22nd April 2024

Agricultural Land Use Assessment

15 Kippenberger Avenue and 78 Northbrook Road, Rangiora ("Site")

Contents

Section 1: Purpose of Report

The purpose of this report is to review and consider the potential agricultural uses of the Site within the context of Waimakariri District Council Zoning (Rural Lifestyle, and Rural) and the National Policy Statement Highly Productive Land classifications.

This report assesses the technical and economic feasibility of a range of agricultural options and their suitability on the Site and viability in the long term for land based primary production purposes.

1.1 Author Expertise

I am a self-employed Registered (NZIPIM) Farm Management Consultant primarily working in Canterbury but with client base between Central Otago and Nelson, and including Central Plateau, with specialisation in pastoral and arable land use systems and development.

I hold the qualifications of Bachelor Agricultural Science, Lincoln University

I work with farmers, local and central government organisations, and industry interest groups.

I specialise in advising in farm and agribusiness management with particular expertise in grazing and stock management systems, arable farming, irrigation & farm development, financial management, and supervise and contract-manage development projects.

I am familiar and experienced with all the farming practises, soils, and climate of the Central and North Canterbury area in general including the Site in question.

I have worked for MAF Advisory Services Division based in Nelson and North Canterbury prior to forming my own consultancy practice, Dunham Consulting Ltd, in 2002

I regularly research and undertake feasibility and financial viability analysis for potential farming options. This has included land development strategy options for unimproved and irrigated land and intensification of land use through conversion to more intensive land use policies. This work has been over a full range of land types and farming systems.

I have acted as an expert witness in relation to various issues including land use planning, land development, farm machinery development disputes and animal welfare prosecutions.

My qualifications as an expert are set out above. The matters addressed in this report are within my area of expertise, however where I make statements on issues that are not in my area of expertise, I have stated where information has been sourced from. I have not omitted to consider material facts known to me that might alter or detract from the opinions included in this report.

1.2 Scope

In this report I address the following issues:

(a) The land use capability of the Site

(b) The range of pastoral, arable and horticultural options that could be physically operated on a long-term basis on the Site.

(c) Consideration of the climate, soils, and water environments of the Site

(d) The type and extent of support industries and resources, contractors, and expertise required for a sustainable and viable farming operation.

(e) The infrastructure on the Site or required on the Site to support a viable farming business.

(f) The Site's neighbouring land uses and the potential impact of viable land use activities onto the neighbours, including reverse sensitivities.

(g) The economic viability of operating a business on the site while being compatible with the Site's District Zoning and designation under the National Policy Statement

(h) Consideration of the effects of only a 3.3 ha area of land located in the eastern edge of the Site remaining for rural land use as a standalone block.

Section 2: Site

The land ("Site") is located in Rangiora between Kippenberger Avenue (north boundary), and Northbrook Road (south boundary), and east of Devlin Avenue on the northern half of the west boundary. The Cam River/Ruataniwha forms the boundary for approximately 135m just above halfway down the eastern boundary. See Image 1A.

Note that the current farmer uses a small triangle of land (approximately 850m²) in conjunction with the Site, in the southwestern corner which is a parcel designated as a Road Reserve. This triangle is not included in this report. See Image 1B.

2.1 Legal Description

Lot 2 DP 394868 and Lot 2 DP 452196	23.0090 ha
Lot 2 DP 12090	8.1999 ha

2.2 Gross Area

31.2089 hectares more or less

Image 1A

Image 1B

2.3 Site Description

2.3a Topography

The Site land is a flat plain tilting from north to south, but approximately level east to west. Kippenberger Avenue lies at approximately 24.0 m.a.s.l and the most southern point adjacent to Northbrook Road is at approximately 16.5 m.a.s.l. About halfway down the Site at a point adjacent to the south end of Devlin Avenue, the height is approximately 21.0 m.a.s.l.

The fall between Kippenberger Avenue and Northbrook Road is approximately 7.50m and the rate of fall is consistent down the Site at approximately 8.1 mm per land metre. The slope of the Site is important as it has implications for soil drainage and how the soils on Site were formed and the subsequent characteristics influencing land use options. See Image 2A & 2B.

Image 2A

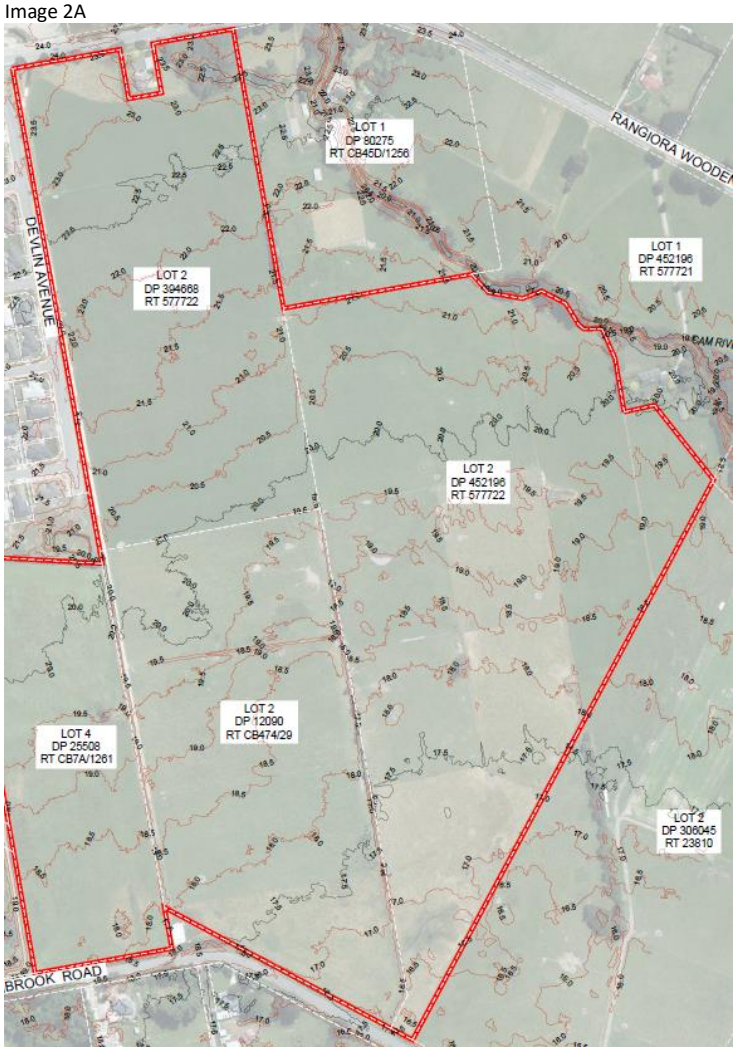


Image 2B

2.3b Drainage

There are approximately 6,150 metres of deep (>1.0m) open drains on the Site draining north to south exiting into the Northbrook Road main drain which flows west to east. See Image 3, 4A, 4B, 4C.

Clay tile subsoil drains are located extensively across the lower third of the Site which feed directly into the open drains, and approximately 3,500m of slotted coil plastic pipe has been installed in the approximately ten hectares at the southern end of the Site. Most clay tiles still work but some have been damaged by machinery and livestock.

Many of the numerous natural springs on the southern third have been connected to the nearest open drain with either clay tiles (older) or plastic slotted coil pipe (newer). New springs still appear on occasion.

There is another open drain (>1.5m deep) that runs for approximately 360m on the southern end of the western boundary, also with an outfall into the Northbrook Road main drain.

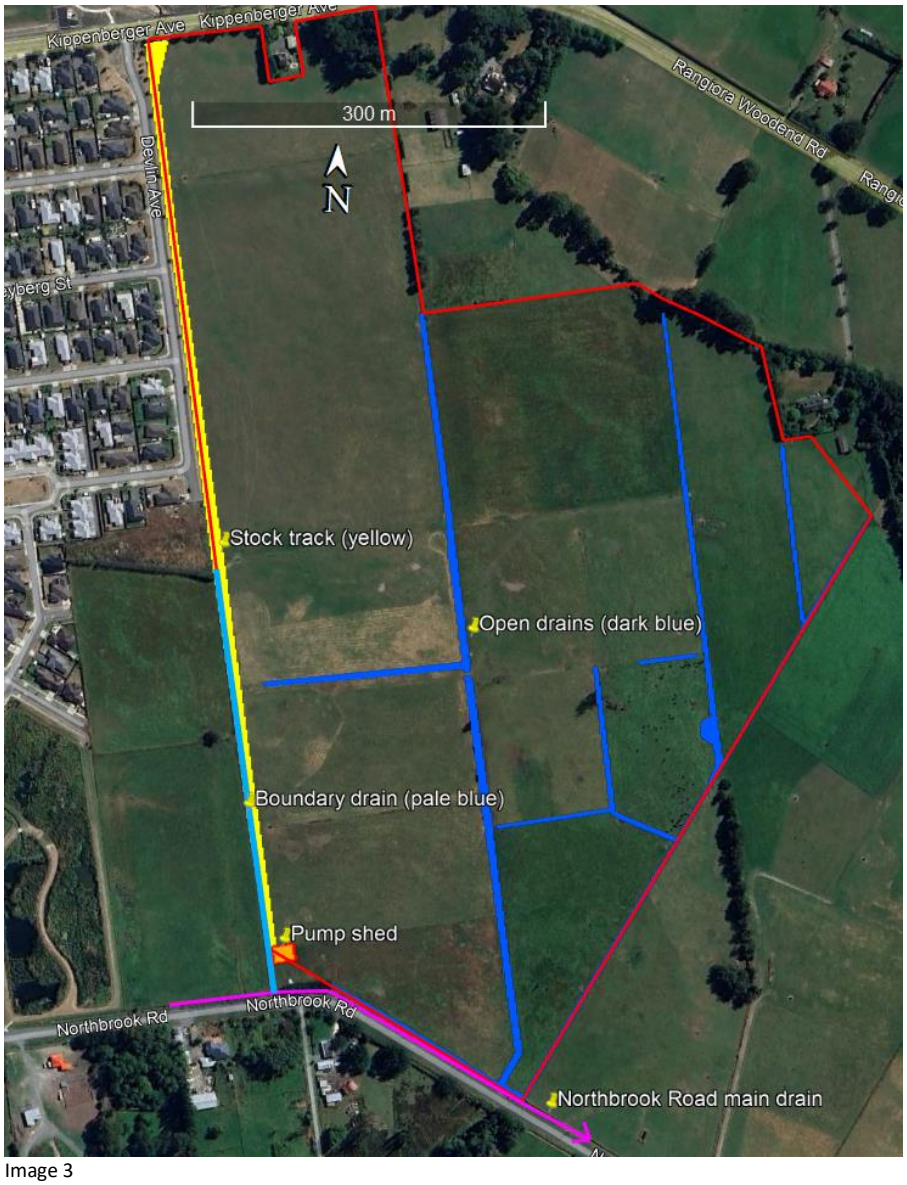


Image 3

Image 4A Open drain looking NNE

Image 4B Clay tiles damage at south end of site.

