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12 April 2022

To whom it may concern,

Please find enclosed a report summarising the site visit from the 20th of September,2021.

In the meantime, should you have any queries please do not hesitate to contact me.

Kind regards,
Louis

AGFIRST

Independent
Agriculture
& Horticulture
Consultant
Network

Property report for Masterton Site

Prepared for Welhom Developments Limited

Louis Batley
12th of April 2022

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1.0 EXECUTIVE SUMMARY

Welhom Developments Limited has approached AgFirst to map and identify the Land Use Capability (LUC) of the rural zone of a property located near Masterton. The results indicated that the property is primarily a 3w1 on silt soils, as evident by the LUC map on page 9. The main limitation of this land from an agricultural perspective is wetness limitation, which is a result of the impermeable pan below the topsoil. Otherwise, the soils are generally regarded as productive agricultural soils.

2.0 INTRODUCTION

AgFirst was approached by Welhom Developments Limited to do Land Use Capability (LUC) survey on a site named "Masterton Site". The site assessment was done on the morning of the 20th of September 2021. The methodology included taking soil samples for fertility and making at least one observation per hectare to identify the productive capability of the land. Below are the findings from the site visit and soil tests.

3.0 PROPERTY DESCRIPTION

The block is located near of the township of Masterton on the northern side of the Waipoua River, between State Highway 2 and the train tracks to the west. The land parcel of interest is approximately 14.7ha in size. There are no considerable landmarks or other features of the property which are unique, other than its proximity to the residential boundary to the south and neighbouring houses to the east and north and the train tracks to the east.

The section consists of two paddocks which are split by a shelter belt. The section is flat, with a slight slope towards the railway tracks (east). At the time of inspection, the fences were in adequate condition. Water is supplied to the blocks via the town supply and reticulated to troughs in each paddock. The property receives between 800 to 1,000mm of rainfall annually, so is not classified as a high rainfall area.

Figure 1: Features Map

At the time of the visit, the weather was fine, although there had been heavy rain the previous days. There was a small puddle in the north western corner near the shelterbelt, which was a result from the heavy rain the previous day and a characteristic of 3w1 soils. This specific area has slightly impeded drainage due to the slope of the paddock and the adjacent railway tracks which are raised. All land was in improved pasture at the time of the visit, which had been resown. There were no stumps or evidence of weed persistence, and the paddock had been well grazed. Furthermore, there is no evidence of artificial drainage.

3.1 Current management

The current management policies of the block include buying lambs in around April and grazing them over the winter and selling them prior to September. The block is then shut up for baleage to be made over the summer months. An annual fertiliser application of superphosphate is applied at around 180kg/ha, and occasionally nitrogen is applied depending on the feed availability. The paddock has also been limed in the past. The paddock has been

cropped historically, but the owner stated that the yields are limited due to the summer dry environment and limitations from the soil type.

Photo on left illustrating recently sown pastures as evident by row spacings and on right illustrating compaction from traffic.

At the time of the site visit, the paddock had just been grazed by lambs and was being shut up for baleage. The pasture was in good condition with few weeds, and considerable amount of clover in parts. At the time of inspection, the paddock was being direct drilled and there was evidence of vehicle traffic across the paddock. No samples were taken from or near the vehicle tracks or drilling site.

3.2 Soils

S-Maps (supplied by Landcare Research) indicate with a high confidence that the soils are Oaklea_3a.1, which is a Mottled-pedal Immature Pallic Soil, and Bushcroft_7a.1, which is a Mottled Orthic Brown Soil. Both soils are silt and are from either loess or alluvium and are imperfectly drained with a weak soil structure.

