldewide 3 does currently need a retrospective resource consent for farming because of illegal intensive winter grazing on Cochrane's blick.

de Wolde So why is it illegal?

Grant It comes back to the scope issue and the fact that you've put 3000 cows on to land that was sheep farm and you don't have a permit for that, and you don't have protection to continue those operations because it's in your activity on that land.

Erceg And it wasn't done in accordance with this rule or the regional water plan.

Grant So there was no good management practices in place when we were out on site, so that's what we discussed at the site visit.

Freeman We should have a discussion separately about that and presumably you would only be expecting a retrospective consent for an activity that continues. Putting your old hat on.

Grant Putting my old hat on, that has been past compliance. So they'll be looking at it and how they approach it.

Freeman Just so you understand Abe, I think the point being discussed there is that, councils will often request, as council's can only request that applications be made for a retrospective activity but normally, this is my personal view, normally councils wouldn't expect a consent application to be made unless the activity is continuing. If the activity is ceased then generally council's aren't expecting consent applications, they might be taking some enforcement action about something that happened in the past, and that would be the difference. Council's might be both taking enforcement action and telling someone they should be applying for a retrospective consent.

Grant That's correct.

Freeman So we're on a similar page.

Grant Yes, you need to have the discussion on who that's going to look going forward.

de Wolde So we're going right back to where we started to I am not able to make my planning decisions because this date is going to be too late for me.

Grant I appreciate that that is going to be a factor for operational but unfortunately the new information that has come through says you've already got the cows on the property. That's kind of like me building a house and going oh I should have probably talked to the council first.

de Wolde No, no, no, no, no, no, when we had a scoping meeting 2016 with Environment Southland people and they say go ahead with it, there's a new formality and we accept the 380 hectare lease, that was when the decision is made. I've got $700,000 worth of feed stored up and we did have the pre-scoping meeting and we did get the green light. And the lease agreement, 3 and a half of the 5 years are gone now. Lease land doesn't lie around so we did the right thing, we went to Environment Southland, they said it's easy, we went and accepted the lease for 380 hectares. So that's when the decision was made. 2016.

Grant Ok. And we appreciate we've had two variations, like we've had two versions of plans come out since then which has changed things for you.

de Wolde Is it two or three now.

Freeman Two, yeah.

de Wolde This is the third time, and half a million dollars and several hundred thousand dollars' worth of stacked up feed. But like, what do I do? So you lease 380 hectares of land, what do I do with it, it's just not practical. And I did the right thing, I did do pre-scoping thing and I did do the pre-coping thing for Woldwide 4 and 5 and then it was that unless the effects of intensification are fully mitigated blah, blah, blah, blah, blah. So we were made to believe then that if we mitigate the effects that we'd be fine. As a farmer I cannot run with that, I end up in a situation that I shouldn't be in because of indecisiveness and incompetence of Environment Southland people, and it's very frustrating.

Grant I'm sorry I know how frustrating it is.

de Wolde I tried to do the right thing and we had the pre-scoping meetings, what more could we have done.

Grant Yes and unfortunately this is just the rule framework that we work with, and I can't tell you what to do with your operations on the ground, but, and I'm sorry if there has been times that you've received bad advice from Environment Southland in the past, and I totally acknowledge that and I think I've been completely open and apologetic to you for that.

de Wolde On top of that we've added to our wintering sheds and they've been asked for, for two years in a row now.

Grant Yes and hey we can put through a consent variation very quickly and easily to put just want you've got on the ground and in the barns, you've already done the extension, so that is always an option but I just want to…

de Wolde But thing is like when we got this Cochrane block we always said like unless the effects are fully mitigated blah, blah, blah, so we were made to believe that if we mitigated the effects of the intensification on the sheep farm, on the rest of our operation, we will be fine.

Grant And that was what was acceptable at the rules, with the rules in the policy at that time but that's changed, and I understand that that's moving goalposts but this is just the environment that we are in at the moment with our regional rules. I totally understand how frustrating it is.

de Wolde But can you see that I as a farmer have done the right thing. So I end up in a situation now with like, so I got this Cochrane block, what can I do with it.

Grant I can't answer that I'm sorry but I do understand how frustrating it is for you. And I can see that you are trying to do the right thing.

de Wolde I really am. I really am.

McMurdo Just to keep pushing it forward.

Freeman You had one other issue didn't you Aurora, I thought you'd made a comment about the existing environment.

Grant So that's what I was talking about with the budget, what's been budgeted on, for Collies block where it's been, the application adds to the nutrient budget both consider that Collies block is allowed to be a dairy farm, so it's consented to be a dairy farm, but unfortunately, we did in 2016 so it doesn't make up part of the existing environment as cows on that block. Was there anything else?

de Wolde So that's the consented effluent area.

Grant No the conversion consent for 5.

de Wolde Yep.

Grant Remember we had the discussion.

de Wolde …sign it otherwise couldn't supply milk and that was….

Grant Yes. One thing I did want to mention as well, I emailed about the activity status. So I've advised that currently with the intensive winter grazing being occurring, it does trigger Rule 24, but if consent was granted under Rule 20 then Rule 24 discharges become a permitted activity. I have discussed that at length but I've arrived back at the it's a discretionary activity, not considering Woldwide 2's pond and what's happening there. I needed to advise that in my report but it will depend on what happens…

Legg Yeah that consent application is being finalised, it's with the chartered engineer at the moment, and so the application will be made under 32(b) part (ii) so it would be a controlled activity.

Grant Ok, cool.

Legg So it's not going to change.

Grant So I can just say…

de Wolde A practical question, if Woldwide 3 is going to be pulled into it, if you're successful in doing that, how are possibly going to provide all the information to the level of detail that you received on the other ones, it'll be a complete impossibility won't it?

Grant It will be something for you to talk to your consultants about looking at what you've already got so hopefully you've already got a farm environmental management plan for that.\

de Wolde You'll want drop tests and you'll want all that other drama.

Gratn Again, putting it back on your consultants that would be for them to say, you know this is late in the piece, if that's the road you want to go down, it's completely up to you, this is late in the piece, we propose drop testing by x date. I would suggest that commissioners looking at that would consider that that would be a reasonable approach and I certainly wouldn't have an issue with that. I'm assuming that you do have nutrient budgets for that and FEMPs for that farm too.

Legg But there won't be a nutrient budget for Woldwide 3, it would just be a new round of reporting nutrient budget, it's going to be nothing like the ??? standard which, you know, we don't have nutrient budgets on hand for Woldwide 3 that are done to a high level of detail. So would that matter? Would that matter?

Grant It would be, it's hard to say without seeing…

Erceg I guess it comes down to whether with the argument you guys are putting forward for the landholding, whether you decide to apply for that consent or not as well.

de Wolde Yes but with this application we were denied access to the commission if we didn't adhere to the way we presented our landholding. Is it an option to say well Woldwide 3 actually will let commissioners decide what they think about it.

Grant That's exactly how I've written my report, I've said in my opinion the whole thing needs to be considered as part of the landholding but I completely respect your right to apply as you have, and then I've assessed what I've got in front of me in terms of environmental effects.

Erceg And the applications are clear that you do disagree with our opinion as it stands and that that was an issue going forward to the commissioners anyway so there is already that discussion to be had with the commissioners about the landholding anyway, because the application is very clear that you disagree with our opinion.

Grant But just do be aware that the Adams decision did give us the steer on what is contained in the landholding with the additional cut and carry block, so because, yeah, the Horner block would be bought into that if you were using the same logic. I'm just trying to be helpful.

de Wolde Would we have the opportunity to say well you know what, let's, in the uncertainty what the commissioners decide on this whole landholding thing there'll be no additional information on Woldwide 3 If they decide it needs to be pulled in yes we'll provide it then.

Grant Yes and that might be quite simple right because some things ??? changing on 3.

Legg But surely you want to know everything about it.

de Wolde Yes!

Grant The RMA directs but you know, the applicants put forward an application that tells me about things, it would be helpful.

de wolde It's compliant farm and it's got a consent and everything. So could we say well if the commissioners rule that it is actually part of a landholding then we'll provide all the information.

Grant Yeah so obviously your consultants will be able to give you a better steer on this in the future.

de Wolde ???

Grant Yes I'm going to tell you that. At the moment Woldwide 3 has a permit to use groundwater and to discharge effluent but your cows on your paddock are currently illegal because you don't have Section 20(a) rights to be a farm, you don't have that protection anymore. So while some aspects of Woldwide 3 are permitted and all good and I don't have any issue about them and I think that they expire 2027, so they're a non-issue to me because we've already given you permission for those activities to occur. But unfortunately now your cows on paddock are not legal so you need a consent.

Legg Because otherwise you're grazing.

Grant Yes. So I need to know what the effects of that are. That's where my focus would be.

de Wolde And you said for the winter grazing, the young stock.

Grant Yes.

de Wolde That's two things.

Grant Yes I just simply put forward the number of factors that I think bring Woldwide 3 into the picture, and we've covered off a few of them, Woldwide runoff because 3 uses Woldwide runoff, there's a transfer of effects there so Adams did give us a steer on that transfer of effects between where intensive winter grazing is done and where support cows go and what not. The other factors being for 3 bringing it in, is that 3's effluent goes on to these two which has also bought it into the mix for me. But like I say I'm more than happy to take some advice on giving you my discussion on landholding. That could be helpful.

Freeman I mean it is very useful to get your perspectives, I think we need Hans' input into some of this or key parts of it, I wouldn't be at all surprised if Hans has a very different view and depending on the strength of his view then we have to decide about what approach to take.

de Wolde Thank you for making us aware of it.