Image 4C Spring location not yet 'tied' to open drain next to fence. Temporarily summer dry on surface, but wet underneath.

2.3c Access onto the Site

There is a main all-weather livestock & farm vehicle access track running the length of the western boundary for approximately 1,560m, from Kippenberger Avenue (north end) to Northbrook Road (south end). See Image 5

Note that currently the south end of this track crosses approximately 38m of land in the neighbouring road reserve (see Images 1A, 1B & 3). It is assumed that at some point the road reserve will be utilised for roading purposes, but that will not alter the functionality of the southern access point from a land use point of view.

Image 5

Adjacent to the Kippenberger Road access point there is a livestock underpass under Kippenberger Avenue. This is no longer used as the land north of Kippenberger Avenue is being developed for residential housing.

There is a farm gate off Devlin Avenue onto the Site, but this is not actively used as the Kippenberger Avenue and Northbrook Road access is better and preferred.

2.3d Sheds and Yards

There are no buildings on the Site except for the pump shed in the southwestern corner. Electricity to the pump shed comes from Northbrook Road. See Image 3.

There are no stockyards on the Site.

2.3e Subdivision, Fencing and Stock Water

There are fourteen paddocks (average 2.0 hectares) with fencing a mixture of permanent post and wire fences on the boundaries, two wire electric where more recent subdivision fencing was installed in the northern third of the Site, and much older hardwood post, barbed wire, No8 wire and electric outrigger fences, the latter being in poorer condition but still stock proof.

Stock water is reticulated from the pump shed via underground alkathene pipe to large round concrete troughs in each paddock. The water supply and distribution are good.

2.3f Current Land Use

Historically the long-term land use of many decades has been dryland dairy farming, and since the early 1970's, irrigated dairy farming.

Since the current owner purchased the land in 1990, the use has been a mixture of dairy milking platform (approximately 10 years), dairy replacement heifer grazing (approximately 10 years), and dry cattle grazing (four years since 2020). The land was used as part of a larger dairy farm, including land to the west of the

Site and land north of the Site (accessed by the underpass from 2016). The Site has been gun irrigated starting mid-November, but typically December to March inclusive on an 18-day round.

Land sales combined with end-of-lease grazing forced a change in policy to dry stock cattle grazing only from 2020.

Baleage (320-400 bales) is made from surplus pasture in mid-November and used to supplement during dry summer periods as required (January to February but can be January to March in drier years).

Summer-autumn dry spells typically start January after the high clay content soils dry out. Drought can be severe, and may last through into April, but late March is more usual.

Grazing in dry winter years is limited to approximately one year in five and requires lower wintering numbers (-20% head) and lighter cattle (rising 1-year olds) supplemented with baleage, but never-the-less grazing is damaging to pastures (pugging) which opens up pastures to weed ingress (e.g. twitch, Californian Thistle).

The preferred grazing policy is to graze rising two-year cattle from approximately start of September through to end of May but can be from the end of September/early October in very wet winter/early spring years. The Site is destocked over winter usually starting early June but can be mid-May if have higher than average autumn rains, through to August/September, so that pastures are not pugged.

Pasture renewal has mostly been by way of spring sown rape crop (grazed January & February), followed by whole crop silage (harvested end-December) and then followed by new pasture, or just straight to new pasture.

The Site is too wet to grow winter green feed crop as heavy pugging is inefficient (high wastage) and damaging to soils and pasture.
The low-lying areas to the south of the Site covering about 6.0-plus hectares (see Image 6A, 6B, 6C) is too wet to cultivate or get tractors over even at the driest times of the year and are in old cocksfoot, brown top and ryegrass pastures.


Image 6A


Image 6B


Image 6C

6A: (21.3.24) Approximate coverage of 'swampy' areas
6B: (21.3.24) Surface water from untapped spring – southeast corner of site in very dry summer
6C: (21.3.24) Surface water from untapped spring – south end of site in very dry summer

2.3g Irrigation

Historically the Site had been irrigated (CRC136638) from well M35/0403 (see Image 5A), but the consent to take irrigation water lapsed and was terminated 11th December 2023. The Site is now a dryland Site.

The well continues to supply stock water to the Site.

2.3h Other bores/wells

Three other bores/wells are recorded on the Site. See Images 5A, 5B, 5C.

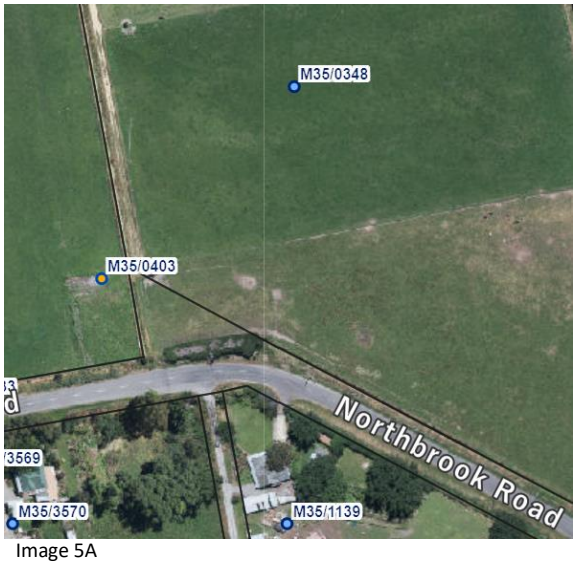


Image 5A

Image 5B

Image 5C

Bore M35/0348 has been disestablished and is not used.

Bore M35/8382 is more correctly located on nearest boundary adjacent to the neighbour's house (JL Leech) and has nothing to do with the Site.

Bore BW24/0247 was used during construction of the underpass and has been disestablished and is not used.

2.3i Electricity

Mains electricity is supplied to the pump shed with a meter at the pump shed. Fencing electricity comes from an energizer at the pump shed.

2.3j Net Effective Area

The net effective farming area after allowance for the stock track (yellow), drains (blue), and areas where water lies on soil surface all year round, is calculated at approximately 28.5 ha. See Images 6 & 7.

Effective Hectares

Gross Hectares	31.20	
less drains	-0.90	
less tracks	-0.50	
less wet surface areas	-1.34	
Total Effective Hectares	28.5	
Very wet, gley & peat soils	4.4	15%
Gley soils	12.4	44%
Mottled soils	11.7	41%

Image 6

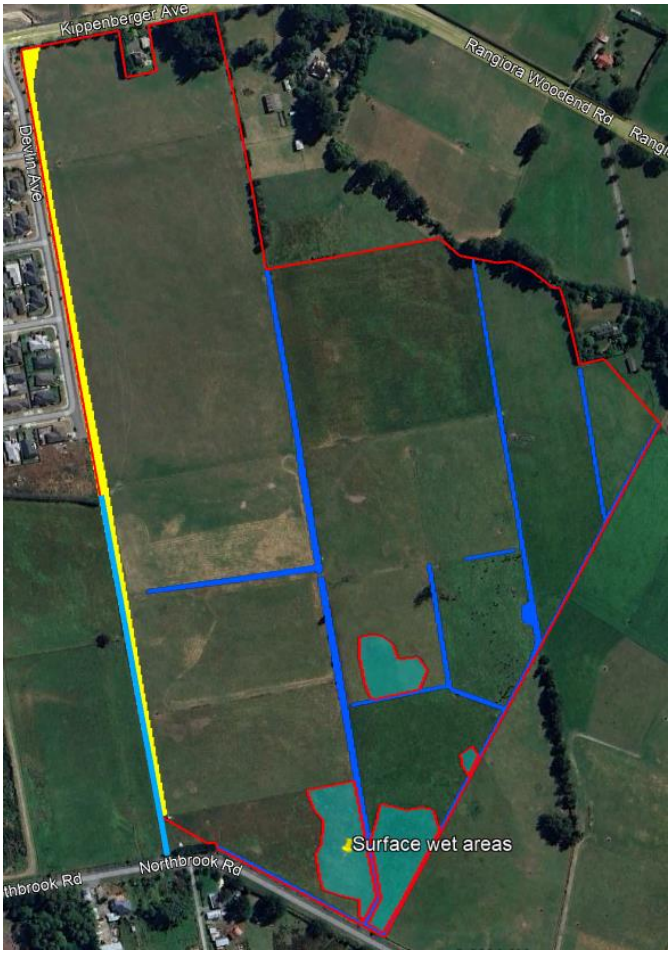


Image 7

Section 3: Site Zones and Classifications

3.1 District Zoning

Waimakariri District Council [WDC]

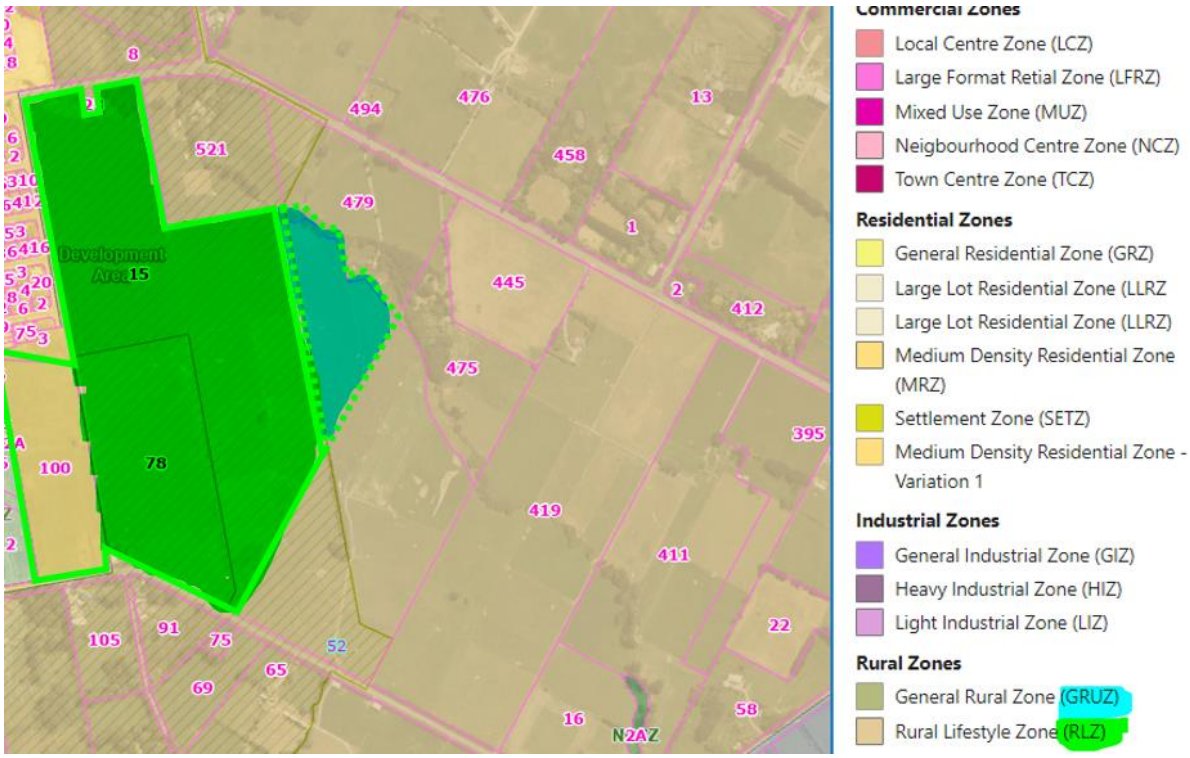


Image 8

The Site comprises of approximately 27.9 ha of Rural Lifestyle Zone (see green highlighted area in Image 8), and approximately 3.3 ha of General Rural Zone (see blue highlighted area in Image 8).