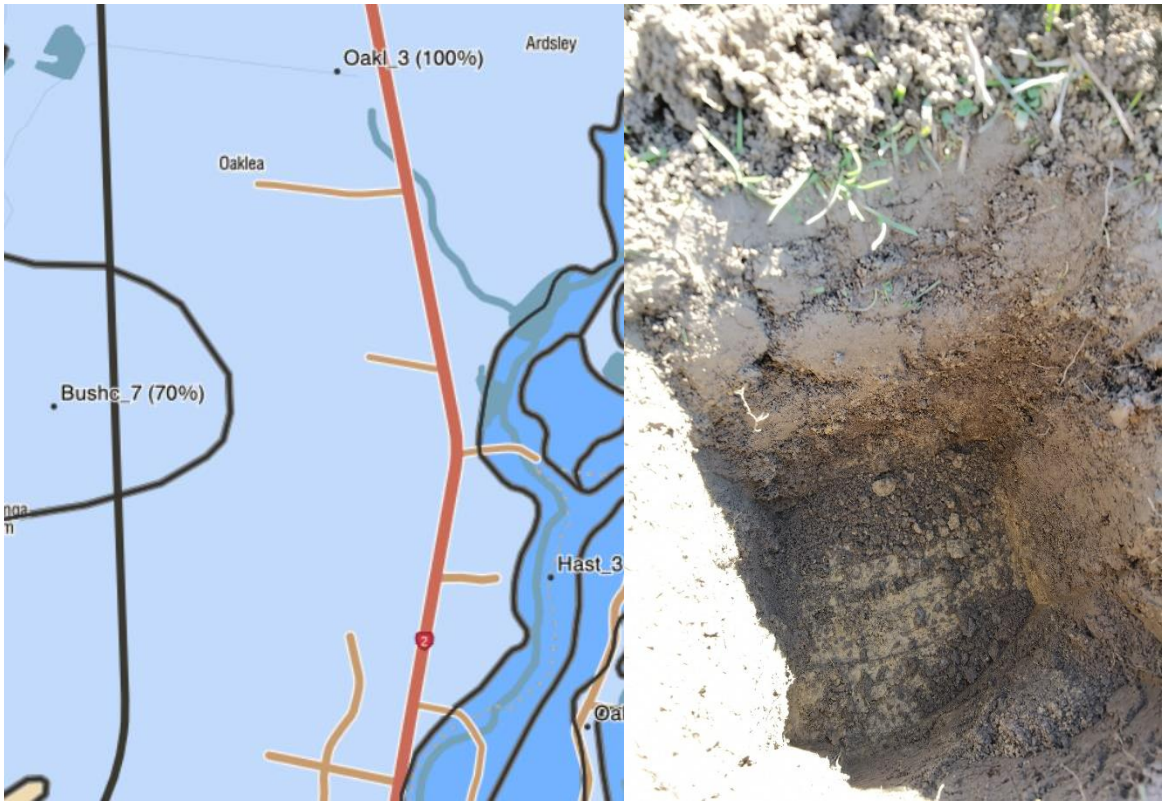

Image on left illustrating soil map while photo on right highlighting the soil profile: 30-50cm of silty topsoil with an impermeable pan beneath with poor drainage.

Nine sites were visually assessed (holes dug varying from 50-100cm depth) to identify the soil types (through visual soil assessment), as well as an assessment of the slope, degree and type of erosion, vegetation present and any other variables. Additional sites were assessed to check the consistency of the soil types but were not formally recorded. Overall, about one observation per hectare was done. Furthermore, soil fertility sampling was done following the transect in figure 1. This included samples at 75mm (standard for pastoral agriculture) and 150mm (standard for arable).

From the samples taken and observations, the soils generally match the given description. The topsoil was freely draining and a good texture, followed by a heavy subsoil with considerable mottling, suggesting that the soil is imperfectly to poorly drained through the subsoil. There was no gravel observed in any of the soil samples, although a single stone was found at near a metre depth in one of the samples.

The soil fertility was reasonable for the current management, with an Olsen P of 18, pH of 5.7 and optimal levels of calcium, magnesium, and sodium, illustrating the natural fertility of the soil which suggests that it is a silt. The main limiting factor is potassium, which is very low. Furthermore, the current fertiliser regime (annual application of super phosphate) only contains sulphur and potassium. Correcting the potassium fertility into the optimum range would be very expensive given the rates which would need to be applied. Soil tests can be found in the appendix on page 11.