Freeman May main perspective about the definition of the landholding, there's got to be a point at which it doesn't keep connecting, connecting, connecting. But where that point is and where that relationship is whether it's a company that's got similar ownership or a completely separate entity I don't know, I suspect we wouldn't be having this discussion if some of these areas of land were owned by completely separate legal entities but had the same relationships, I'm not sure whether you'd automatically assuming that it was a single landholding. But, you know, a lot of these things I'm sorry Abe, do end up with lawyers having to crawl all over them and then someone like a commissioner making a call at the end of the day between two lawyers sometimes with equally plausible arguments being put in front of them.

de Wolde A two way question, why me, is my question.

Grant This is a large operation you have and…

de Wolde No it's not a large operation.

McMurdo Where are we at people?

Grant I think that's, that's the key issues that I've got in my 40A, anything else major that isn't under, like I've obviously talked about in more detail in them but that's the crux of it.

Freeman It's appreciated, there's no point of anybody ambushing anybody at the eleventh hour at the hearings.

Grant No and I appreciate that, especially the landholding where I've arrived at. I have tried to keep the rest of the 42A quite separate from that and obviously what you've put in front of me, separately. But that is just a fact for you to be aware of and I do think that 3, it currently, requires a farming consent too, regardless of however you slice the cake, it either needs a separate one or it needs to be bought into the landholding global arch.

McMurdo Is there any information in relation to the proposed amendments that hasn't been covered? Anything else anyone wants to talk about?

Grant I think we've got until Monday to determine a scope.

Freeman Yep.

Grant Which is the only thing we haven't talked about from what I can see, there's no major thing and I don't think it will change the scope.

Legg I agree.

Grant So we don't need to go down that track, but is there any, obviously we've talked about the fertiliser use and management on farm but there's not, I just want to make doubly sure there's not an additional block of land.

Legg Just the dairy effluent reports change that's all.

Grant In my opinion so far from what I can see I wouldn't consider that there is a change of scope there. But it si something that the commissioners would want.

de Wolde So what about Woldwide 3, that's a lot of extra stuff that needs to come in isn't it, if we have to go down that track.

Grant How do you mean, oh if that comes into the scope.

de Wolde If you want to pull in Woldwide 3 as well. That will be a lot of extra information.

Grant It will be. I think that Adams also, sorry to keep referring back to that but it gave us a steer on scope and they were happy to bring the cut and carry block that came up at the hearing into it without it being a change of scope. I have no idea what they would consider without a farm being added. I mean, I'm really not too sure on how that will go. But again, that's why I've tried to keep it separate, I'll still consider that as two separate applications and that there's essentially a missing puzzle piece in the middle and I've tried to frame it up like that so it's not like this whole thing is in together.

Freeman Ok. We'll work on all that.

Grant A very interesting question bringing it up.

Freeman In terms of feeding back to the commissioners on the specific questions that they posed to us, it sounds like you're going to flick a draft round so that we might all basically, before the end of the day, be able to say yes we agree with you with that proposition if you like put to the commissioners.

Grant Yes, and if we could revisit, just to make sure given that I appreciate I've thrown some quite big things at you, are we still ok with that first stage? You don't want more time? I appreciate Hans is quite busy also.

Freeman I think some of that might depend on Hans' advice. If Hans's advice is strongly along the lines of essentially saying no, that's ridiculous, the definition couldn't possibly be extended that far and is very confident about his advice, then I'm sure we'd be pressing hard for that. Conversely if Hans comes back and says oh my god, you know, they've got us by the short and curlies, we're going to

have to completely rethink, you know, if he comes back with something like that then I'm sure we'll be in touch.

Grant Yes and you do always have mechanisms under the Act you could use. Great. Ok, well I'll draft that up now and flick it around.

McMurdo Thanks for attending today everybody, we'll get this transcribed passed around by Wednesday.

Freeman I'll be hanging out for it. All 10 pages of it.

End.

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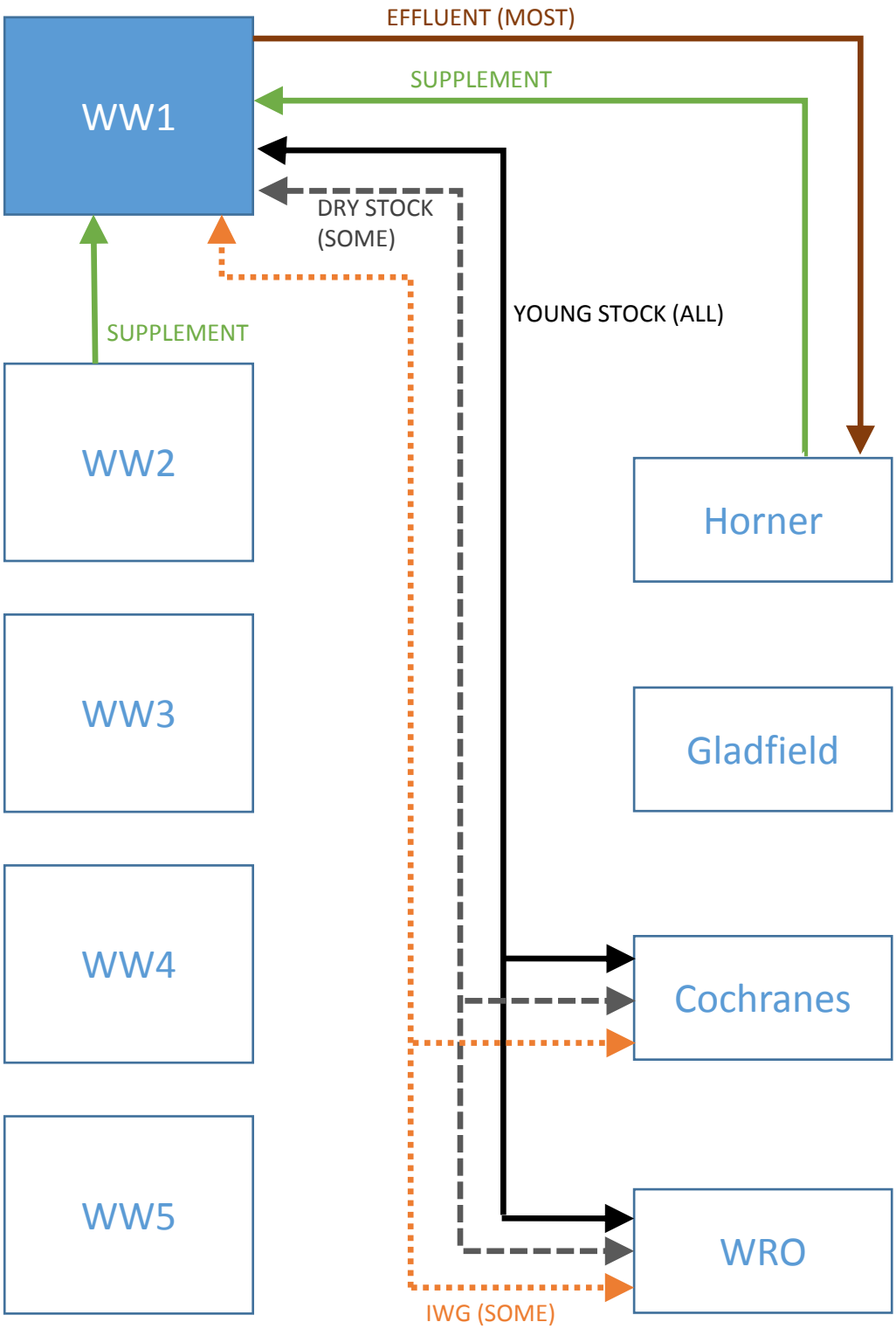
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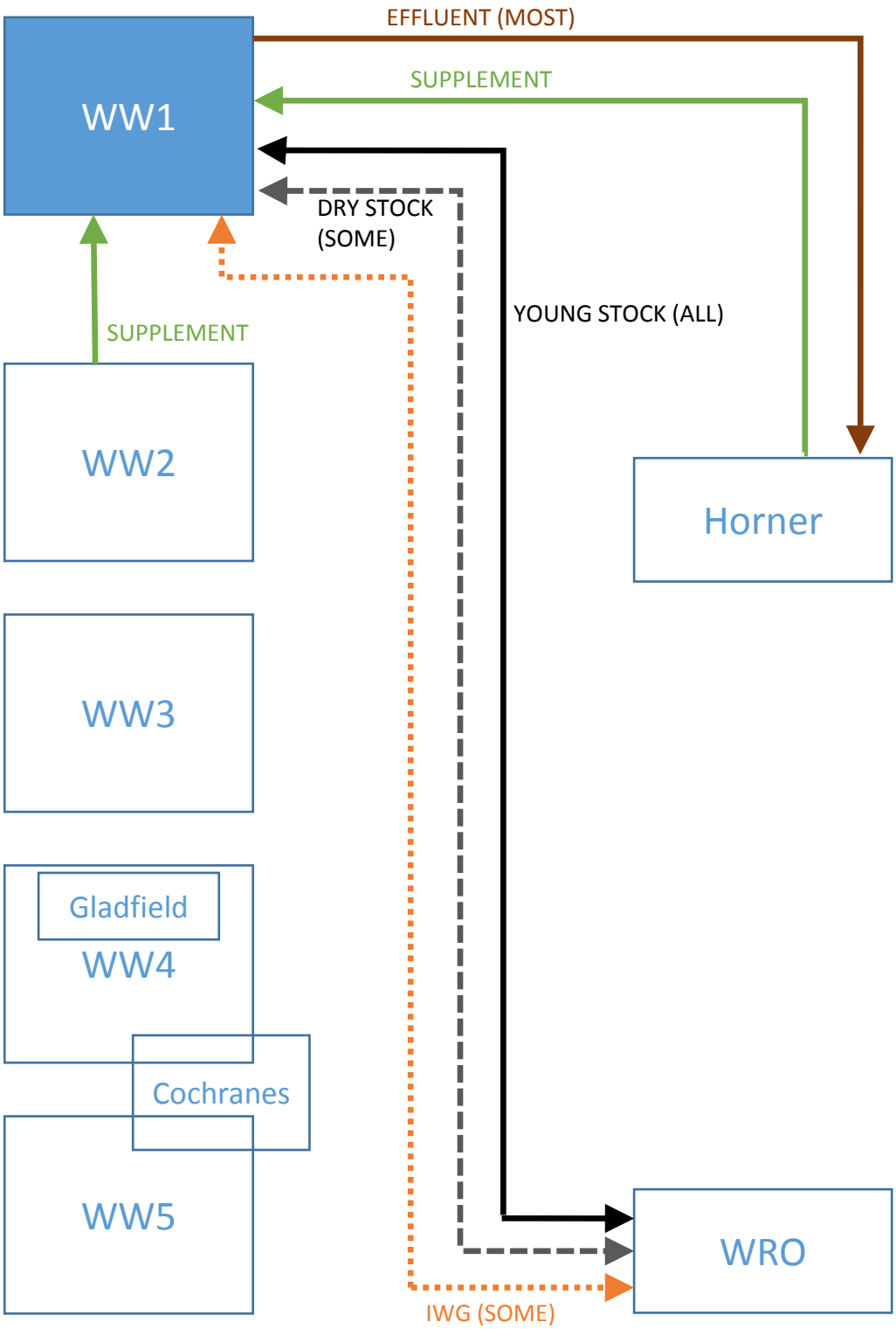
Gladfield
WW4
Cochranes
WW5
WRO
IWG (SOME)