The site lies east of residential housing.

For the purposes of this report the green and blue areas will be considered as one whole area (31.2ha). Later in this report, the blue area will be discussed as a standalone parcel (the "Additional Land").

3.2 National Zoning

The site includes land with National Environmental Standard (NES) classification:

Highly Productive Land: **Class 2 and 3** National Policy Statement of 17th October 2022 (NPS-HPL)

The purpose of the NPS-HPL is to manage the subdivision, use and development of this non-renewable resource (soil), *providing a framework for Councils to enhance protection for highly productive land from inappropriate subdivision, use, and development and ensure it is available for growing vegetables, fruit, and other land-based primary production, now and into the future.*

This includes all land that is zoned General Rural or Rural Production and classed as Land Use Capability (LUC) 1, 2 or 3 which is considered as highly productive land for the purpose of the NPS-HPL.

3.3 Land Use Capability of the Site (LUC)

The Land Use Capability of the Site is summarized in Image 9 & 10, compiled from individual LUC polygons in Appendix B [Images 11 and 12]. [Images 9 to 12 Ref: LRIS Portal: NZLRI Land Use Capability 2021]

Gross Hectares	LUC group	LUC Description
12.58	2	2*s* 2
18.62	3	3*w* 1
31.20		

Image 9

Image 10

All of the Site land meets the NPS-HPL definitions.

3.3a Details of northern LUC

See Image 10 **for LUC 2 details. For** the purposes of the NPS-HPL the specific LUC full rating is **'2*s* 2'**.

Interpretation of land Use Class Descriptions

Land Class	**2**	[versatility class]
Land Class Unit	**2*s***	[restrictions to versatility]
Land Class Units	**2*s* 2**	[degree of versatility restriction compared to other 2s polygons]

The **Land Class** of the Site is '2' meaning:
'Land with slight limitations for arable use and suitable for cultivated crops, pasture, or forestry'

The **Land Class Unit** is '2*s*' meaning:
*'s' soil – where soil physical or chemical properties in the rooting zone such as shallowness, stoniness, low moisture holding capacity, low fertility (which is difficult to correct), salinity, or toxicity first **limits** production.*

The **Land Class Units** is '2*s* 1' meaning:
The third numeral associates and orders polygons below the level of LUC subclass and can be disregarded as it simply allows location of land polygons with similar restriction characteristics and ranks them according to increasing degree of limitation to use.

3.3b Details of southern LUC

See Image 10 for LUC 3. For the purposes of the NPS-HPL the full LUC rating is **'3*w* 1'**.

Interpretation of land Use Class Descriptions

Land Class	**3**	[versatility class]
Land Class Unit	**3*w***	[restrictions to versatility]
Land Class Units	**3*w* 1**	[degree of versatility restriction compared to other 3w polygons]

The **Land Class** of the Site is '3' meaning:
'Land with moderate limitations for arable use and suitable for cultivated crops, pasture, or forestry'

The **Land Class Unit** is '3*w*' meaning:
*'w' wetness – where soil wetness resulting from poor drainage or a high-water table, or from frequent overflow from streams or coastal waters **first** limits production*

The **Land Class Units** is '3s 1' meaning:
The third numeral associates and orders polygons below the level of LUC subclass and can be disregarded as it simply allows location of land polygons with similar restriction characteristics and ranks them according to increasing degree of limitation to use.

Refer to Appendix A for Land Use Capability Definitions.

Section 4: Soil limitations

4.0a Soil limitations on Class 2 land

The Class 2 land (12.6 ha Gross) is defined as having slight limitations to use, resulting from soil limitations that derive from a marked soil moisture deficit for typically approximately 8-weeks (early/mid-January to mid-March) but can be 12-14-weeks (early January to mid-April) approximately one year in five, which significantly impacts on pasture productivity and pasture feed quality especially during January to late March.

4.0b Rainfall

Rainfall is estimated at 655mm/yr. with annual evapotranspiration (PET) at 917mm [reference: Overseer version: 6.5.4], indicating a significant summer soil moisture deficit of approximately 262mm, about 40% of the annual rainfall.

Without irrigation or rainfalls (sufficient quantity & spread timeliness), the Class 2 and Class 3 land is expected to take between 12 days and 18 days to go from fully moist soil to wilting point depending on the particular soil type. See Image 13.

Site Soils Moisture Deficit Physical Characteristics

Approx hectares		ratio	Texture	Depth	PAW (100cm)	Approx. Soil Moisture Deficit mm	Approx. Days to Wilting Point
31.20	Temu_49a.1	39%	silt over clay	deep	176	-262	16
	Kaia_1a.1	24%	silt	deep	198	-262	18
	Pah_16a.1	18%	silt	deep	128	-262	12
	Flax_2a.1	15%	silt	deep/mod.deep	190	-262	17
		95%			167		

Image 13

Pasture growth starts in about early to mid-September depending on how wet the soils are which influences soil temperatures. Spring growth is generally strong, and with high Profile Available Water, growth continues without limitation until early/mid-summer; then evapotranspiration rates start to exceed available soil moisture, and plants are under moisture stress for typically much of January to March

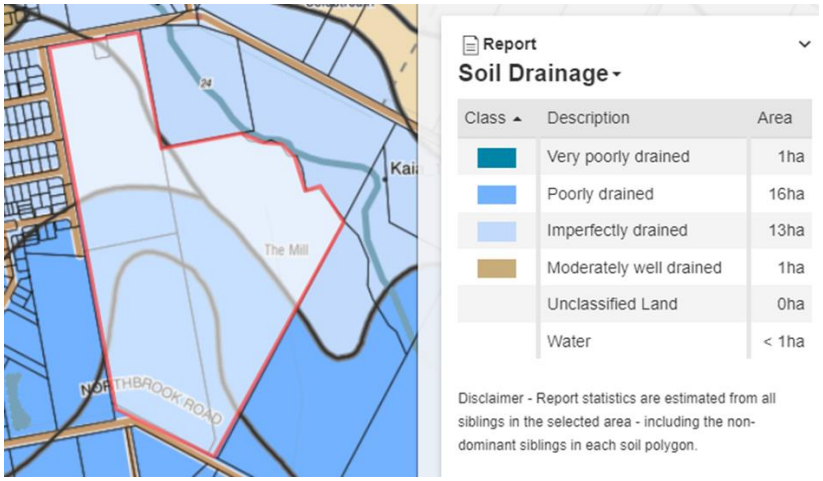
and in some years into early April, depending on rainfall frequency, timing, and volume. Autumn growth then depends on rate of cooling soil temperatures.

4.0c Wetness limitations on Class 3 land

The Class 3 land has moderate limitations to use, dictated by wetness limitations that derive from a high water-table and slow subsoil drainage on approximately 18.6 hectares.

The Class 3 land on the Site is '*poorly*' drained (see Image 14) as a result of high water-tables for most of the year, with soils being water-logged for typically majority of the year apart from January – March, and in some years are wet all year round.

In addition, the soil horizons have different rates of moisture permeability. On the Class 3 land, they are 'moderate over slow' where a moderately permeable topsoil layer overlies a much more slowly permeable B-horizon soil layer. See Image 15.



Ref: S-Maps - Image 14

This means that high rainfalls or a close sequence of rainfall events, or very low-lying land with little outfall height results in extended periods of high water-table saturating the soil, on this site typically winter to early summer and in some years into late summer. The soil water in the upper layer perches above the slower draining 'poor' drainage permeability layer until it is able to drain away, which doesn't occur until the surrounding land starts to dry out and water-tables fall, typically about mid-spring.

This causes roots to be waterlogged and lack of aeration in the root zone, resulting in poorly oxygenated roots and reduced pasture productivity while the soils are wet. Pastures are generally weakened, with poor botanical mix and low usable herbage productivity.

LUC Class 3 - Soil Permeability					
Soil Depth	Permeability	Rate	Soil	Aeration in Root Zone	% of Class 3
0-30/80 cm	moderate	< 4 mm/hr	Temuka & Flaxton	Very limited	100%
>30/80 cm	slow	4 - 72 mm/hr			

Image 15 Ref: S-Maps Landcare Research

The Class 2 land also has wetness limitations that are similar to the Class 3 land with 57% of the area being 'moderate over slow permeability', and 43% of 'moderate' permeability - see Image 16, but the wetness limitations are a secondary limitation compared to the primary limitation of soil moisture deficit.

The impact is less on the Class 2 land because the land sits higher than the Class 3 land and the water table is more seasonally variable with high water table being present for a much shorter time (primarily winter and very early spring).

LUC Class 2 - Soil Permeability					
Soil Depth	Permeability	Rate	Soil	Aeration in Root Zone	% of Class 2
0-40/80 cm	moderate	< 4 mm/hr	Pahau	Limited	57%
>40/80 cm	slow	4 - 72 mm/hr			
0 - >1.0 m	moderate	4 - 72 mm/hr	Kaiapoi	Moderately limited	43%

Image 16 Ref: S-Maps Landcare Research

Section 5: Soils on the Site

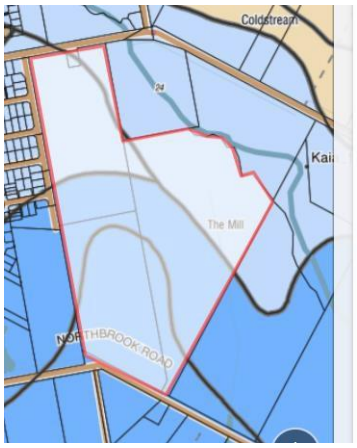
5.0a Soil types

There are four types of soil identified on the Site including three different types (siblings) of Kaiapoi silt loams, two different types of Pahau silts, and two different types of Flaxton silts.

- Temuka silt over clay
- Kaiapoi silt loams
- Pahau silt loams
- Flaxton silt loams

Combined these represent 95% of the Site land area.

Small quantities of other soil types combine to make up the remaining 5% of the area (see Image 17 & 18), including a very small area (< 0.8ha) of peat over clay soil. [reference: Landcare Research S-Maps].



