

Farm Scenario Plan

Current and Proposed System Nutrient Budgets for Effluent consent with Winter Barn Example

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60877676

WORLDWIDE FOUR LIMITED

C/- A & JJ DE WOLDE

104 SHAWS TREES ROAD; RD 3 WINTON 9783

07/08/2018

Reviewed by Andrée Callaghan (CNMA)



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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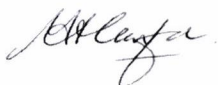
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Mark Crawford

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 °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 °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	20 th August for main Herd, 12 th August for Heifers				
	Dry-Off date	1 st June for main herd and 25 th 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

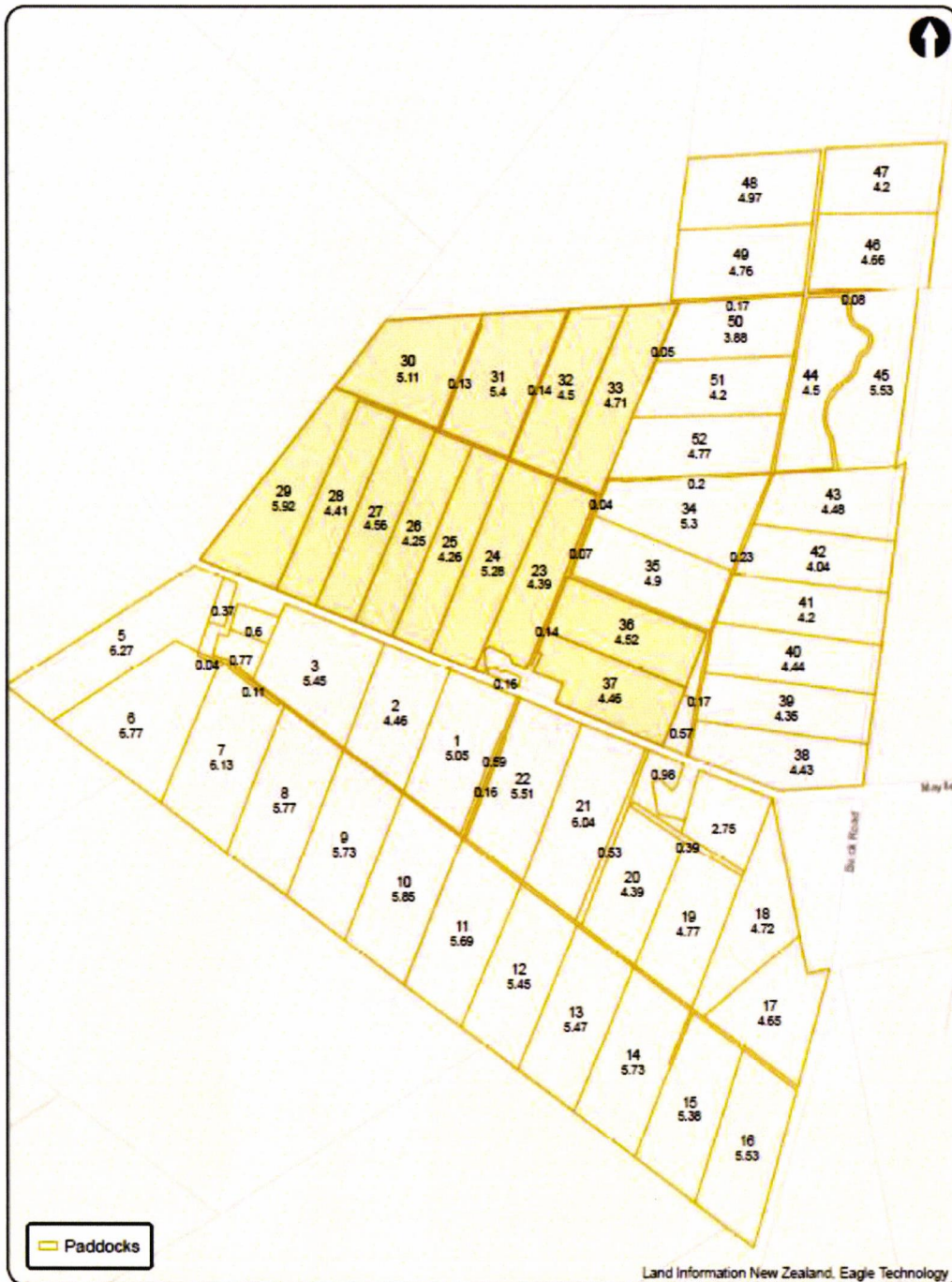
Management Unit details and Soil Information: Table 1