Proposed, WW1



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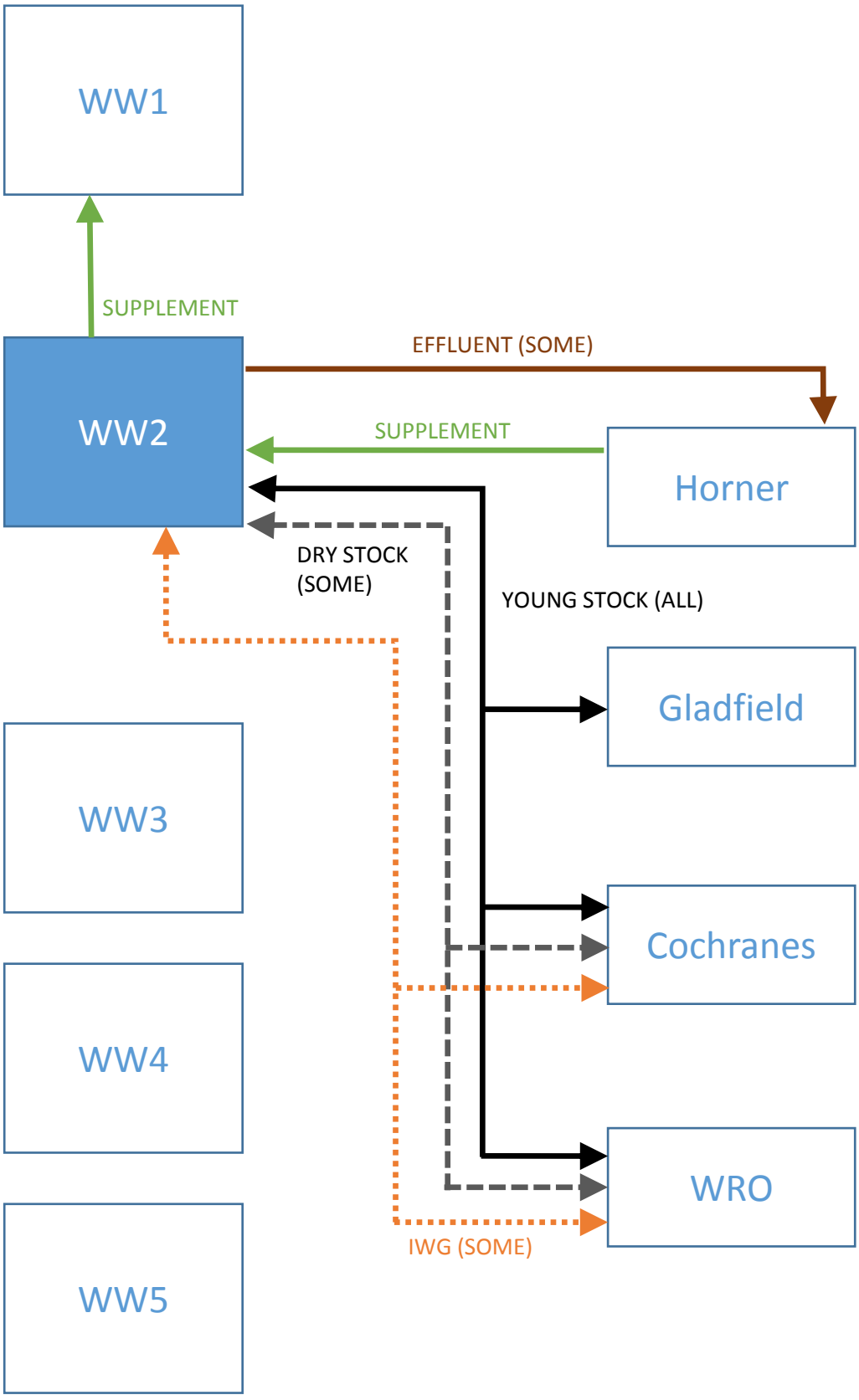
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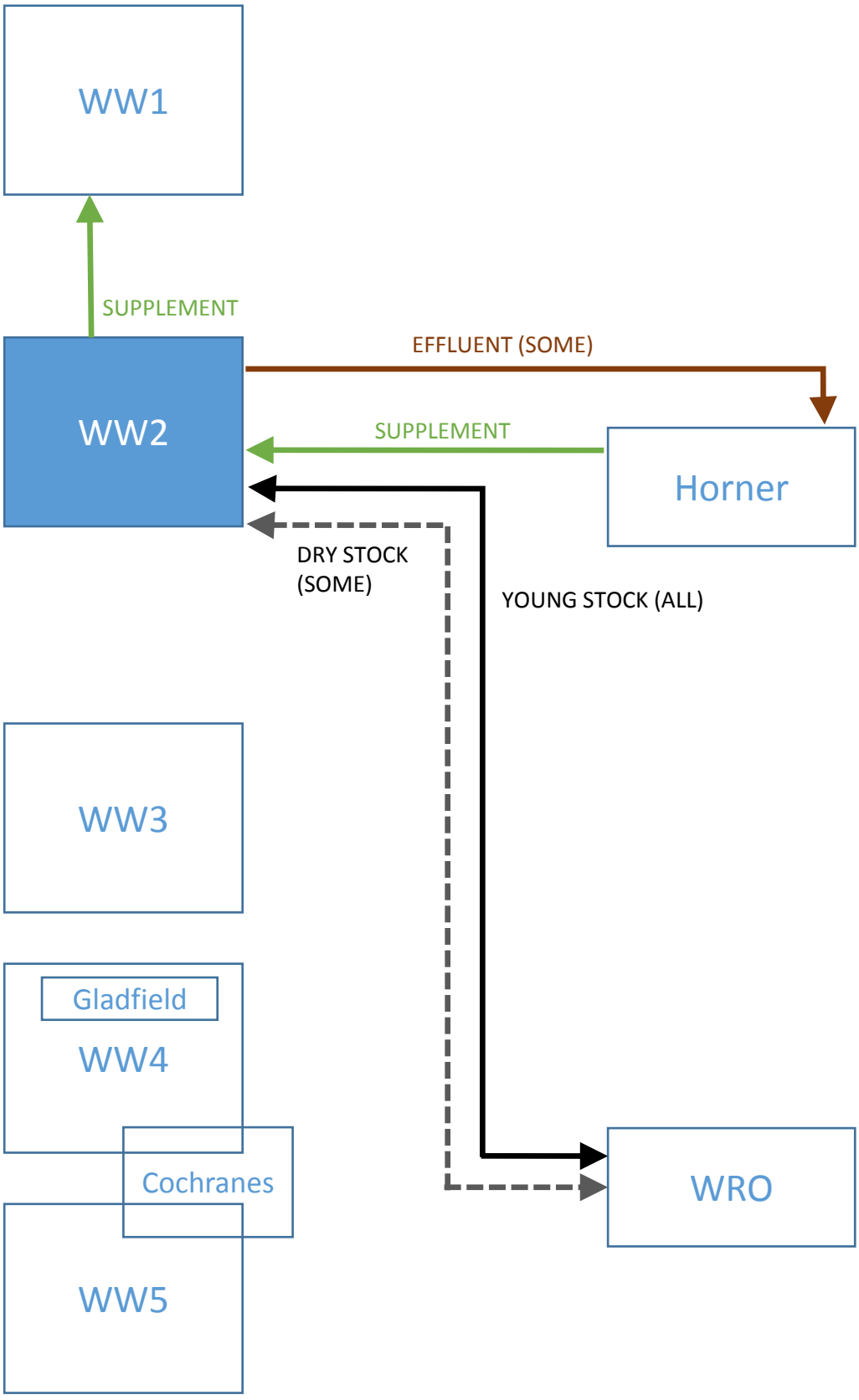
Cochranes
WW4
WRO
IWG (SOME)
WW5