Soil Siblings

Sibling	Area	Proportion
Temu_49a.1	12 ha	38.6%
Kaia_1a.1	5 ha	17.0%
Paha_16a.1	4 ha	13.7%
Flax_2a.1	2 ha	8.1%
Flax_1a.1	2 ha	6.8%
Kaia_2a.1	1 ha	4.8%
Paha_2a.1	1 ha	3.9%
Payn_6a.1	1 ha	2.7%
Kaia_4a.1	1 ha	2.4%
Darn_1a.1	1 ha	2.0%

All of the siblings in the area selected are listed above - including the non-dominant siblings in each soil polygon.

Image 17 All soils on site

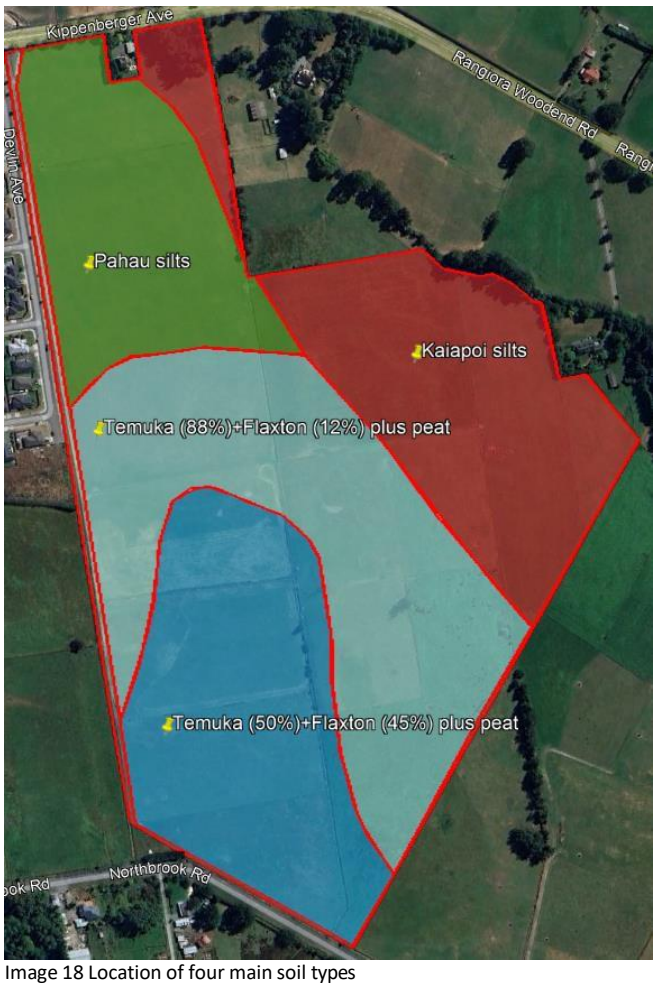


Image 18 Location of four main soil types

The Site is located within an essentially flat shallow basin of floodplains and all the soils are formed from repeated layering of silt from the Ashley River and associated waterways such as the Cam River/Ruataniwha over geological time.

All the soils have relatively high clay contents that reduce the rate of soil drainage in the lower soil horizons, resulting in imperfect drainage forming.

The Temuka & Flaxton soils (54% of Site) to the south of the Site are the lowest lying and geologically were part of a basin characterised by high water tables and very long periods of the year being fully saturated. The poor drainage has led to formation of gley soils. The gley soils define the Class 3 area.

The Pahau & Kaiapoi soils (46% of Site) to the north are higher lying and able to drain more freely resulting in shorter periods with high water tables. The 'imperfect' drainage (as opposed to 'poorly') and more seasonal wetter-drier cycles have resulted in these soils being mottled and are the Class 2 lands. The mottled soils define the Class 2 area.

All the soils have high structural vulnerability (easily physically damaged), and all have high water logging vulnerability apart from Kaiapoi soils (24% site) with moderate water logging vulnerability.

Combined, these soils typically experience significant summer moisture deficit (-262mm) as described in section 4.0b, impacting on pasture and crop production unless irrigated.

For the purposes of this report the Soils Summary (Image 20) is used to define main soil types (which includes significant areas of soil siblings) and used in discussing land use options.

Site Soils Summary		
	Hectares	%
Temuka_49a.1	12.0	38%
Kaiapoi_1a.1	7.5	24%
Pahau_16a.1	5.5	18%
Flaxton_2a.1	4.7	15%
	31.2	95.0%

Image 20

5.0b Soils Discussion

42% of the site consists of mottled Kaiapoi and Pahau soils (spots or blotches of colour often rusty red in colour, showing the presence of iron oxides) indicating that there are periods of restricted profile drainage, usually early winter to mid-spring. See Image 21 & 22 for soil comparison.

53% of the site consist of gley Temuka and Flaxton soils which are more extreme in the degree of mottling or more usually have the iron and manganese oxides segregated out into layers in the subsoil and restrict rooting depth at the point of the chemical segregation.

The key point is that both groups of soils are formed from high groundwater tables, are imperfectly to poorly drained, and consequently trafficability (livestock and machinery) is very limited when soils are wet, typically winter to mid spring (or to early summer for the gley soils), hence the high structural vulnerability rating (e.g. from livestock pugging - see Image 22). Likewise, pasture productivity is significantly reduced when roots lie in very wet soil particularly during early to mid- spring.

All the soils apart from the Kaiapoi soils have moderate permeability of water lying over slow permeability layers of varying depths, which in practise can result in roots in the topsoil layer being slightly dry to dry, while roots below approximately 20cm are impacted by being too wet. This will also negatively impact on pasture yield and seasonality.
Waterlogged conditions also result in soil organism activity being restricted because of anaerobic conditions, negatively impacting on pasture health and growth.

Profile available water (PAW) is rated as high on the site at 167 mm of water. In practise this means that the soils dry out and pastures come under moisture stress later (e.g. January) than in free draining, lower PAW soils (e.g. late November) but will still experience significant periods of moisture stress mid-January to March (-262mm soil moisture deficit on average).

In summary, all soils on the Site are limited in plant and crop production (and therefore in livestock stocking rates, and range of crop options and performance) while waterlogged and while under soil moisture stress. See Image 21

		Waterlogged			Moisture Deficit				
Soil		Time	Typical window	can be	Time	Typical window	can be	Plant & Animal Productivity	
Temuka	Gley	long	Jun-Nov	May-Dec	short	late-Jan - Mar	Jan - Apr	↓	lower
Flaxton	Gley	long	Jun-Nov	May-Dec	short	late-Jan - Mar	Jan - Apr		...
Pahau	Mottled	long-mod	Jun-Aug	Jun-Sept	long	Jan - Mar	mid-Dec - Apr		...
Kaiapoi	Mottled	moderate	Jun-Aug	Jun-Aug	long	Jan - Mar	mid-Dec - Apr		higher

Image 21

Bellgrove South - whole Site

Site Soils Physical Characteristics

Approx hectares		ratio	Texture	Depth	PAW (100cm)	Structural Vulnerability	Soil Group
31.20	Temu_49a.1	38.6%	silt over clay	deep	176	high	gley
	Kaia_1a.1	24.2%	silt	deep	198	high	mottled
	Pah_16a.1	17.6%	silt	deep	128	high	mottled
	Flax_2a.1	14.9%	silt	deep/mod.deep	190	high	gley
		95%			167		

		ratio	Drainage Class	Water Logging Vulnerability	Permeability Profile
31.20	Temu_49a.1	39%	poorly	high	moderate over slow
	Kaia_1a.1	24%	imperfectly	moderate	moderate
	Pah_16a.1	18%	imperfectly	high	moderate over slow
	Flax_2a.1	15%	poorly	high	moderate over slow

		ratio	
31.20	Temu_49a.1	39%	Deep, poorly drained, gley, weakly developed silt over clay loams
	Kaia_1a.1	24%	Deep & mod. deep, imperfectly drained, mottled, weakly developed silt loams
	Pah_16a.1	18%	Deep, imperfectly drained, mottled, weakly developed silt loams
	Flax_2a.1	15%	Deep, poorly drained, gley, weakly developed silt loams

		ratio	Diggability Depth	Topsoil Clay%	Topsoil
31.20	Temu_49a.1	39%	Deep >1.0m	20 - 35%	stoneless
	Kaia_1a.1	24%	Deep (>1.0m) + mod. Deep (45-90cm)	12 - 25%	stoneless
	Pah_16a.1	18%	Deep >1.0m	18 - 35%	stoneless
	Flax_2a.1	15%	Deep (>1.0m) + mod. Deep (45-90cm)	12 - 30%	stoneless

Image 22

5.0c Practical considerations for land-use

On winter wet soils, green feed crops are more difficult to consume efficiently with higher wastage and high potential topsoil structural damage from pugging (and machinery if required for feeding out supplement). Soil damage from compaction requires significantly longer pasture rotation intervals (more years in pasture between green feed crops) to restore soil structure, or alternative winter feed strategies are required such as silage instead of green feed crop (typically a more expensive option) to minimise pugging damage.

Therefore, animal feed crops grazed in situ, are constrained by winter soil wetness limitations, which limits the range of livestock policies available. Best practise is to not grow winter green feed crops.

Consequently, the range of arable crops for grain & seed production are significantly limited or infeasible due to the late planting dates and fewer growing-degree days to bring crop to maturity, resulting in lower subsequent yields when not irrigated. Similarly, horticulture ground crop options are very limited by late sowing dates and summer moisture deficits. Wet winter soils rule out tree crops and viticulture as well.

In summary, primary production policies on the Site are limited to livestock policies with horticulture options being ruled infeasible by winter wet soils, late spring growth, and dry summer to late- autumn soil moisture deficits. Arable crop options are limited to late spring sown feed cereal (barley).

Section 6: Productivity

Average land productivity (as assessed by LandCare Research for Class 2*s* 2 and 3*w* 1 land on the Site – see Image 23) is 12.0 stock units per hectare, with top farmers 15.6 su/ha and potential productivity (without scale, technological or economic limitations) at 17.0 su/ha. Note that these definitions of stock units and stocking rates were made in the 1970's and 1980's and are made assuming no climate limitations; they are

different to current-era definitions of stock units and stocking rates but are valid for comparative purposes.

		Class 2	Class 3	Site
Effective Hectares		12.4	16.1	28.50
LUC		2*s* 2	3*w* 1	2*s* 2 + 3*w* 1
Stocking Rate*	Average	12	12	12.0
	Top Farmers	15	16	15.6
	Potential	17	17	17.0

Table Ref: LRIS Portal: NZLRI Land Use Capability 2021

* LRIS definitions of stock units are used for purposes of land polygon comparison

Image 23

Current district farming practise in this location and on similar soil types are benchmarked against Beef & Lamb Farm Class 8 Survey data and adjusted with local knowledge of livestock farming practices. See Image 24.