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 Galdfield Support block (or run off), totally 78.3 ha, with 0.5 ha non productive


Land Management Unit Map and Farm Map



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 Note: Areas are in hectares
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Effluent area 61.8 ha

0 70 140 280 420 560 Metres



04 May 2018

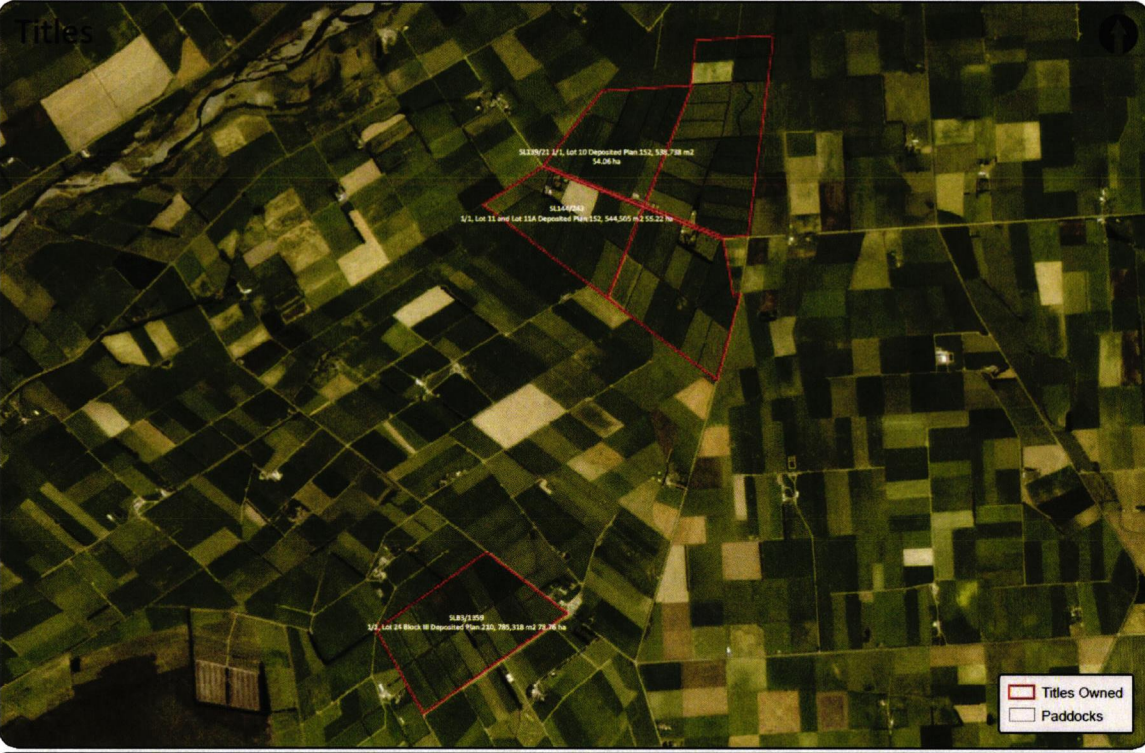
Farm map with Effluent block shaded in yellow, 61.7 ha in total less estimated setback areas based on 92 % equates to 57 ha. Total area with Gladfield support block is 349.3 ha, estimated pastoral area of 337.5 ha.