Proposed, WW2



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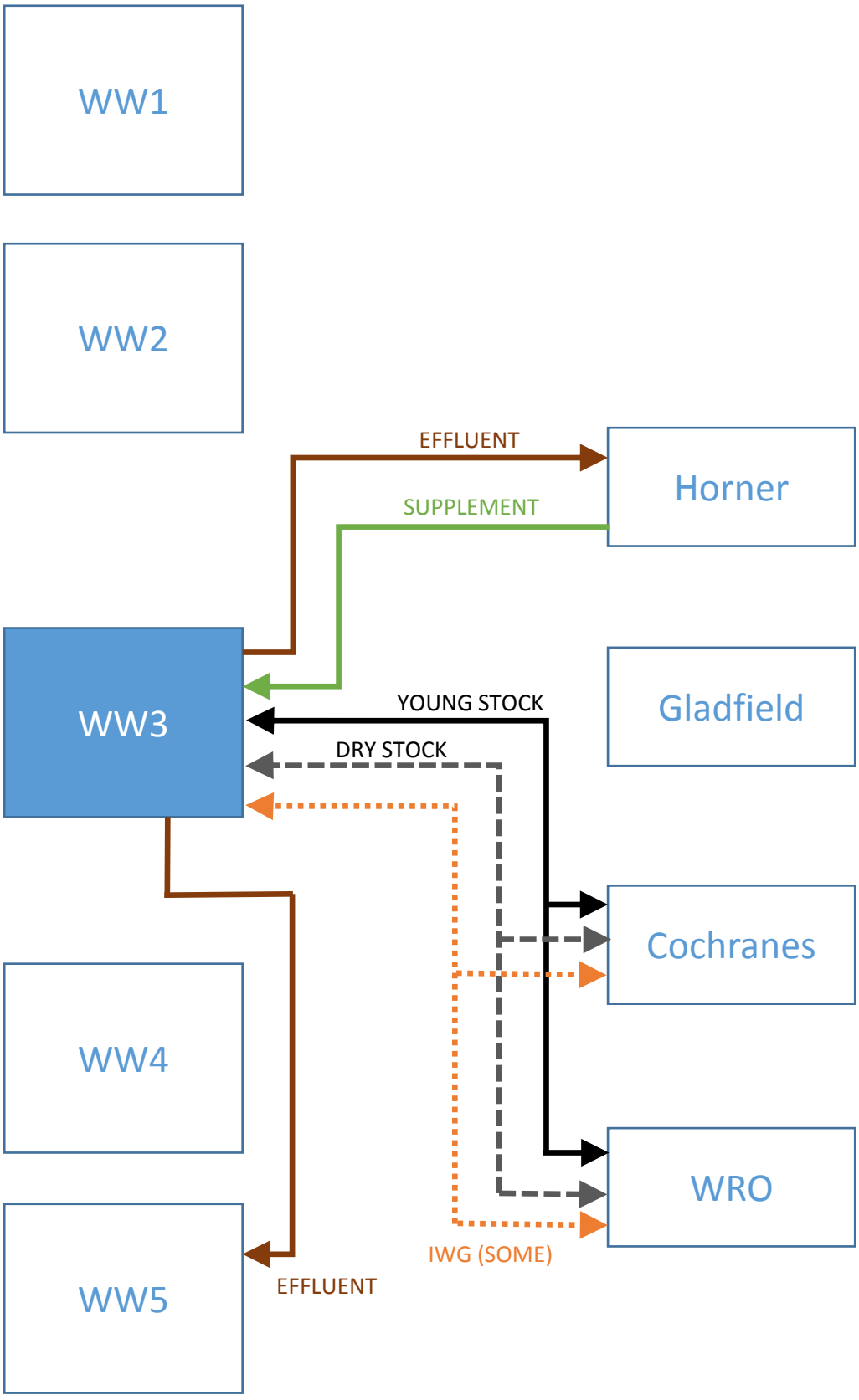
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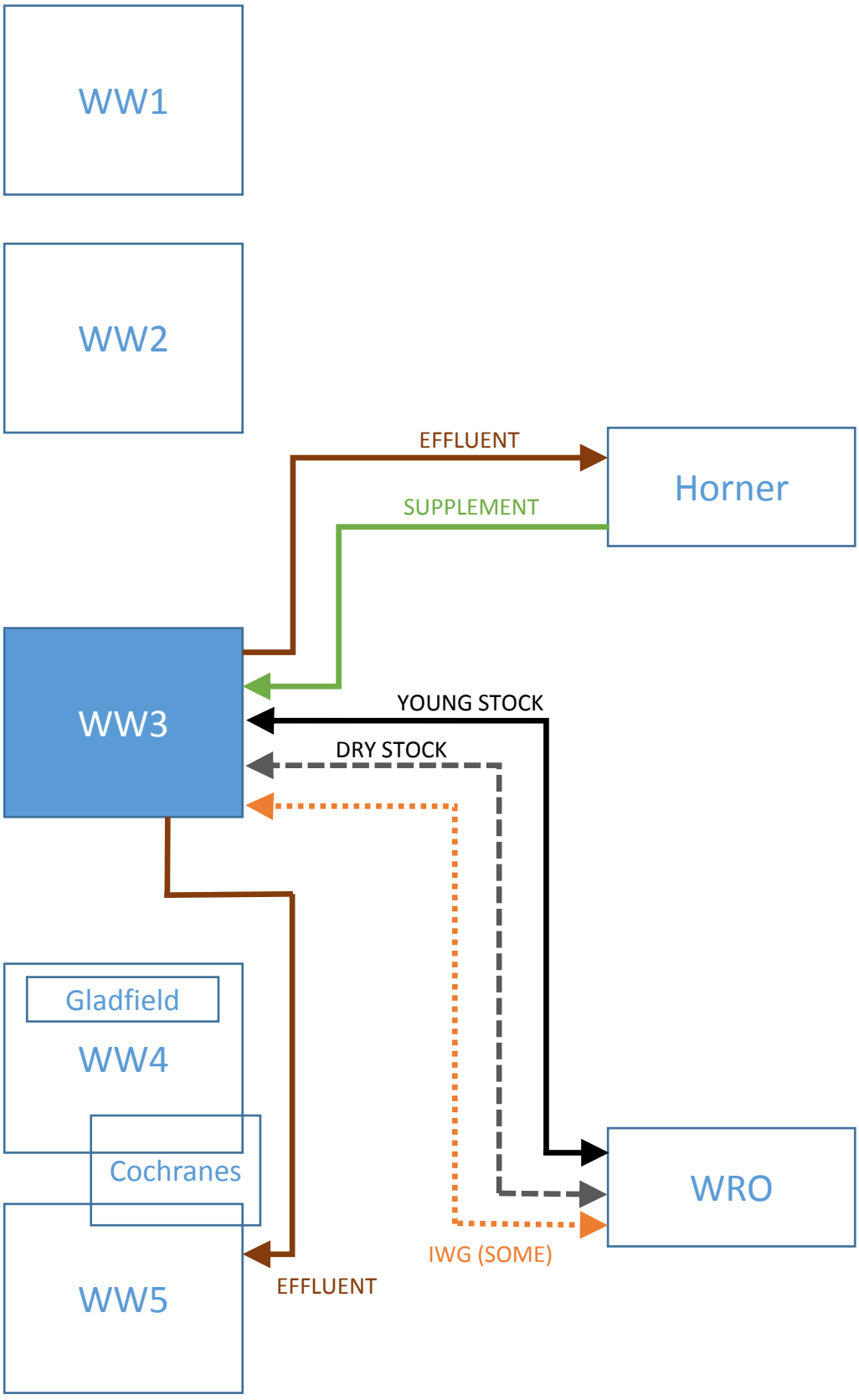
IWG (SOME)
WW5
EFFLUENT