		Current District Stocking Rates**		Site Average**
		Class 2	Class 3	Site
Effective Hectares		12.4	16.1	28.50
LUC		2s 2	3w 1	2s 2 + 3w 1
Stocking Rate	Average	10.5	10.6	10.5
	Top Farmers	13.5	13.5	13.5
Total Stock Units	Average	130	170	300
	Top Farmers	167	217	385

** Dryland farming

** Beef & Lamb NZ: Farm Class Survey; local knowledge of farming systems

Image 24

6.0a Discussion

In practise there is effectively no difference in productivity (measured as stocking rates) between the Class 2 and Class 3 land.

Livestock farmers in the district on comparable soils and climate are stocking slightly higher than the Beef & Lamb benchmarks, but for practical purposes it makes little difference to the total livestock able to be run, with 300 su compared to 385 su for average farmers and top farmers respectively.

It is therefore assessed that the potential loss of the Class 2 and Class 3 Highly Productive Land is 300 stock units (28.5 ha at 10.5 su/ha).

For the purposes of this report in order to pressure test the potential economic land use options, the stocking rates of top farmers have been used, that is 385 stock units in total.

Section 7: Considerations for use of HPL land on the site

7.0 Site access, neighbours, and infrastructure

7.0a Contractor access to site

Historically access to the Site has been from Kippenberger Avenue to the north as this linked the Site with the farmers other land parcels, however practical access can also be achieved from Northbrook Road to

the south of the Site.

The majority of contractors or suppliers such as for cultivation & drilling, chemical spraying, harvesting, stock trucks, fertiliser applications, etc. in support of primary production land-use activities are located in all directions around the Site but primarily to the west and south in the Eyreton, Swannanoa, Cust, Oxford, Rangiora hinterland arc.

Access to the site is not easy given the proximity to Rangiora township. Irrespective of direction of access all contractors and suppliers will either have to reach the site by traversing urban residential and or CBD Rangiora from the west along Kippenberger Avenue or west along Northbrook Road, or west along Boys Road. See green lines in Image 25 below.

Alternatively, contractors can either divert north around Rangiora via River Road, or south of urban Rangiora traffic by crossing Lineside Road south of Southbrook and then onto either SH1 or use small secondary roads such as through Tuahiwi to reach Northbrook Road from the east, or Kippenberger Avenue from Rangiora-Woodend Road. See red lines in Image 25 below.

None of the routes are straight forward but it is considered likely that the red marked routes especially south and east of the site would be used by choice by contractors, and Northbrook Road preferred over the busy Kippenberger Avenue access point.

All contractors will have to manage journeys with consideration of peak road traffic times, particularly commuting hours to and from Christchurch, and opening and closing hours of local schools and other educational facilities, as well as manage mud and dirt transfer from vehicles particularly tractors.

Some site access is required to be time-specific such as chemical spraying which must be done in very low wind conditions, and coordinating traffic flows and local wind conditions can be difficult to manage.

Harvesting activities of grains or supplement feeds are often dictated by requirement for low wind conditions and warm drying weather. Crop-specific conditions can be any time during the day or evening and traffic will need to be taken into consideration.

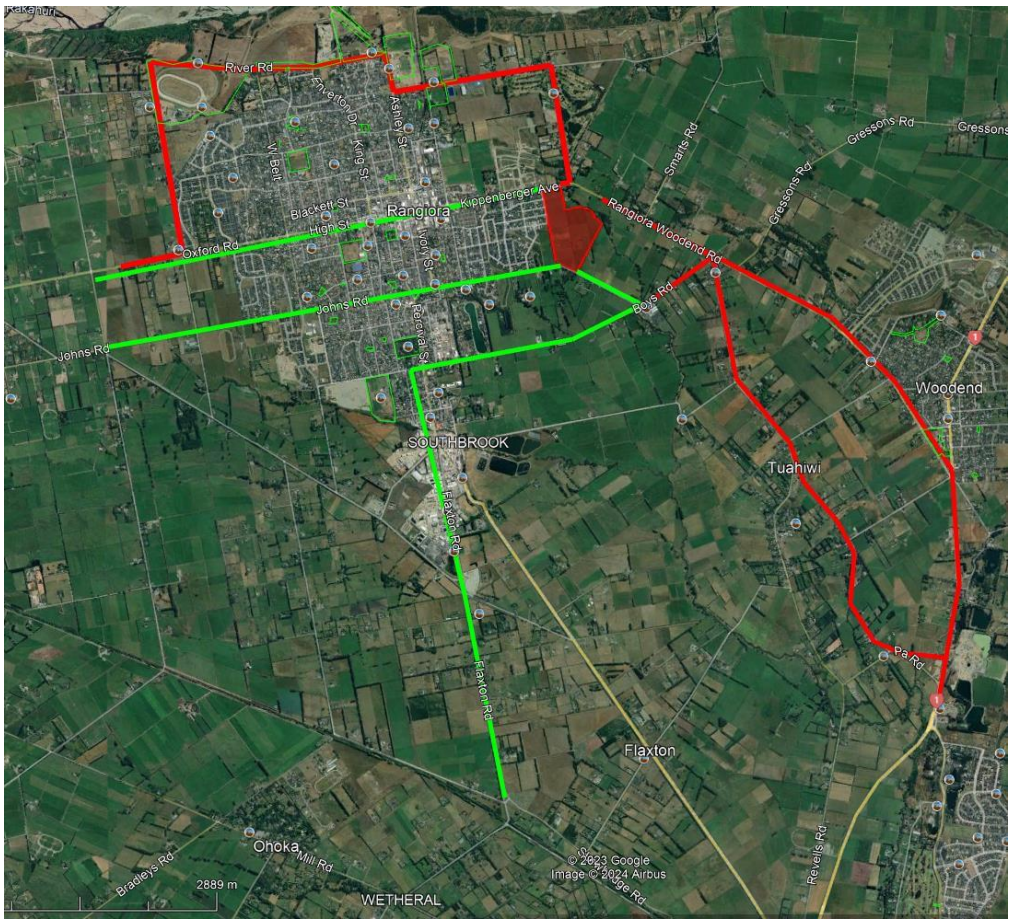


Image 25

Overall, it is expected that these high traffic peaks will have a significant impact on farm contractors and suppliers as well as well as on other road users.

Truck delivery or removals (e.g., livestock) are less likely to be time bound or difficult to manage on urban roads.

The paddock effective areas are small (average 2.0 ha), and it is most likely that the maximum area of any one activity would be no more than 6.0 ha, based on likely crop rotations. Experience supervising farming activities adjacent to urban areas would indicate that most contractors would be unwilling to put up with the difficulties of managing traffic and potential mud and noise pollution issues for such a small job. It would be uneconomic for them at normal contract rates and even if they were willing to do the work, they would not prioritise work on the Site over and above closer and larger long-standing clients (to them).

In summary this means that the pool of available contractors is relatively small and less likely to respond when needed for time-sensitive or condition-sensitive activities.

7.0b Neighbours

Direct neighbours are (see Image 26):

- East & south – Rural pastoral farmland (yellow)
- North & west – Residential houses, rural lifestyle (red)

Image 26

Potential impacts on neighbours from primary production activities that may be carried out on the Site include agricultural chemical spraying, dust from land cultivation and fertiliser spreading, and noise pollution from machinery and vehicle use.

These activities are not expected to have negative impacts on Site neighbours to the east or south because of either similar land use activities within the Rural Zone, or distance.

Existing residential housing (red in Image 26) lies directly adjacent to the west and after completion of residential subdivision, to the north of the site. The closest housing to the closest land use on the site is approximately 40m straight-line. It is expected that the residences adjacent to and further back from the Site will be potentially impacted by rural activities on the Site.

Reverse sensitivities also apply. Any prudent land user of the Site considering grazing livestock particularly sheep, but also young cattle, will take into account the probability of neighbourhood dog harassment of livestock and impact from injury and deaths through to reduced productivity. Further, cats are vectors for spreading sheep disease (e.g., toxoplasmosis), affecting lambing percentages.

Vandalism and theft are also more frequent in locations close to residential areas. Livestock and machinery security will need to be at higher levels than more rural located farms with similar farm policies.

7.0c Current Consents

There are no other consents on the site.

Section 8: Primary Production Land Use Options

In order to analyse possible primary production land uses on the Class 2 & 3 land, the following assessments and assumptions have been made.

8.0a Stock water

The existing stock water supply and reticulation is expected to continue and meet sheep and cattle requirements for production and for animal welfare purposes. No improvements required.

Annual running costs of approximately $600/year for electricity.

8.0b Irrigation water

There is no consented irrigation water on the Site.

Livestock (sheep & cattle) can be grazed dryland or irrigated, and arable crops can be grown dryland albeit at lower average yields with a wider yield variance range than under irrigation.

Both livestock and arable crops (cereals, peas) or horticulture tree crop would benefit production-wise from irrigation as the soil moisture deficit of -262mm at approximately 40% of annual rainfall is both significant and marked.

Irrigation water will be required for any more intensive specialist crops or with high yield requirements or exacting product specification requirements (seed or grain quality), or horticultural activity. Some of the latter crops such as market garden vegetables can be grown dryland but require irrigation to produce consistent yields of the very high quality required to be meet contract buyer specification and at economically profitable prices.

Irrigation development costs

The cost of a bore, screen, pumps & electrics, power supply (it is assumed that the power supply currently over the land is sufficient but may require either an upgrade or new transformer depending on power requirements of the application system), and a water application system tailored to the land use activity (but assumed to be sprinkler based) would cost approximately $180,000 - $200,000 including consenting fees. It is probable that consent conditions would require a deeper well, effectively meaning a new well bore.

Irrigation consents would be required to take water and to use water. The site is located within the Ashley—Waimakariri Nutrient Allocation Zone, which is a Red Nutrient Zone. Any approved irrigation consents are required to meet diminishing nutrient leaching targets from a starting nutrient baseline, which limits the range and intensity of potential land use activities. Gaining appropriate consents with satisfactory water use conditions that don't restrict crop/pasture irrigation timing with sufficient annual volumes is not guaranteed.

Successful consent application would require that the applicant's well would not impact on existing neighbouring wells and other irrigation users within 1.5km of the planned well site, and on the Cam River stream flows.

It is considered that the likelihood of obtaining irrigation consents is low to very low given the location and the general over-allocation of groundwater resources in the Waimakariri Irrigation Zone, combined with the very close proximity to existing streams and existing irrigation users.

Annual running costs are seasonally dependent estimated at $5,000 - $7,000/year depending on electricity line fees, with annualized consent renewal fees, consent audit fees, Farm Environment Plan costs, water use monitoring charges estimated at an additional $2,000-$2,500/year.

The applicant will also need to be prepared to take a total loss of approximately $60,000 - $70,000 if the consent is not granted (drilling a test well, flow rate testing, preparation of application, ECAN application fees, etc).