Date: 2/05/2018 **ravensdown** 60877676 WOLDWIDE FOUR LTD - DE WOLDE A & J J

0 465 930 1360 Metres

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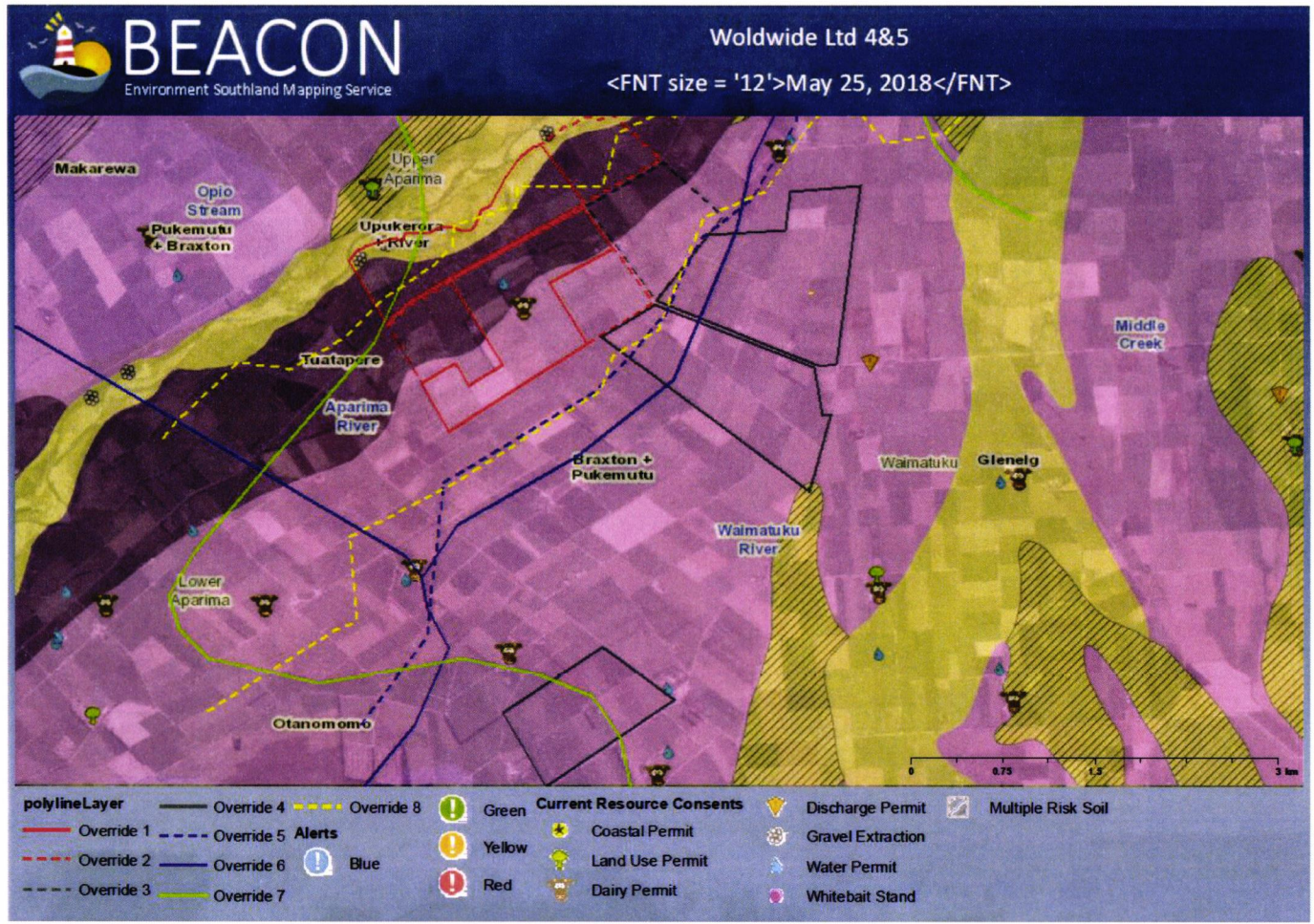
Date: 2/05/2018 **ravensdown** 60877676 WOLDWIDE FOUR LTD - DE WOLDE A & J J

0 205 530 1040 Metres

Titled Area: 346.20
Effective Area: 341.92

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;	

		<ul style="list-style-type: none"> ➤ 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 	
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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.