Proposed, WW3



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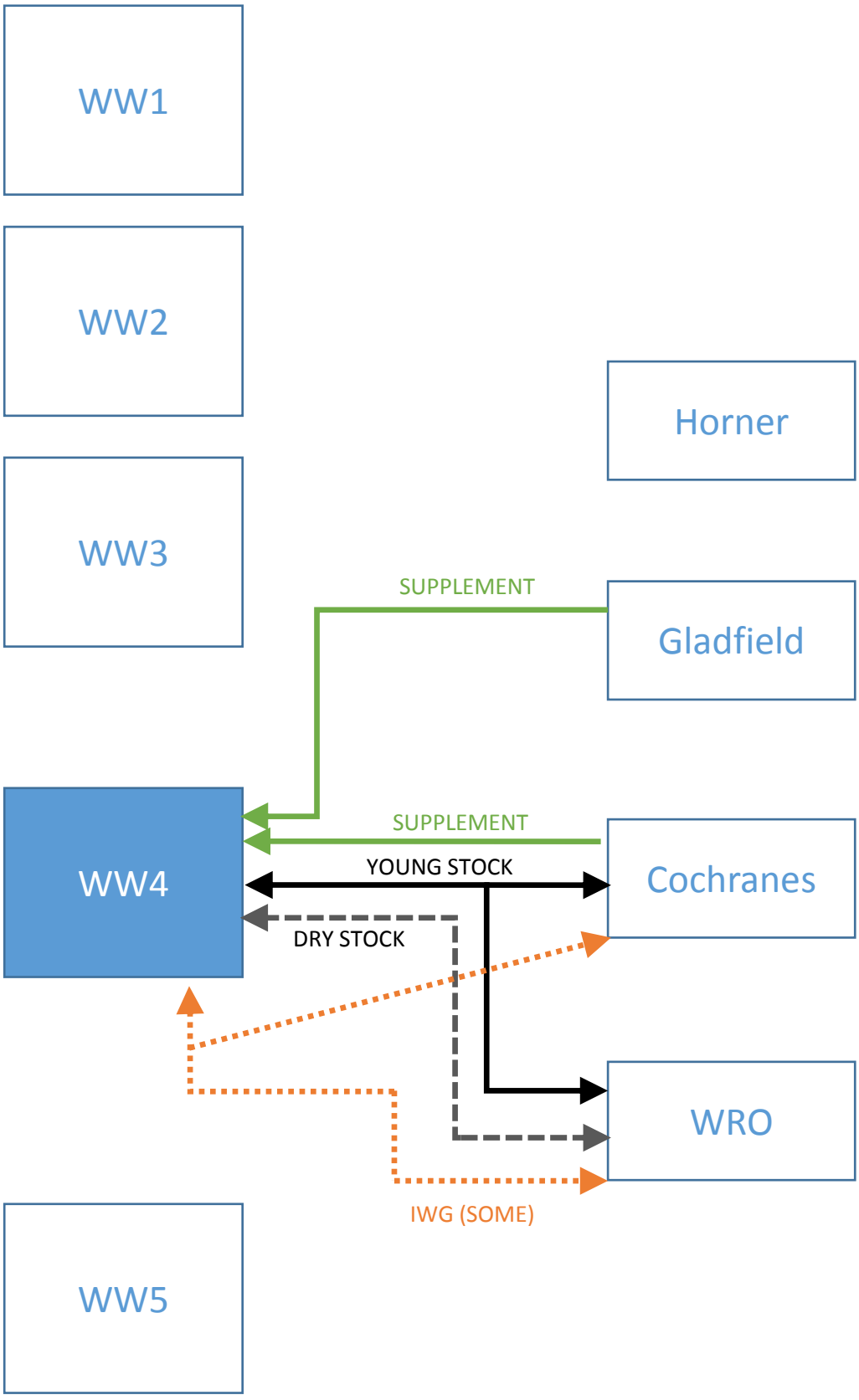
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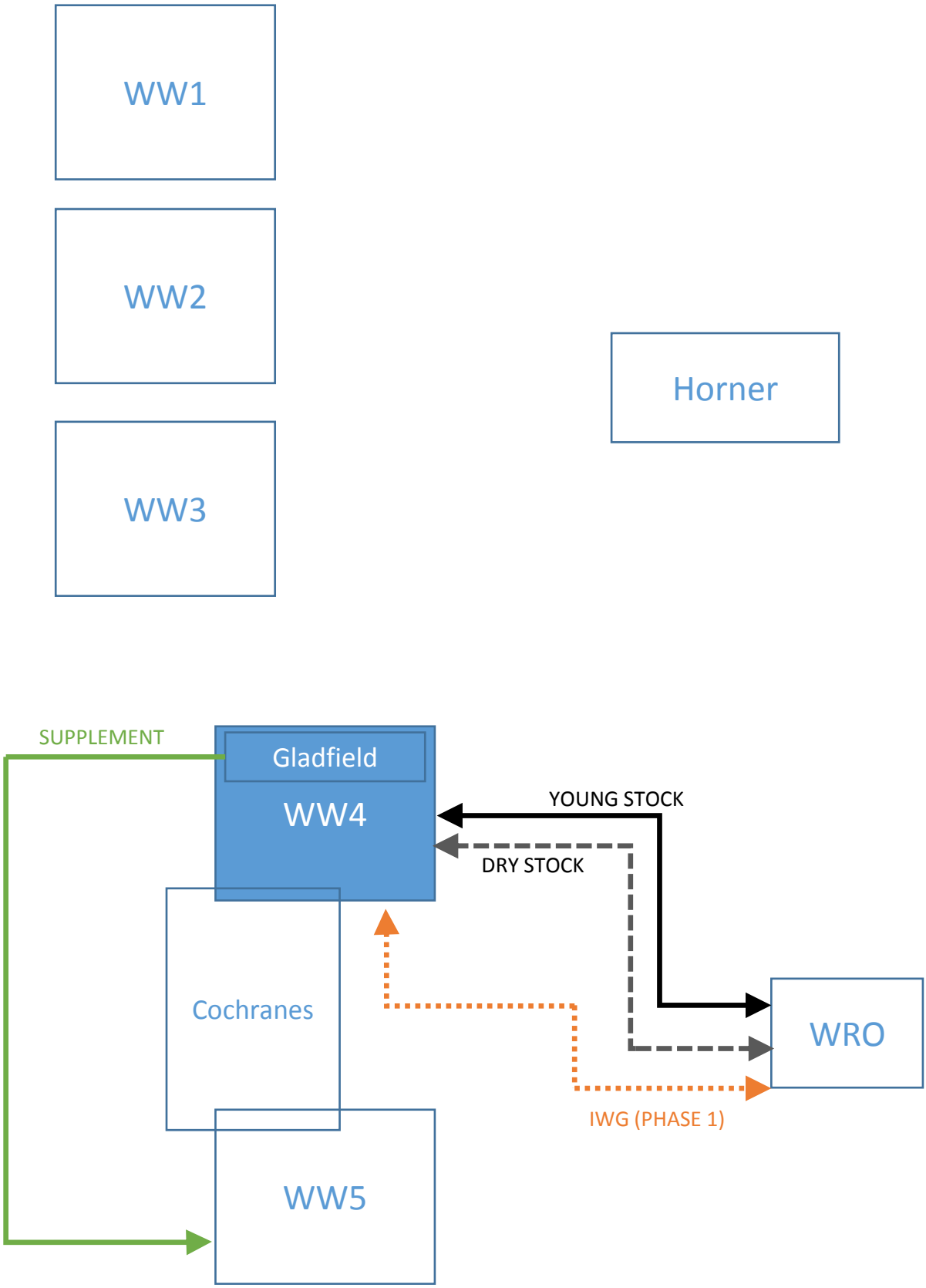
DRY STOCK
IWG (SOME)

Proposed, WW4



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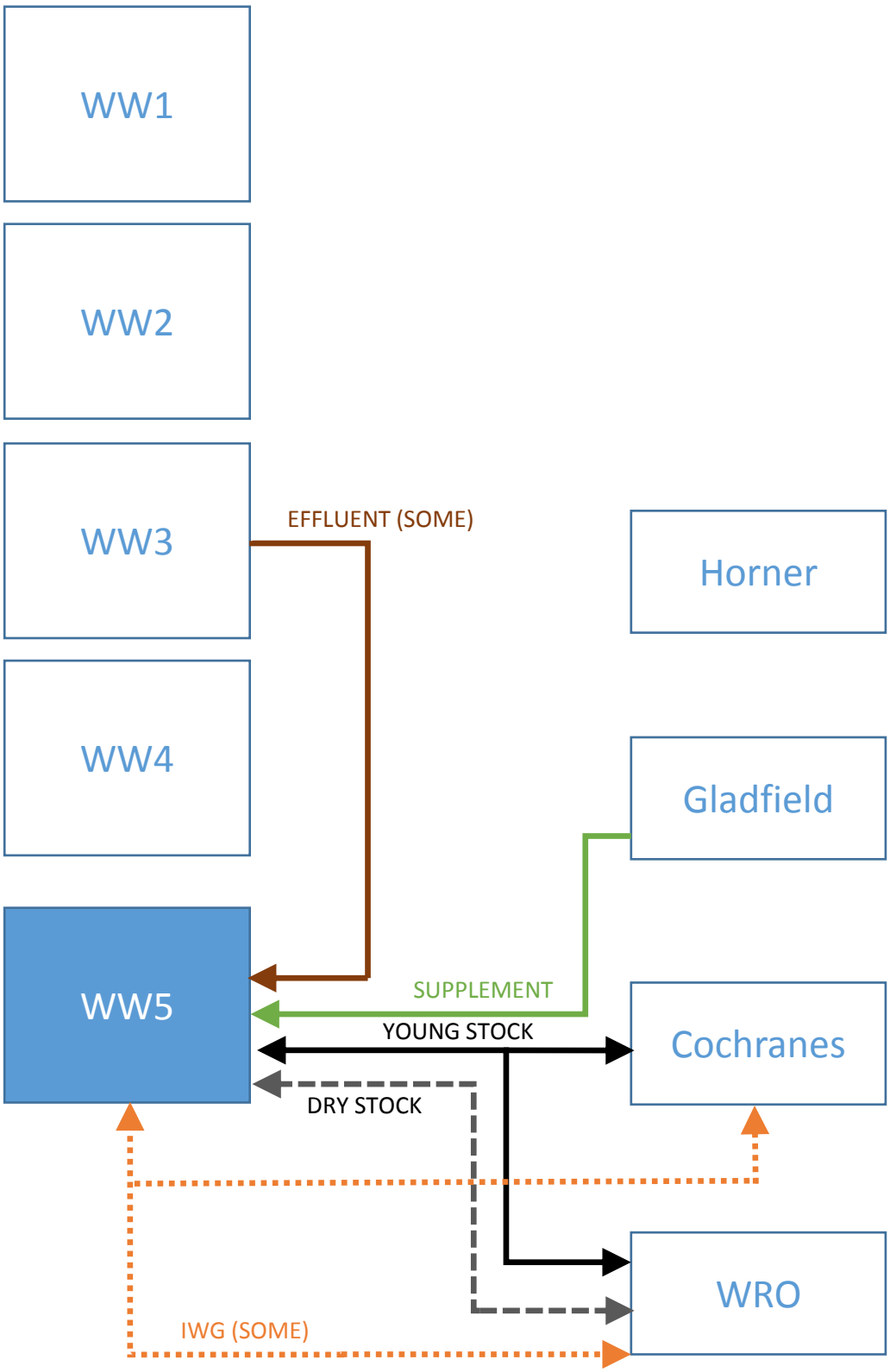
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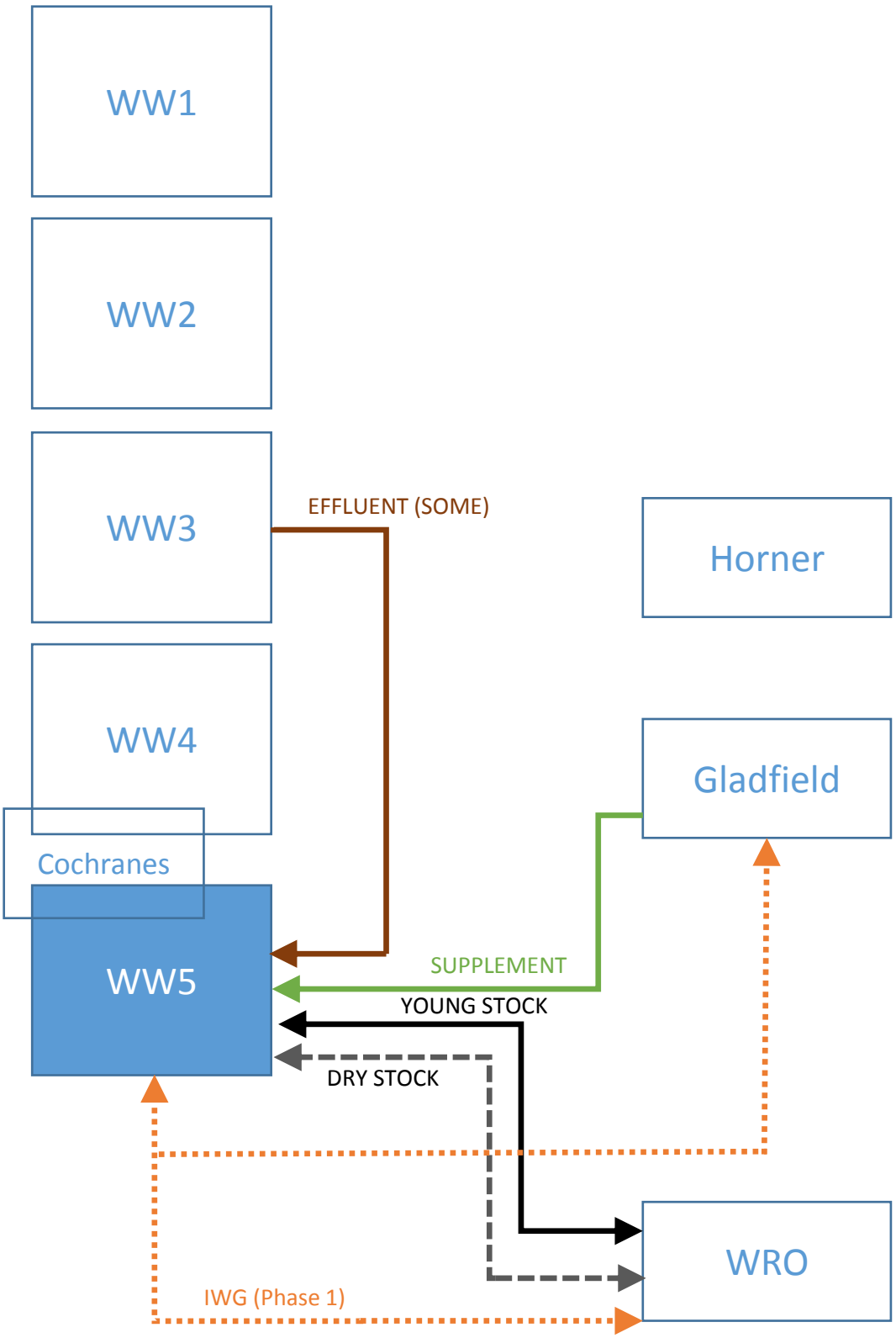
IWG (SOME)