In summary, as the likelihood of being granted an irrigation consent is highly unlikely, primary production land use activities that require irrigation have been ruled out. This excludes viticulture and horticulture and market gardening activities; while these could be pursued as dryland ventures, in my opinion no prudent land user would undertake investment with the levels of summer and autumn drought risk involved.

8.0c Physical Access
Access is from Northbrook Road or Kippenberger Avenue.

8.0d Electricity Supply
Electricity is from the existing metered supply at the pump shed.

8.0e Stock yards and load-out ramp
There are no existing cattle and sheep yards on the Site. Assumes that $12,000 is required to build a small set of yards including a load-out ramp.

8.0f Sheep Shearing
Normally a shearing shed is needed, but given the small potential number of sheep, it is assumed that shearing outdoors with electric battery shears is sufficient to harvest wool and meet sheep welfare requirements (flystrike, etc).

8.0g Fencing
It is assumed that the Site has permanent livestock fencing around it. Any further fencing within the existing fourteen paddocks is assumed to be provided by temporary electric fencing, using mains energizer. Cost $1000

8.0h Contractors
It is assumed that all the contractors required, depending on the type of land use activity, are available in the district, and are not limiting in terms of potential land use choices available.

8.0i Other costs
The land has rates costs (Waimakariri District Council and Canterbury Regional Council - GST exclusive) of approximately $16,947 per year.

Section 9: Farming Land Use Options

Technically feasible options for this Site are:

- Dry-stock sheep
- Dry-stock cattle
- Mixed cropping (arable and dry-stock sheep)
- Sale of hay and baleage
- Dairy heifer contract grazing

9.0 Discussion of Options

9.0a Dairy heifers
Dairy heifer contract grazing options are restricted by heavy winter wet soils being easily pugged, and best practise would be to remove heifers over winter. Grazing contracts are typically:

- type-A - 21 weeks (as calves - December to April)

- type-B - 52 weeks (yearlings - May to April)
- type-C – 73 weeks (calf to R2 – December to April)

The vast majority of contracts are type-C with only a few of type A or B which are only occasionally and inconsistently available.

Generally dairy farmers do not place small number of calves out grazing as it splits mobs up and requires additional supervision time and additional freight cost for calves. 85 dairy calves are calculated as potentially summer-autumn grazed on site, when grazing contracts typically are for herd sizes of 125 – 150 calves, or more.

Only type A contracts would suit the soils on this Site (lightest weight calves and no winter pugging damage), but it is assumed that getting and retaining type-A contracts are unlikely and not feasible.

9.1b Dry stock Sheep

There are a large number of sheep policy permutations, but district practise sheep policy would be breeding ewes, selling the progeny finished to a processor or store to other farmers to finish. Usually with small flocks, replacement ewes are purchased, rather than bred and grown out.

Using the *Beef & Lamb NZ Economic Service; Class 8 SI Finishing* as a benchmark, the site would carry 335 breeding ewes (385 stock units).

9.1c Dry stock cattle

The usual small block cattle policy is to purchase yearling cattle and graze for approximately 12-14 months before sale to meat processors, however given the very wet winter soils, the policy is more likely to be purchase of heavier yearlings and kill at the end of autumn just before winter destocking. Using the Beef & Lamb Economic Service data, this Site would be expected to carry 77 head (385 stock units).

9.1d Mixed cropping

Dryland arable cropping is carried out in Canterbury on a small scale and as part of an integrated crop and stock policy. The most common crops grown are barley, and sometimes low-specification old varieties of perennial grass seed. Given the winter wetness limitations from high water tables, it is typically not until mid-spring (early September) before soils are dry enough to prepare a viable seed bed. Despite this, yields are expected to be at above average (+15%) because of the high fertility of the soils, and because majority of crop growth will have occurred before soil moisture deficits become limiting in most years.

Rotations typically would be spring sown barley, to permanent pasture for 4-5 years, then repeat; with sheep or light-cattle grazing the pasture.

Dryland barley yields 6.3 t/ha, and barley straw at 6 medium round bales per hectare; and during pasture years 335 breeding ewes.

9.1e Supplementary feed hay or baleage

Permanent perennial pasture with commonly two spring and early summer cuts, and two mid-late autumn cuts assuming there has been sufficient autumn rainfall. Harvest 900 bales hay or baleage (270+295+185+150). The harvest yields and timing on the Class 3 land is expected to be more variable than Class 2 land given the wet spring/early summer periods. This may also result in more hay (sale at $70/bale) being made than baleage (sale at $100/bale), because of poorer feed quality.

Drier than usual summer periods have potential to prevent viable harvests of cuts 3 and 4, so income is not reliable.

Note: in all scenarios, perennial pastures require replacement after 6-8 years to maintain quality & vigour.

Section 10: Economic Viability

The four technically feasible options with markets to support them, and able to be undertaken as part of normal farming practise year-in-year-out are:

- Dry-stock sheep
- Dry-stock cattle
- Mixed cropping
- Sale of hay and baleage

10.1 Assumptions

There are no costs included for wages or owners time in undertaking the land use activity, such as shifting stock, undertaking animal health activities, buying, and selling of livestock and produce, shifting hay or baleage, and administrative & regulatory requirements related to the farming activity.

It is assumed that the land is debt free and there are no interest and or principal payments attached to the land purchase, and the owner does not require a return on investment.

Infrastructure costs only include any permanent improvements specific and essential to the proposed land use activity, such as stock water, stock yards, irrigation, access, etc.

The general machinery required such motorbikes or 4WD utility vehicles or tractors are all assumed to be on hand and suitable for the activities required, excluding cropping or pasture renewal which are all undertaken by contractors. A nominal contribution is allowed for fuel and vehicle servicing operating expenses, and no allowance is made for depreciation or vehicle replacement costs.

The economic viability of each option is detailed in Images 28 & 29.

10.2 Operating Net Surplus Summary

Three land use options are able to generate sufficient income to cover direct operating expenses, and one has a small operating loss. Average operating results across all four options is +$4,160.

	Net annual trading result (rounded)
• Dry-stock sheep	+$5,000
• Dry-stock cattle	+$9,800
• Mixed cropping	+$3,800
• Sale of hay/baleage	-$1,900

One key reason for the operating profit being relatively low is the high standing charge cost of rates at $16,947 or $595/effective hectare, 43% of sheep and beef operating expenses.

10.3 Capital investment, interest & principal costs

Capital investment is required to purchase livestock (average $39,000) and to provide necessary infrastructure (average $9,750) to efficiently carry out the land use options.

Using an interest cost of capital at 5.0% and principal payments made over 5-years for livestock and 10-years for infrastructure (average I&P of $11,800), then annual Net Cash Results are:

	Capital for Improvements	Capital for Livestock	Interest & Principle p.a	Net Annual Cash Result*
Dry-stock Sheep	$13,000	$43,493	-$12,823	-$7,800
Dry-stock Cattle	$13,000	$78,489	-$21,572	-$11,800
Mixed Cropping	$13,000	$34,795	-$10,649	-$6,900
Sale hay/baleage	$0	$0	-$2,263	-$4,200
* rounded Average	$9,750	$39,194	-$11,827	-$7,675

Image 27

10.4 Summary

No options are able to generate sufficient income to cover direct expenses, and interest & principal (cost of livestock and cost of infrastructure improvements).

The average Net Cash Result of the four options is -$7,675. This is considered to have moderate-low profit resilience as future combinations of input cost increases and normal seasonal variations (yields, or animal growth rates or reproductive rates resulting from poor climatic conditions - particularly late spring growth from very wet winters, and from longer summer-autumn dry periods) would easily result in an increase in Net Cash Loss of up to 100% - 200%.

Given that there is no provision for owner's labour, no return on the assumed debt-free Site land purchase, no replacement provision on the assumed in-place vehicles & machinery suite, the Net Cash Result is untenable, and no prudent farmer would view any of these options as economically viable on this Site.

Sheep

Policy: 335 ewes, 140% lambing, all lambs to kill, 4.2 kg wool/ssu, 5.1% deaths

Effective Hectares	28.50				
SU/ha (+10% higher)	13.5				
Total SU	385				
:ome - incl sire costs		**$44,995**			
Direct Farming Expenses					
Rates (pro rata)	$16,947				
Insurance	$998				
Animal health	$2,155				
Electricity	$600				
Shearing	$2,677				
Annual fertiliser	$4,232				
enewal - annualised	$4,399				
Hay/Baleage made	$2,434				
R&M	$577				
Freight IN	$361				
ACC	$280				
Administration contribution	$2,378				
Vehicle Opex Contribution	$1,902	**$39,939**		**$5,056**	A
				Net Annual Trading Result	
Livestock Loan Interest	$2,175	5.0%	$43,493		
Livestock Loan Principle	$8,699	5-years			
		$10,873		**-$5,817**	B
Improvements Loan Interest	$650	5.0%	$13,000		
Improvements Loan Principle	$1,300	10-years			
		$1,950		**-$7,767**	C

Beef

Policy: 77 yearling purchased, 77 sold at 20mths, 1.3% deaths

Effective Hectares	28.50				
SU/ha	13.50				
Total SU	385				
Gross Income - net of purchase costs		**$48,499**			
Direct Farming Expenses					
Rates (pro rata)	$16,947				
Insurance	$998				
Animal health	$1,508				
Electricity	$600				
Shearing	$0				
Annual fertiliser	$4,232				
Annual Pasture renewal	$4,399				
Hay/Baleage made	$3,386				
R&M	$577				
Freight IN	$1,539				
ACC	$280				
Administration contribution	$2,378				
Vehicle Opex Contribution	$1,902	**$38,746**		**$9,753**	A
				Net Annual Trading Result	
Livestock Loan Interest	$3,924	5.0%	$78,489		
Livestock Loan Principle	$15,698	5-years			
		$19,622		**-$9,869**	B
Improvements Loan Interest	$650	5.0%	$13,000		
Improvements Loan Principle	$1,300	10-years			
		$1,950		**-$11,819**	C

Image 28

Mixed Farming (Barley + drystock sheep)					
Policy: Barley at 6.3 t/ha, 6 b/ha straw & 4yrs sheep					
Effective Hectares	28.50				
SU/ha	13.50				
Total SU	385				
Gross Income - annualised		**$53,550**			
Barley price average last 5yrs less 10% for sale off header					
Direct Farming Expenses					
Rates (pro rata)	$16,947				
Insurance	$998				
Animal health	$1,724				
Electricity	$600				
Shearing	$2,141				
Annual fertiliser	$3,386				
Pasture renewal - annualised	$1,320				
Hay/Baleage made	$1,947				
R&M	$577				
Freight IN	$289				
Barley Crop Direct Exp	$15,305				
ACC	$280				
Administration contribution	$2,378				
Vehicle Opex Contribution	$1,902	**$49,793**		**$3,758**	A
				Net Annual Trading Result	
Livestock Loan Interest	$1,740	5.0%	$34,795		
Livestock Loan Principle	$6,959	5-years			
		$8,699		**-$4,941**	B
Improvements Loan Interest	$650	5.0%	$13,000		
Improvements Loan Principle	$1,300	10-years			
		$1,950		**-$6,891**	C

Hay/Baleage Supplement					
Annual Policy: 898 bales (4x cuts) grass, stored & sold during winter					
Effective Hectares	28.50				
SU/ha	13.50				
Total SU	385				
Gross Income		**$86,056**			
Direct Farming Expenses					
Rates (pro rata)	$16,947				
Insurance	$998				
Animal health	$0				
Electricity	$600				
Shearing	$0				
Annual fertiliser	$10,981				
Pasture renewal - annualised	$4,399				
Hay/Baleage made	$49,377				
R&M	$115				
Freight IN	$0				
ACC	$280				
Administration contribution	$2,378				
Vehicle Opex Contribution	$1,902	**$87,977**		**-$1,921**	A
				Net Annual Trading Result	
Delayed sale Interest	$60,358	5.0%	$2,263		
		$2,263		**-$4,184**	B
Improvements Loan Interest	$0	5.0%	$0		
Improvements Loan Principle	$0	10-years			
		$0		**-$4,184**	C

Image 29

Section 11: "Additional Land"

The Site gross area includes an approximately 3.3 ha block of land in a triangle shape on the eastern side of the site. See Image 8 and 30.