In general, the fertility is suitable for the current management, apart from the potassium levels, but if the land use were to be used more intensively (for dairy, arable or horticulture) the general fertility would need to be lifted. This is indicated by the results to 150mm (suitable to arable), where the fertility is below optimum alluding to a limitation in potential productivity.

The soil test results show that there is a reasonable Olsen P and pH, with an agronomic optimum pH between 5.8 to 6 with current pH at 5.7 and optimum pH between 20-30, currently at 18. However, the soil has very low levels of potassium with a MAF unit of 3 at 75mm, while the optimum should be between 7-10. This is likely to be a limiting factor to production.

4.0 LUC MAPPING

Prior to the site visit, information was gathered around the current LUC units within the area by using the current regional scale LUC maps and the “Land Use Capability Classification of the Southern Hawke's Bay-Wairarapa Region” book by the National Water and Soil Conservation Authority, 1985. Given the location of the site, the LUC units were narrowed down to the LUC suite on alluvium and peat. This was decided given that the location is near the Waipoua River and the historic river terraces nearby. More information on the LUC suites can be found in the appendix.

Figure 2: Site Methodology

The soil sampling was consistent across the entire property, with the only difference being the variation in the amount of topsoil across the paddock, with deeper topsoil in the eastern side of the paddock compared with the west. The samples consistently showed heavy texture of the subsoil in conjunction with the mottling.

On all sites, the soil was identical (no changes throughout the site), the slope was predominantly A or B (flat to very slightly undulating or sloping) and there was no evidence of erosion. All pasture was improved species and well grazed. The land use in the neighbouring paddocks included dairy grazers and pastoral livestock. There are horticultural operations further away, but these occur on the higher terraces so are likely to have a different soil type and possibly a different LUC.

As a result of the site assessment, the entire site was mapped at a 3w1 see map below.

Figure 3: LUC Map

This is primarily due to the physical limitations of the poorly drained subsoil, which restricts the land production potential. It should be noted that in order to get the land to be more productive it would require considerable fertiliser application (very large amounts of potash or other fertiliser with potassium), which may not be economically viable nor practical given the proximity to the residential boundary. Other limitations which constratin agricultural production includes the climate which is traditionally dry over the summer. Irrigation may be necessary for the land to be productive year round in pastoral systems, or alternatively drought prone pasture species, such as lucerne, incorporated into the system.

5.0 CONCLUSION

From the visit, the Masterton site was deemed to be class 3 soils. The soils were predominantly river silt (30-50cm in depth) which overlay heavy subsoils which were poorly drained, as evident by mottling and pooling from rain the previous day. The poorly drained subsoils limit the productive capability of the land and would require subsoil drainage to overcome. The soil fertility is also not optimal and would be expensive to correct through fertiliser applications.

6.0 APPENDIX

6.1 Soil Test Results

Sample Name: 75mm **Lab Number:** 2711133.1
Sample Type: SOIL Mixed Pasture, Dry Stock (S82)

Analysis		Level Found	Medium Range	Low	Medium	High
pH	pH Units	5.7	5.8 - 6.2			
Olsen Phosphorus	mg/L	18	15 - 25			
Potassium	me/100g	0.15	0.40 - 0.60			
Calcium	me/100g	6.1	4.0 - 10.0			
Magnesium	me/100g	0.47	0.80 - 1.60			
Sodium	me/100g	0.14	0.20 - 0.50			
CEC	me/100g	14	12 - 25			
Total Base Saturation	%	48	50 - 85			
Volume Weight	g/mL	0.99	0.60 - 1.00			
Soil Sample Depth*†	mm	0-75				
Base Saturation %		K 1.1 Ca 42	Mg 3.2 Na 1.0			
MAF Units		K 3 Ca 8	Mg 10 Na 6			

Sample Name: 150mm **Lab Number:** 2711133.2
Sample Type: SOIL Mixed Pasture, Dry Stock (S82)