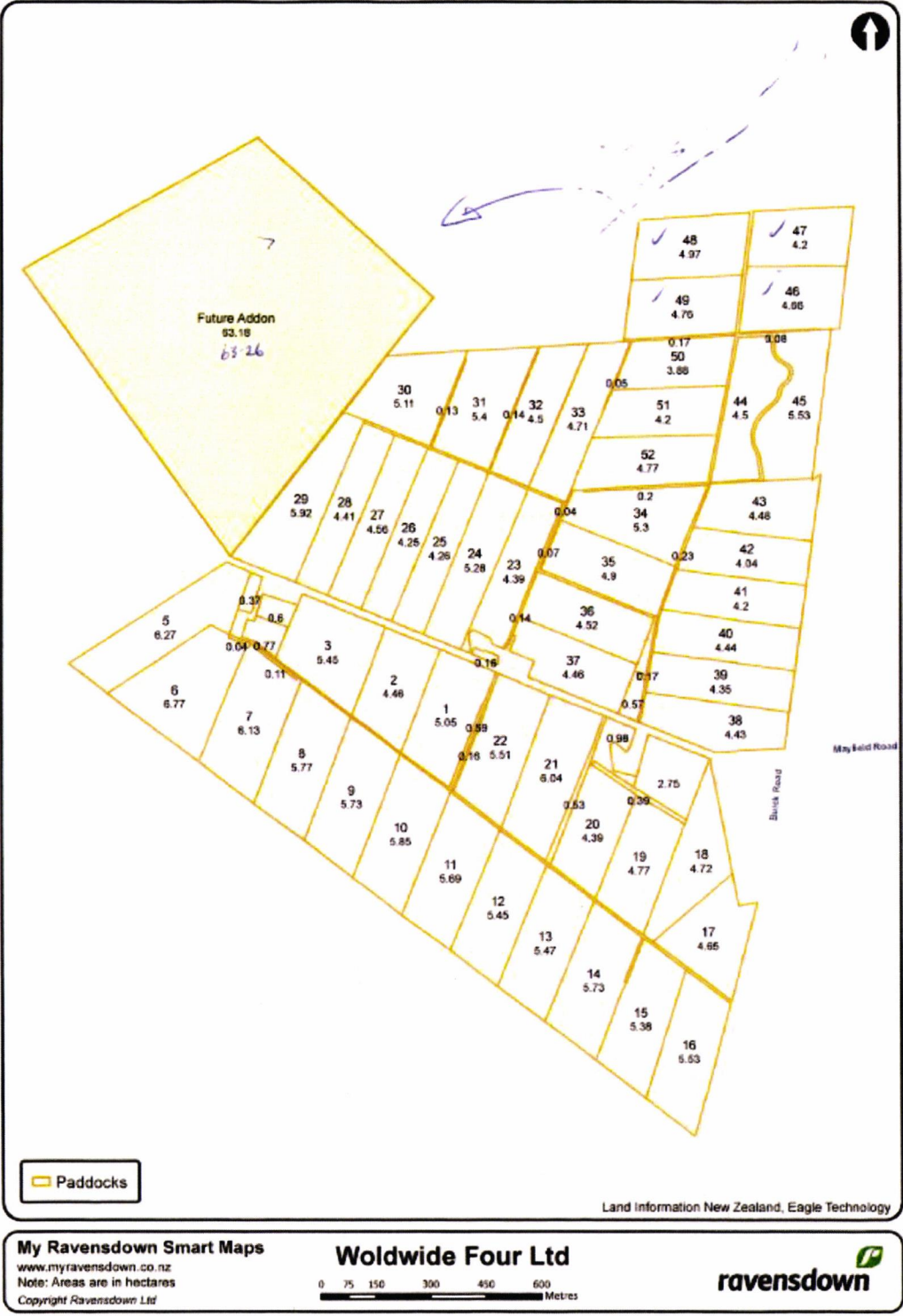
All other factors have remained the same.