I have been asked to consider the land use options of this Additional Land if it was a standalone block. The following paragraphs discuss any features or attributes that are materially different to the previous discussion of the whole site (Sections 1-10).

11.1 Location & Accessibility

The Additional Land is bound by the Cam River/Ruataniwha directly for approximately 135m on the north side, but the Cam/Ruataniwha effectively prevents any access from the north-east-south arc as there is no public bridging available, or the neighbours are on freehold land.

If the Additional Land is separated from the whole Site, the Additional Land is isolated without any legal access. Any possible access would need to be provided by way of legal easement through the 27.92 ha site from Devlin Avenue (see red arrow, Image 30), or via the establishment of access from the new roading network established as part of development of the wider Site to medium density residential development, assuming the rump area is zoned residential.

Image 30

11.2 Land Use Capability

The Additional Land has broadly the same LUC rating as the whole site, at 49% LUC 2 (whole site 40%), and 51% LUC 3 (whole site 60%). See Image 31.

Image 31

11.3 Contour & Drainage

Altitude-wise the Additional Land is very similar to the whole Site but with a narrower altitude range, lying at just below the middle of the range of the whole site, between 21.5 m.a.s.l at the north end (24.0 m.a.s.l whole site) to 17.5 m.a.s.l at the southern end (16.5 m.a.s.l), and 19.5 m.a.s.l on the eastern most point with a similar rate of fall. See Image 32.

Image 32

Being higher altitude on average, the Additional Land has a much more favourable balance of 'imperfectly' drained soils to 'poorly' drained soils, being predominantly (98%) imperfectly drained compared to about 50/50 for the whole site.

Soil Drainage Characteristics

	Additional Land	Whole Site
poorly	2%	54%
imperfectly	98%	42%

Open drains service the Additional Land the same as the whole Site. See Image 32.

The same soil types are found on the Additional Land but in different ratios. This changes the soil permeability, root aeration and water logging vulnerability risk profiles in favour of the Additional Land compared to the whole site.

Water Logging Risks & Profile Available Water

	Additional Land	Whole Site
Mottled	98%	42%
Gley	2%	54%
PAW (100cm)	198	167

Although the Additional Land has better Profile Available Water characteristics at 198mm, this only translates to an additional 3 days longer before soil moisture deficits start to impact significantly on pasture growth (18 days to wilting point compared to 15 days on the whole site).

11.4 Effective Area

The net effective area after allowance for open drains is 3.2 hectares.

11.5 Stocking Rate Productivity

Section 6 tables showed that the LUC stocking rates for LUC 2 and LUC3 are the same, so the Additional Land productivity is the same as the whole Site. See Image 33.

		Additional Land	Whole Site
Effective Hectares		3.20	28.50
LUC		2s 2 + 3w 1	2*s* 2 + 3*w* 1
Stocking Rate*	Average	10.5	10.5
	Top Farmers	13.5	13.5
	Potential	17.0	17.0
Total Stock Units	Average **	34	300
	Top Farmers **	43	385

Table Ref: LRIS Portal: NZLRI Land Use Capability 2021

* LRIS definitions of stock units are used for purposes of land polygon comparison

** Dryland farming

** Beef & Lamb NZ: Farm Class Survey; local knowledge of farming systems

Image 33

If the Additional Land on its own was removed from primary production as defined under the NPS: HPL rules, the loss is calculated as 34 stock units (3.20 ha at 10.5 su/ha).

However, as the land is slightly higher lying on average and with relatively likely shorter periods of waterlogged soils, still with summer moisture deficits, and being a small parcel of land which typically translates to slightly higher effective stocking rates, then the actual productive stocking rates can be assumed to be higher, at the stocking rate of Top Farmers at 43 stock units (3.20ha at 13.5 su/ha).

11.6 Infrastructure

The Additional Land has no infrastructure apart from permanent fences into two paddocks.
There will be no stock water as the current source of water (plus pump and power) is in the southwest corner of the whole site, and when the Additional Land is separated off as standalone the stock water will also be cut off.

While water demand for sheep is relatively low, and higher for cattle, livestock water is required for production and for animal welfare reasons.

A shallow bore can be installed to source water for stock use. Environment Canterbury designate livestock water as a permitted activity from groundwater sources as long as the take is less than 10m³ per property per day, which is more than would be required for the Additional Land.

It is estimated that a < 20m installed well with a small surface pump driven by a small petrol or diesel generator, auto switch on/off controls, 35,000-litre tank, and a small protective pump-shed would cost approximately $18,000, depending on final depth. Included is sufficient alkathene pipe to connect to the existing troughs.

Annual running costs of approximately $400/year for fuel.

Alternatively, a rainwater collection corrugated iron ‘roof’ with water gravity-collected into a 35,000- litre tank and then pressure pumped (either petrol or diesel pump or solar pump) to the troughs. A building permit will be required to build the collection structure, and total project cost is estimated to be approximately the same as shallow well, with less reliability.

If the Additional Land is not able to be used as a farm, and instead was sold as a 'lifestyle' block, it is common practise where total stock numbers are low, to divert spare domestic water into a separate tank for livestock use. Cost of tank and pressure pump estimated at $7,500. Note that the effective area would reduce to approximately 2.85 ha of effective farmland as the house, curtilage and access drive is assumed to use approximately 0.35ha. This would reduce the potential stock units to 45 from 50.

For the purposes of this report examining primary production, it is assumed the cost of providing reliable stock water is $18,000.

A small set of stock yards and loadout ramp will be required, cost estimated at $12,000.

11.7 Summary of Physical Characteristics

The Additional Land is effectively a small mirror-image of the whole Site. It is slightly higher lying, and less waterlogged (more mottled soils), and the grazing window is earlier than the whole Site. Climate, neighbouring land use and drainage are the same.

The Additional Land is land-locked and would require an access easement to allow any land use, and there is no stock water, requiring a new water supply, as well as stock yards.

11.8 Land use options

There are three technically feasible options able to be operated following normal farming practises year-in-year-out, and with national and international markets to support them financially:

- Dry-stock sheep
- Dry-stock cattle
- Sale of hay and baleage

The growing of arable crops (such as barley) is not practical as the land area is so small, so the mixed cropping option is not considered feasible.

The assumptions about each land use activity are the same (see 9.1b, 9.1c, 9.1e and 10.0 above)

11.9 Operating Net Surplus Summary

Two land use options are able to generate sufficient income to cover direct operating expenses, with a small operating surplus, while one has a small operating loss.

Average operating results across all three options is +$560, effectively a breakeven result. See images 34 and 35 below.

	Net annual operating result (rounded)
• Dry-stock sheep	+$0
• Dry-stock cattle	+$750
• Sale of hay/baleage	-$230

The high standing charge cost of rates at $1,903 or $595/effective hectare remains a key reason for the operating profit being low.

If the Additional Land is used as 'lifestyle block' and the effective net grazing area is reduced to 2.85 ha, the rates will not be fully GST claimable, and the cost will be even higher on a per hectare basis due to the capital cost of the residence which will make any land use activities even less viable. For reference, the 4.81ha block immediately north of the Additional Land including a residence has rates charge of $1,001/ha (GST exclusive).

Sheep

Policy: 38 ewes, 140% lambing, all lambs to kill, 4.2 kg wool/ssu, 5.1% deaths

Effective Hectares	3.20				
SU/ha (+10% higher)	13.5				
Total SU	43				
Gross Income - incl sire costs		**$5,052**			
Direct Farming Expenses					
Rates (pro rata)	$1,903				
Insurance	$112				
Animal health	$242				
Electricity	$600				
Shearing	$301				
Annual fertiliser	$475				
Pasture renewal - annualised	$494				
Hay/Baleage made	$273				
R&M	$65				
Freight IN	$85				
ACC	$31				
Administration contribution	$267				
Vehicle Opex Contribution	$214	**$5,061**		**-$9**	A
				Net Annual Trading Result	
Livestock Loan Interest	$244	5.0%	$4,883		
Livestock Loan Principle	$977	5-years			
		$1,221		**-$1,230**	B
Improvements Loan Interest	$1,550	5.0%	$31,000		
Improvements Loan Principle	$3,100	10-years			
		$4,650		**-$5,880**	C

Beef

Policy: 9 yearling purchased, 9 sold at 20mths, 0% deaths

Effective Hectares	3.20				
SU/ha	13.5				
Total SU	43				
Gross Income - net of purchase costs		**$5,633**			
Direct Farming Expenses					
Rates (pro rata)	$1,903				
Insurance	$112				
Animal health	$169				
Electricity	$600				
Shearing	$0				
Annual fertiliser	$475				
Annual Pasture renewal	$494				
Hay/Baleage made	$380				
R&M	$65				
Freight IN	$173				
ACC	$31				
Administration contribution	$267				
Vehicle Opex Contribution	$214	**$4,883**		**$750**	A
				Net Annual Trading Result	
Livestock Loan Interest	$441	5.0%	$8,813		
Livestock Loan Principle	$1,763	5-years			
		$2,203		**-$1,453**	B
Improvements Loan Interest	$1,550	5.0%	$31,000		
Improvements Loan Principle	$3,100	10-years			
		$4,650		**-$6,103**	C