Proposed, WW5



From: Aurora Grant
Sent: Tuesday, 10 September 2019 4:11 p.m.
To: Lacey Bragg
Subject: FW: WW4 & 5 - Cochrane Block, Gladfield Block and staging

From: Mike Freeman <mike.freeman@landpro.co.nz>
Sent: Thursday, 27 June 2019 9:52 AM
To: Aurora Grant <Aurora.Grant@es.govt.nz>
Cc: abe@woldwide.nz; 'Nessa Legg' <nessa.dgl@xtra.co.nz>; Alex Erceg <Alexander.Erceg@es.govt.nz>; 'Mark Crawford' <mark.crawford@ravensdown.co.nz>
Subject: WW4 & 5 - Cochrane Block, Gladfield Block and staging

Hi Aurora

A quick note to clarify these matters.

Cochrane Block – Woldwide Farm leases the relevant parts of the Cochrane Block to WW4 & WW5

Gladfield Block – the intention is to use the full extent of the block for effluent application (minus exclusion areas for houses & bores).

Staging – We propose to accelerate the original staging proposal and, on the assumption that consents would be granted and issued before the end of November 2019, specifically that the winter barn for WW4 would be built and be operational by 1 May 2021 and the winter barn for WW5 would be built and operational by 1 May 2022.

Many thanks

Regards

Mike

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From: Aurora Grant <Aurora.Grant@es.govt.nz>
Sent: Wednesday, 26 June 2019 9:36 PM
To: 'Nessa Legg' <nessa.dgl@xtra.co.nz>; Alex Erceg <Alexander.Erceg@es.govt.nz>; Mike Freeman <mike.freeman@landpro.co.nz>
Cc: abe@woldwide.nz
Subject: RE: answers

Hi Nessa,

Thanks for clarifying. Mike, under 4&5's proposal with including the Cochranes block into the dairy platform, will it (Cochranes block) remain under Woldwide Farms ownership?

Cheers,

Aurora

From: Nessa Legg <nessa.dgl@xtra.co.nz>
Sent: Wednesday, 26 June 2019 12:28 PM
To: Aurora Grant <Aurora.Grant@es.govt.nz>; Alex Erceg <Alexander.Erceg@es.govt.nz>
Cc: abe@woldwide.nz; 'Mike Freeman' <mike.freeman@landpro.co.nz>
Subject: RE: answers

Hi Aurora,

To clarify, wintering of cows and young stock will occur at WW1&2 (barns) and WRO under the proposal.

The nutrient budget analysis reports for WW1&2 and for WRO (one year only) show stock wintering numbers on those land areas in the years modelled. Abe is referring to wintering at the Cochrane block (June 2019), which obviously is not in the nutrient budget analysis but is consistent with what has been done up to the present; i.e. IWG activity in the Heddon Bush area - in recent years this includes R2s from WW1&2.

The various proposals move the Heddon Bush/IWG activity into barns and/or to WRO depending on the season and space available.

Regards,
Nessa

From: Aurora Grant <Aurora.Grant@es.govt.nz>
Sent: Tuesday, 25 June 2019 9:51 p.m.
To: 'abe@woldwide.nz' <abe@woldwide.nz>
Cc: 'Nessa Legg (nessa.dgl@xtra.co.nz)' <nessa.dgl@xtra.co.nz>; 'Mike Freeman (mike.freeman@landpro.co.nz)' <mike.freeman@landpro.co.nz>; Alex Erceg <Alexander.Erceg@es.govt.nz>
Subject: RE: answers

Thanks Abe, where is this carried out? This is important as I was under the impression that all winter grazing of WW1&2 cows (and youngstock/ drystock etc) was done only on land owned by WRO and WW1&2.

From: abe@woldwide.nz [mailto:abe@woldwide.nz]
Sent: Tuesday, 25 June 2019 9:48 p.m.
To: Aurora Grant
Cc: 'Nessa Legg'; 'Mike Freeman'
Subject: RE: answers

Winter grazing offered by Woldwide Farm Ltd is performed on land owned by Woldwide Farm Ltd only

Abe

From: Aurora Grant <Aurora.Grant@es.govt.nz>
Sent: 25 June 2019 21:29
To: 'abe@woldwide.nz' <abe@woldwide.nz>
Cc: 'Nessa Legg' <nessa.dgl@xtra.co.nz>; 'Mike Freeman' <mike.freeman@landpro.co.nz>
Subject: RE: answers

One additional clarification – is the winter grazing which is offered by WWF carried out on WRO blocks, or elsewhere?

Thanks,

Aurora

Aurora Grant
Team Leader Consents
Environment Southland *Te Taiao Tonga*

P 03 211 5115
Cnr Price St & North Rd, Private Bag 90116, Invercargill 9840
Aurora.Grant@es.govt.nz | www.es.govt.nz | facebook.com/environmentsouthland

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From: abe@woldwide.nz [mailto:abe@woldwide.nz]
Sent: Tuesday, 25 June 2019 9:25 p.m.
To: Aurora Grant
Cc: 'Nessa Legg'; 'Mike Freeman'
Subject: answers

Aurora,

Nessa asked us to answer these questions.
Answers:
1: Yes, Woldwide Farm Ltd owns Horner block in its entirety
2: Woldwide Farm Ltd owns one Leonberger dog, called Ellie, and no other animals
3: Woldwide Farm Ltd offers winter grazing to Rising Two year olds for WoldWide One Ltd, WoldWide Two Ltd and WoldWide Three Ltd, and R1 bulls and carry over cows for WoldWide Runoff Ltd
Depending on the excess of winter crop Woldwide Farm Ltd might have to offer grazing to third parties (not associated with WoldWide Dairy Group) at the end of the winter once feed budgets become clearer.
In previous years we have occasionally offered grazing to such third parties.

Abe

Could you please clarify for me the following regarding woldwide farms limited:
If WwF owns Horner Block in its entirety?
If WWF owns any cows, including youngstock or bulls?; and
What winter grazing woldwide offers as a company, and, to what other parties, where this winter grazing occurs, and what cows from which farm are supported by WWF.