Management Unit details and Soil Information: Table 1b

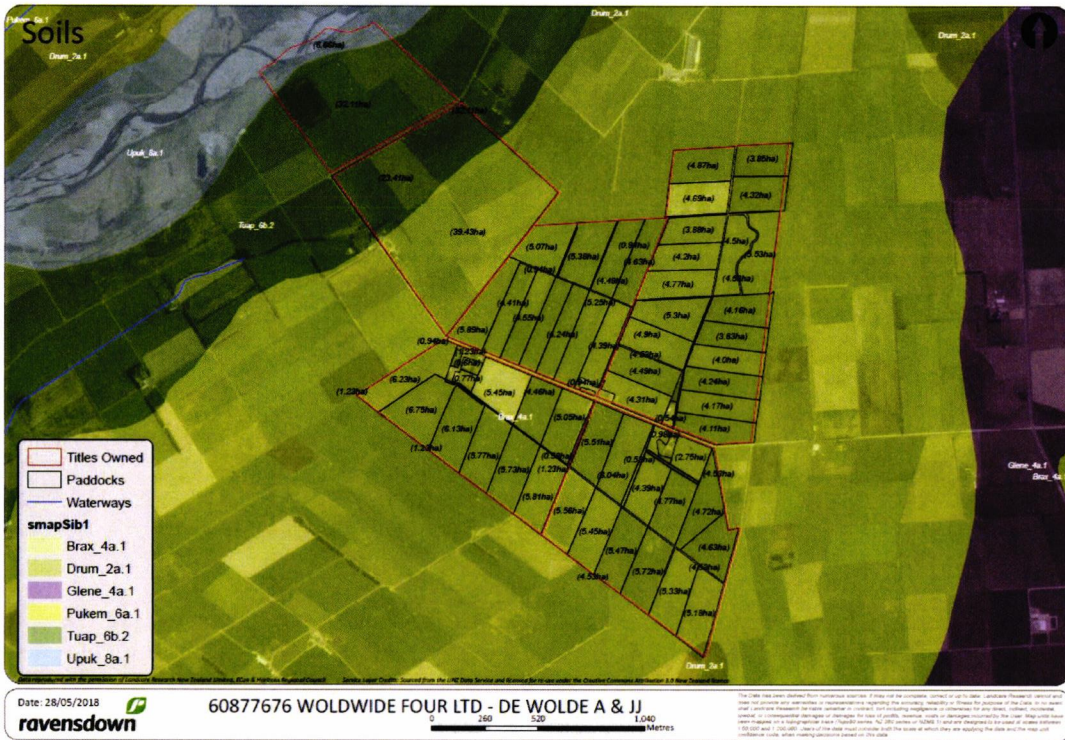
Block Name	Stock	Block Type	Soil Order	Drainage Class	Effluent	PAW (0-60cm)	Effective Area (ha)	Increased or Reduced Area Sheep
Brax_4a.1 Effluent	Dairy	Pastoral	Orthic Gley	Poorly drained	Liquid	148.7	25.6	
Brax_4a.1 Eff Tile	Dairy	Pastoral	Orthic Gley	Poorly drained	Liquid	148.7	36.1	
Brax_4a.1 Non 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/m³ N; 800 g/m³ P; 4,400 g/m³ K; 400 g/m³ S

Applying 15.2 m³/hectare applies slurry effluent at a depth of 1.5 mm. Discharging slurry effluent at 15.2 m³/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	15,194**	14,154**	16,220
- Support Block (Cut and carry)	12,255	12,255	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)	10,558	1,120	11,678	11,298	11,142
Dairy platform*	9,016			9,756	10,694
Support block	1,542			1,542	448
Nitrogen leaching loss to water (kg N/ha)	30	18	30	27	27
Dairy platform	33			29	32
Support block	20			20	6
Phosphorus runoff to water (Total kg P)	312	26	338	343	368
Dairy platform	270			300	353
Support block	42			43	15
Phosphorus runoff to water (kg P/ha)	0.9	0.4	0.9	0.8	0.9
Dairy platform	1.0			0.9	1.1
Support block	0.5			0.5	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**.

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.

DRAFT

Appendices

Current farm System Whole Farm Nutrient Budget

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

Mark Crawford

WoldWide 4 plus Gladfiled Run Off

Ravensdown

Client reference: 60877676

Dunedin

Farm name: Woldwide 4 Current (16/17)

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

Mark Crawford

New Sheep Farm

Ravensdown

Client reference:

Ravensbourne

Farm name: Purchased Sheep Farm Current - copy 1 (17/18)

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 ₂ O 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 ₂ O 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 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.

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 Farr

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 ₂ O 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				
<hr/>					
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 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.

Proposed System Pasture Production, Other Values and Effluent Report

Abe and Anita De Wolde
 WoldWide 4 plus Gladfield Run Off
 Client reference: 60877676
 Farm name: Woldwide 4 Proposed -consent#- copy (16/17)

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 Ravensdown
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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 Gladfield Run Off
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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 date	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

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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.