Image 34

Hay/Baleage Supplement

Annual Policy: 114 bales (4x cuts) grass, stored & sold during winter

Effective Hectares	3.20				
SU/ha	13.50				
Total SU	43				
Gross Income		**$10,882**			
Direct Farming Expenses					
Rates (pro rata)	$1,903				
Insurance	$112				
Animal health	$0				
Electricity	$600				
Shearing	$0				
Annual fertiliser	$1,233				
Pasture renewal - annualised	$494				
Hay/Baleage made	$6,244				
R&M	$13				
Freight IN	$0				
ACC	$31				
Administration contribution	$267				
Vehicle Opex Contribution	$214	**$11,110**		**-$229**	A
				Net Annual Trading Result	
Delayed sale Interest	$7,477	5.0%	$280		
		$280		**-$509**	B
Improvements Loan Interest	$0	5.0%	$0		
Improvements Loan Principle	$0	10-years			
		$0		**-$509**	C

Image 35

11.10 Capital investment, interest & principal

Capital investment is required to purchase livestock (average $5,300) and to provide necessary infrastructure (average $20,700) to efficiently carry out the land use options.
Using an interest cost of capital at 5.0% and principal payments made over 5-years for livestock and 10-years for infrastructure (average I&P of $4,500), then annual Net Cash Results are:

	Capital for Improvements	Capital for Livestock	Interest & Principle p.a	Net Annual Cash Result*
Dry-stock Sheep	$31,000	$4,883	-$5,871	-$5,900
Dry-stock Cattle	$31,000	$8,813	-$6,853	-$6,100
Sale hay/baleage	$0	$0	-$280	-$500
* rounded Average	$20,667	$4,565	-$4,335	-$4,167

Image 36

11.11 Summary

None of the potential options are able to generate sufficient income to cover direct operating expenses, interest & principal (cost of livestock and cost of infrastructure improvements), with the best option (sale of supplements) calculated at a small loss at best.

The average Net Cash Result of the four options is -$4,200. This is considered to have low profit resilience as future combinations of input cost increases and normal seasonal variations (yields, or animal growth rates or reproductive rates resulting from poor climatic conditions - particularly late spring growth from very wet winters, and from longer summer-autumn dry periods) would easily result in an increase in Net Cash Loss of up to 2-4-fold.

Given that there is no provision for owner's labour, no return on the assumed debt-free Site land purchase, no replacement provision on the assumed in-place vehicles & machinery suite, the Net Cash Result is not viable in the short or long term. No prudent farmer would view any of these options as economically viable on the Additional Land.

Section 12: Discussion of the NPS: HPL exemption

In addressing Clause 3.10 of the National Policy Statement for Highly Productive lands (NPS-HPL): Exemption for highly productive land subject to permanent or long-term constraints, it is my opinion that the use of Highly Productive Land on this site for primary production is not able to be economically viable for at least 30 years and that in coming to that conclusion I have evaluated all of the reasonably practical options.

The models that I have used to test the commercial viability of the block show the highest and best possible land use options taking into account factors including long periods of soil winter excessive wetness, marked summer soil moisture deficits, lack of size, no irrigation capability, the limitations of servicing an agricultural business at this location, the nutrient leaching management requirements if the site was irrigated, and potential for pollution impacts on neighbours including reverse sensitivity impacts.

The economic models used are above the average performance of the benchmark models.

Section 13: Summary and Conclusions

- The Site is classified as Land Use Classes 2 and 3 which brings it under the NES Highly Productive Land regulations.
- The effective area of 28.5ha is flat and sloped to the south with open drains flowing to

the southern end.

- The Kaiapoi and Pahau soils lie at higher altitude, are imperfectly drained, mottled soils; the Temuka and Flaxton soils are lower lying and poorly drained, gley soils. All are winter wet from high water tables and have moderate over slowly permeable lower soil horizons, with the Temuka & Flaxton soils being more so, which limits the range and types of primary production that can be undertaken.
- The winter wet soils are also structurally vulnerable soils that are easily damaged by livestock pugging or by machinery and vehicle activity such as winter feeding out of supplements (best practise is to not grow winter green feed crops), which limits the range and type of livestock policies especially those including heavier cattle, as well as arable crops and horticulture crops.
- There is a marked summer soil moisture deficit (262mm) which limits pasture production from mid-January to late March and requires more conservative stocking rates, animal growth rates, and arable and supplement yield expectations.
- Loss of the Site from long term primary production is calculated at 300 stock units (28.5 ha at 10.5 su/ha).
- Spring establishment of arable crops are moderately late (early-mid September) by the time soils are sufficiently dry, but high fertility will increase potential crop yields above dryland averages.
- A very limited range of arable crops can be grown dryland (typically barley) but can be rotated approximately every four to five years with perennial pasture for soil restoration as part of a mixed cropping & livestock enterprise.
- Light weight livestock (sheep and calves) minimise winter pugging risk as long as baleage or hay is used for supplement. Heavier cattle can be grazed late spring to end of autumn but need to be destocked over winter.
- Site is dryland and there are no buildings apart from a pump shed. Stock water and mains electricity are present, but cattle and sheep stock yards are required.
- Irrigation consents are highly unlikely to be granted on this Site, so only dryland land use options are available. This excludes horticulture and viticulture options.
- Even in the unlikely event of irrigation consent being granted, the high capital cost of up to approximately $200,000 would add approximately $10,000 per year in interest costs (5%) and $10,000 per year in principal repayments (20-year term)
- While the full range of contractors and suppliers are expected to be available from the North Canterbury hinterland, the Site's urban fringe location significantly limits the ability of contractors to reliably deliver time-critical work for some weather condition-specific activities such as spraying & harvesting, and consequently when combined with the small size of the Site, contractor costs are expected to be higher per-hectare than normal.
- There is expected to be high potential impact on Site neighbours to the west and north from dust, spray-drift, and noise as well as mud & debris on the access roads.
- There are five technically feasible land use options, including one (dairy calf summer & autumn grazing) that has a low likelihood due to low availability of contracts which are not commonly available or at the low heifer numbers that can be carried on this site.

- Potential land use options include dryland sheep, dryland beef cattle, mixed cropping arable & sheep, selling supplementary feed (hay or baleage).
- All options bar supplements are able to produce a trading profit and cover direct expenses (range +$9,800 to -$1,900).
- Total infrastructure development is minimal (stock yards, electric fence energizer) at $13,000 for three options, and $0 for one option.
- Livestock purchase costs average $39,200 ($0 to $78,500) and interest and principal costs range between $2,300 and $21,600.
- When the cost of capital (5.0% interest) and principal payments are included, then total Net Cash Results are losses for all options ranging -$4,200 to -$11,800.
- The average Net Cash Result of all options is -$7,700, and is considered to have very low profit resilience, and easily result 2-3-fold increase in losses as a result of climate or market variability.
- Livestock economic viability has been calculated using stocking rates higher than the district benchmark averages by using stocking rates of top-farmers (385su), which indicates that higher stocking rates are not able to overcome lack of economic viability while at the same time significantly increasing productivity risk with more stock being grazed during summer drought months.
- Even using higher stocking rates and given that there is no provision for owner's labour, no return on the assumed debt-free Site land purchase and no replacement provision on an assumed in-place vehicle & machinery suite, the Net Cash losses are unacceptable.
- The small 3.20 net effective hectares of the Additional Land to the east of whole Site, is principally a small mirror image of the whole Site, albeit with better drained soils with less water logging risk.
- If the Additional Land on its own was removed from primary production the loss is calculated as 34 stock units (3.20 ha at 10.5 su/ha).
- The Additional Land is landlocked and will require an access easement from land to the west.
- Infrastructure is the same except that stock water is required as well as stock yards.
- Economic operating surplus averages +$170 across dryland sheep, dryland cattle, and supplementary feed sales options. After allowance interest and principal payments, the Net Cash Surplus averages -$4,200.
- It is difficult to see any prudent land user placing themselves under these kinds of risks to farm the land on either site scenario, or with little likelihood of recouping any capital invested into land purchase. Full recovery of cost of improvements is at risk given the essentially breakeven status (at best) of the land use options.
- The small scale of the two sites, high vulnerability of the soils to structural damage from high water tables, summer drought periods, restrictive site access for contractors, very low chance of obtaining irrigation water consents, as well as very expensive irrigation infrastructure means that there is no reliable long term economically viable primary

production land use for this Site.

- In addressing NES: HPL Exemption requirements it is my opinion that the use of Highly Productive Land on this site for primary production is not able to be economically viable for at least 30 years and that in coming to that conclusion I have evaluated all the reasonably practical options.

Geoff Dunham

Geoff Dunham B Agr Sci
Agricultural Business Consultant MNZIPIM (Reg.) Inst of Dir.

M 0274 33 6564 **T** +64 3 313 9458

Email: geoff@dunham-consulting.com **Web:** www.dunham-consulting.com

Post: PO Box 310 Rangiora 7400

DUNHAM CONSULTING

Auckland // Christchurch // Melbourne

Appendix A:Land Use Capability Definitions

Land Classes 1 to 4 are suitable for arable cropping (including vegetable cropping), horticultural (including vineyards and berry fields), pastoral grazing, tree crop or production forestry use.

Land Classes 5 to 7 are not suitable for arable cropping but are suitable for pastoral grazing, tree crop or production forestry use, and, in some cases, vineyards and berry fields. The limitations to use reach a maximum with LUC class 8.

Land Class 8 land is unsuitable for grazing or production forestry and is best managed for catchment protection and/or conservation or biodiversity.

LUC 1	Land with virtually no limitations for arable use and suitable for cultivated crops, pasture, or forestry.
LUC 2	Land with slight limitations for arable use and suitable for cultivated crops, pasture, or forestry.
LUC 3	Land with moderate limitations for arable use and suitable for cultivated crops, pasture, or forestry.
LUC 4	Land with moderate limitations for arable use and suitable for occasional cultivated crops, pasture, or forestry.
LUC 5	High producing land unsuitable for arable use, but only slight limitations for pastoral or forestry use
LUC 6	Non-arable land with moderate limitations for use under perennial vegetation such as pasture or forestry
LUC 7	Non-arable land with severe limitations for use under perennial vegetation such as pasture or forestry
LUC 8	Land with very severe to extreme limitations or hazards that make it unsuitable. for cropping pasture or forestry.

Land use capability subcategory

Each LUC unit has a subcategory of the LUC class through which the main kind of physical limitation or hazard to use is identified. Four limitations are recognised:

- 'e' erodibility – where erosion susceptibility, deposition, or the effects of past erosion damage *first* limits production
- 'w' wetness – where soil wetness resulting from poor drainage or a high-water table, or from frequent overflow from streams or coastal waters *first* limits production
- 's' soil – where soil physical or chemical properties in the rooting zone such as shallowness, stoniness, low moisture holding capacity, low fertility (which is difficult to correct), salinity, or toxicity *first* limits production.
- 'c' climate – where climatic limitations such as coldness, frost frequency, and salt-laden onshore winds first limits production

Appendix B: LUC Source Images

Image 11