Cheers,

Aurora

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From: Aurora Grant
Sent: Tuesday, 10 September 2019 4:10 p.m.
To: Lacey Bragg
Subject: FW: APP-20191140 Request for further information

Importance: High

From: Alex Erceg <Alexander.Erceg@es.govt.nz>
Sent: Monday, 22 July 2019 11:07 AM
To: 'Mike Freeman' <mike.freeman@landpro.co.nz>
Cc: 'abe@woldwide.nz' <abe@woldwide.nz>; Matilda Ballinger <matilda@landpro.co.nz>; Aurora Grant <Aurora.Grant@es.govt.nz>
Subject: RE: APP-20191140 Request for further information
Importance: High

Hi Mike

Can you also please provide the following clarifications:

The proposal for Woldwide Four includes an application for land use for the use and maintenance of the existing effluent storage facilities, which includes the clay lined effluent pond, however there is also mention that that pond will be relined under phase 2, and at that time the required resource consent will be applied for.

Am I correct in that the clay lined pond will make up part of the land use consent for existing structures, and then prior to phase 2 (and the exercise of the new discharge permit, should it be granted) a new consent will be applied for, for the reconstruction of the clay lined pond in order to install the synthetic liner?

Noting, that the application states that this will be a condition of the discharge permit.

Thanks

From: Aurora Grant
Sent: Monday, 22 July 2019 10:36 AM
To: 'Mike Freeman' <mike.freeman@landpro.co.nz>
Cc: Alex Erceg <Alexander.Erceg@es.govt.nz>; 'abe@woldwide.nz' <abe@woldwide.nz>; 'Nessa Legg (nessa.dgl@xtra.co.nz)' <nessa.dgl@xtra.co.nz>; Matilda Ballinger <matilda@landpro.co.nz>
Subject: RE: APP-20191140 Request for further information

Mōrena Mike,

Thanks for that.

I will be providing draft conditions with the reports.

Nga mihi,

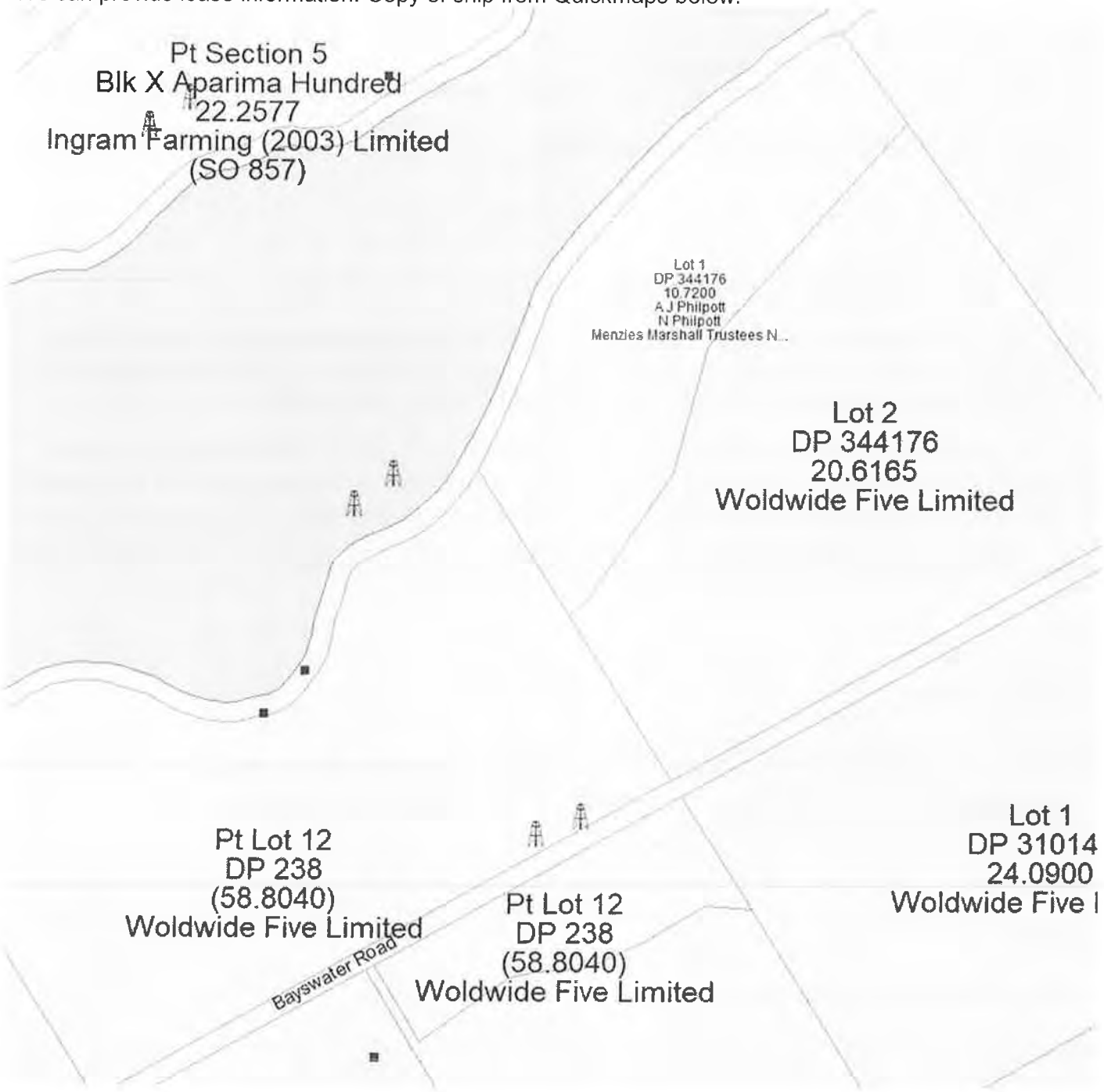
Aurora

From: Mike Freeman <mike.freeman@landpro.co.nz>
Sent: Monday, 22 July 2019 10:21 AM
To: Aurora Grant <Aurora.Grant@es.govt.nz>
Cc: Alex Erceg <Alexander.Erceg@es.govt.nz>; 'abe@woldwide.nz' <abe@woldwide.nz>; 'Nessa Legg (nessa.dgl@xtra.co.nz)' <nessa.dgl@xtra.co.nz>; Matilda Ballinger <matilda@landpro.co.nz>
Subject: RE: APP-20191140 Request for further information

Hi Aurora

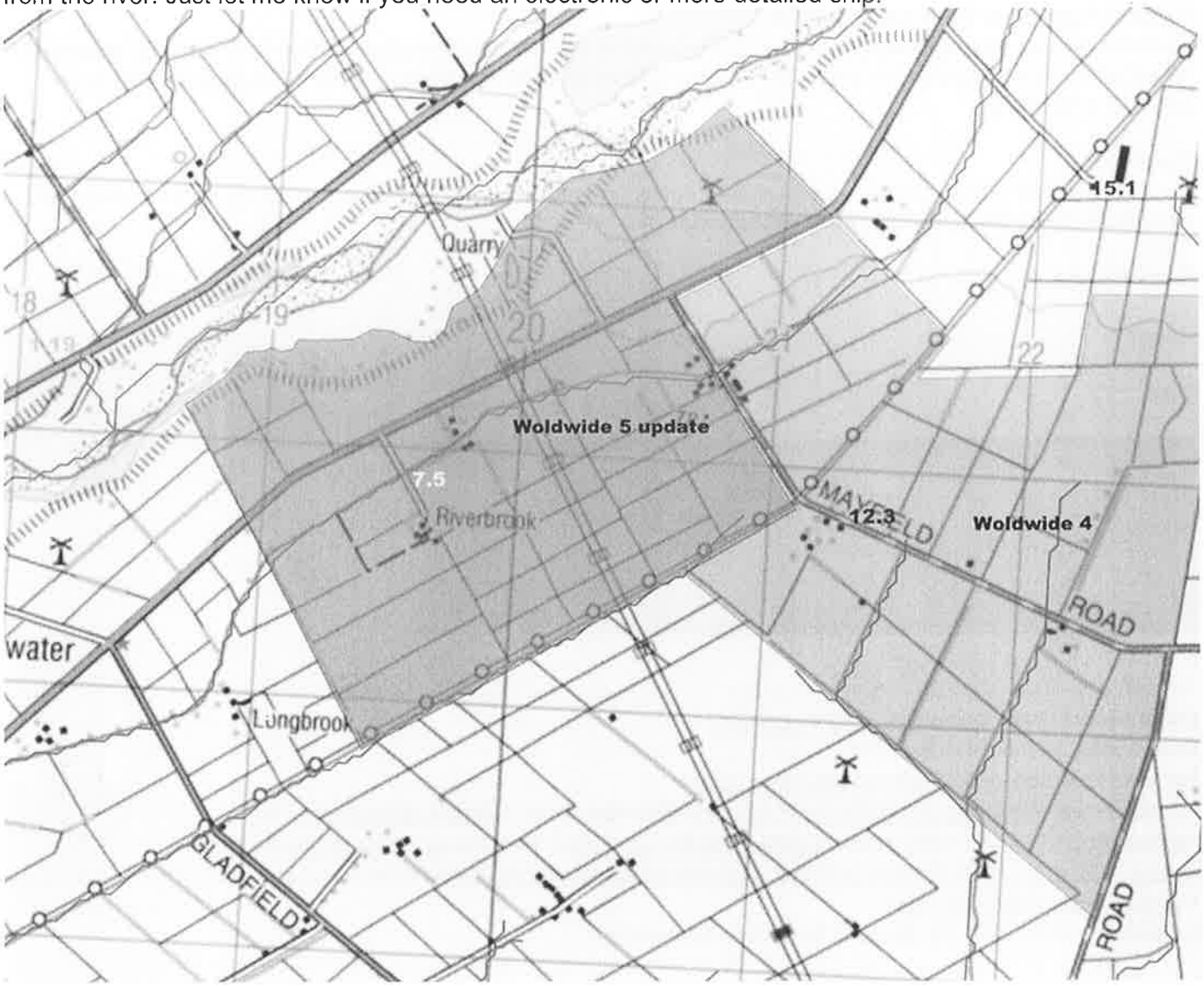
Many thanks for those detailed questions and comments. Some quick responses:

Land ownership
There is a 10.7 ha leased block of land owned by the Philpotts (Philpotts and Menzies Marshall Trustees). We can provide lease information. Copy of snip from Quickmaps below:



Riverbed

I agree - the original maps in the application appeared to illustrate the area a bit too far into the riverbed. I have re-drawn the area off titles from Quickmaps as shown below. We will ensure that effluent is not applied beyond the titles and we will ensure that there will always be at least a 5m setback (see below) from the river. Just let me know if you need an electronic or more detailed snip.



Riverbed case law
The case law hasn't finished yet on the riverbed definition and associated rules. The High Court decision (Dewhirst) limited ECan's preferred broad definition of a river bed which appears to hinge on the definition of "banks". The Court of Appeal case that Abe's lawyer is involved with on Tuesday 20 August is that case.

I do recognise that this case will have implications for how the 5m setback is determined given that Rule 20 refers to 5m distance from the "…outer edge of the bed of any lake, river …". My understanding is that the HC did not accept the literal meaning of "fullest flow" and preferred: "*the bed of a river comprises those lands covered by water during the ordinary rainy season but contained within the banks of the river and extending from bank to bank".* Let' see what the Court of Appeal thinks!

Contact person
As you may be aware Tanya has led this application but has now finished and will be having a baby in about three weeks (I heard yesterday that she is having pregnancy complications and was heading to Dunstan or Dunedin hospital).
I am now the primary planning representative for the applicant. I can be your primary point of contact but Matilda is working with me and you will from time to time receive communication from her.
I will continue to copy Nessa in on WW4&5 matters just in case there are any matters of common or general interest. I'm sure that if Nessa thinks anything is unnecessary or irrelevant she will tell me.

Communication with the Ministry of Education's representative

I am quite entitled to contact a submitter directly to discuss technical matters. I am not required to involve all parties. If you don't want to be copied in, no problem. As you have requested, I will not involve you in any subsequent communication on these matters.

PSWLP Rule 20 & RMA Section 20A
As indicated, we acknowledge that IWG occurred that did not fully comply with PSWLP Rule 20 conditions as we all observed during the site visit. We are willing to apply for all necessary retrospective resource consent applications.

Conditions
On a completely different topic - I would be interested in knowing in advance if you you be providing draft conditions regardless of your recommendation(s)?

Many thanks

Regards

Mike

From: Aurora Grant <Aurora.Grant@es.govt.nz>
Sent: Friday, 19 July 2019 8:47 PM
To: Mike Freeman <mike.freeman@landpro.co.nz>
Cc: Alex Erceg <Alexander.Erceg@es.govt.nz>; 'abe@woldwide.nz' <abe@woldwide.nz>; 'anita' <anita@woldwide.nz>; Lacey Bragg <Lacey.Bragg@es.govt.nz>; 'Nessa Legg (nessa.dgl@xtra.co.nz)' <nessa.dgl@xtra.co.nz>; Matilda Ballinger <matilda@landpro.co.nz>; Michael Durand <Michael.Durand@es.govt.nz>
Subject: RE: APP-20191140 Request for further information

Thanks Mike.

Another couple of questions –
Who owns the land on WW5 block immediately next to the Aparima River where you are proposing to spread wintering barn effluent on? Our property layer is not showing WW as the owner. Also, it is incredibly close to the river – given recent case law coming out of Ecan could you check and confirm that the area right adjacent to the river is not actually part of the bed of the river?

Also can you confirm who is the planner on this application now please? I am getting correspondence from yourself, Matilda and Tanya, and I also notice that you have CC'd in Nessa to WW4&5 matters. It would be helpful if you had one point of contact as we do here – anything process related is through Lacey, and I (or Alex) will only be in touch with the planner if I have a planning question related to landpro's application.

In addition, I am also being cced into correspondence that you are sending to submitters regarding evidence which I consider is completely inappropriate – any matters like this where you wish to involve the council please direct to Lacey so correspondence can be directed through the correct channels and remains transparent to all parties. Approaching some submitters directly requesting evidence without others knowing about it is not what I consider good practice and I ask that you leave any of my team out of these emails if you wish to approach submitters for evidence individually.

In regards to Rule 20, Rule 24 and S20A rights, you may recall that commissioners provided commentary around S20A rights requiring acknowledgement from council that that right was available to them for their activity for the recent Adams decision. In the case of the IWG on the Cochranes block currently, no S20A rights exist for this block and it should not have been grazed without rule 20 consent. I am also seeking legal advice on this point, but this will be detailed in the S42A report.

Nga mihi nui,

Aurora

From: Mike Freeman <mike.freeman@landpro.co.nz>
Sent: Thursday, 18 July 2019 4:29 PM
To: Aurora Grant <Aurora.Grant@es.govt.nz>
Cc: Alex Erceg <Alexander.Erceg@es.govt.nz>; 'abe@woldwide.nz' <abe@woldwide.nz>; 'anita' <anita@woldwide.nz>; Lacey Bragg <Lacey.Bragg@es.govt.nz>; 'Nessa Legg (nessa.dgl@xtra.co.nz)' <nessa.dgl@xtra.co.nz>; Matilda Ballinger <matilda@landpro.co.nz>
Subject: RE: APP-20191140 Request for further information

Hi Aurora

Many thanks for your emails over the past week or so. Here are my brief responses to each key topic.

1. **RFI dated 15 July 2019 - stream depletion and bore interference**
We will provide a stream depletion assessment, a groundwater/bore interference assessment and an assessment of the implications of that for surface water quality and quantity. We will provide this information as part of the evidence for the hearing.

2. **WW3 effluent**
Yes some effluent from WW3 is spread over WW5 land. I understand that Tanya has discussed this **with you and provided Mark Crawford**'s summary.

3. **Timing of wintering barn construction & operation**
I confirm my earlier email that the original plan has now been refined and Abe & Anita propose to have the wintering barn on WW4 operational by the winter of 2021 and WW5's barn operational by the winter of 2022. Could you please accept this email as clarification on (addendum to) the timing for phase 2 indicated in the application.

4. **Consents for Slurry storage from the new wintering barns**
I think it would be preferable to allow Abe & Anita time to assess the most appropriate system(s) to use after they have clarity on the detailed outcome of the consent process and to see if there are any changes to the relevant rules in the PSWLP that come out of the plan appeal process. We would be quite happy with a simple condition that requires consent applications to be made within six months of the relevant consent commencing.

5. **Retrospective resource consent applications (15 July email)**
We are in the process of seeking legal advice on this. However, our current view is that the situation that was observed at WW5 was promptly rectified and is not currently occurring. All parties involved in managing the farm are now clear on PSWLP Rule 20 requirements and 5m water setback distances are all being met. Therefore, we are satisfied that for at least the past three weeks and into the future all relevant conditions of Rule 20 are being complied with. Similarly, we are satisfied that with all the GMPs currently in place and being put in place, along with respecting the relevant permitted activity setback distances the risk of any discharge occurring that would result in non-compliance with any Rule 24 condition has been reduced to at least the practicable minimum.

We do accept that for a relatively short period of time there was non-compliance and are prepared to apply for retrospective authorisation. However, we think it would be prudent to wait until we get legal advice and would welcome your view on the situation as outlined above.

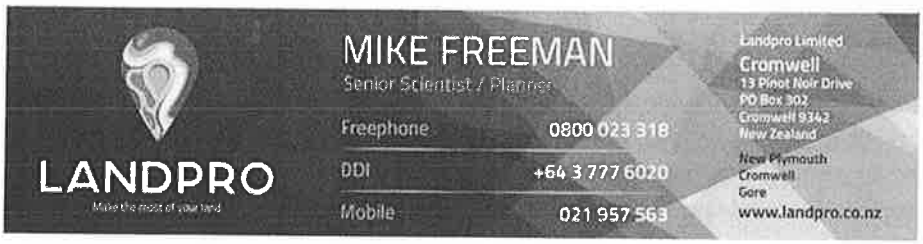
I think your original email on this topic was directed to Nessa but stated that this applies to WW4 & 5 as well. Hopefully, this response covers WW1&2 as well.

If you need any further information please don't hesitate to contact me.

Many thanks

Regards

Mike



From: Aurora Grant <Aurora.Grant@es.govt.nz>
Sent: Wednesday, 17 July 2019 3:56 PM
To: Mike Freeman <mike.freeman@landpro.co.nz>
Cc: Alex Erceg <Alexander.Erceg@es.govt.nz>; 'abe@woldwide.nz' <abe@woldwide.nz>; 'anita' <anita@woldwide.nz>; Lacey Bragg <Lacey.Bragg@es.govt.nz>
Subject: APP-20191140 Request for further information

Tēnā koutou I tēnei ahiahi Mike,

Attached is the RFI that was discussed yesterday for the increased take on WW5 for Phase 2.

Any questions let me know,

Ngā mihi nūi,

Aurora

Aurora Grant
Team Leader Consents
Environment Southland *Te Taiao Tonga*

P 03 211 5115
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Aurora.Grant@es.govt.nz | www.es.govt.nz | facebook.com/environmentsouthland

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