Analysis		Level Found	Medium Range	Low	Medium	High
pH	pH Units	5.7	5.8 - 6.2			
Olsen Phosphorus	mg/L	11	15 - 25			
Potassium	me/100g	0.13	0.40 - 0.60			
Calcium	me/100g	6.4	4.0 - 10.0			
Magnesium	me/100g	0.33	0.80 - 1.60			
Sodium	me/100g	0.12	0.20 - 0.50			
CEC	me/100g	14	12 - 25			
Total Base Saturation	%	50	50 - 85			
Volume Weight	g/mL	1.00	0.60 - 1.00			
Soil Sample Depth*†	mm	0-150				
Base Saturation %		K 0.9 Ca 45	Mg 2.4 Na 0.8			
MAF Units		K 3 Ca 8	Mg 7 Na 5			

The above nutrient graph compares the levels found with reference interpretation levels. NOTE: It is important that the correct sample type be assigned, and that the recommended sampling procedure has been followed. R J Hill Laboratories Limited does not accept any responsibility for the resulting use of this information. IANZ Accreditation does not apply to comments and interpretations, i.e. the 'Range Levels' and subsequent graphs.

Soil Analysis Results							
Sample Name:		75mm	150mm				
Lab Number:		2711133.1	2711133.2				
Sample Type:		SOIL Mixed Pasture, Dry Stock	SOIL Mixed Pasture, Dry Stock				
Sample Type Code:		S82	S82				
pH	pH Units	5.7	5.7	-	-	-	-
Olsen Phosphorus	mg/L	18	11	-	-	-	-
Potassium	me/100g	0.15	0.13	-	-	-	-
Potassium	%BS	1.1	0.9	-	-	-	-
Potassium	MAF units	3	3	-	-	-	-
Calcium	me/100g	6.1	6.4	-	-	-	-
Calcium	%BS	42	45	-	-	-	-
Calcium	MAF units	8	8	-	-	-	-
Magnesium	me/100g	0.47	0.33	-	-	-	-
Magnesium	%BS	3.2	2.4	-	-	-	-
Magnesium	MAF units	10	7	-	-	-	-
Sodium	me/100g	0.14	0.12	-	-	-	-
Sodium	%BS	1.0	0.8	-	-	-	-
Sodium	MAF units	6	5	-	-	-	-
CEC	me/100g	14	14	-	-	-	-
Total Base Saturation	%	48	50	-	-	-	-
Volume Weight	g/mL	0.99	1.00	-	-	-	-
Soil Sample Depth*†	mm	0-75	0-150	-	-	-	-

6.2 Site Photos

6.2.1 Site 1

Site one was dug to a depth of approximately 1 metre where the water table was found. Note evidence of mottling (yellow-brownish spots) throughout soi profile after first 30cm, illustrating anoxic conditions illustrating poor drainage.

6.2.2 Site 2

Site 2 similar to that of site 1, and photo on right showing mottling in subsoil.

6.2.3 Site 3

Photo on left illustrating soil profile while on right illustrating the topsoil which is free draining and has a reasonably good structure.

6.2.4 Site 4

Photo on left showing topsoil and some mottling from subsoil and on the right showing the hard subsoil and mottling.

6.2.5 Site 5

6.2.6 Site 6

6.2.7 Site 7

6.2.8 Site 8

6.2.9 Site 9

6.3 LUC Classsifications

LUC UNIT Us 1 (32 110 ha)-Figure 17

This unit occurs on flat river terraces and plains. Soils are moderately deep, with 45 to 90 cm of free-draining alluvium overlying gravels, e.g., Kopua series. These soils are light textured, and slightly more susceptible to summer drought than LUC class I units. However, with adequate soil moisture, summer irrigation in lower rainfall areas, and conservation measures to minimise the slight wind erosion potential (which exists under cultivation), a wide variety of crops can be grown. These include cereals, vegetables, asparagus, process peas, potatoes, berry fruit, pip and stone fruit, grapes, and root and green fodder crops. Kiwifruit may be grown given adequate shelter and irrigation. The versatility of this unit is not being fully utilised at present. The dominant land uses are intensive grazing, dairying, and root and green fodder cropping, rather than intensive cropping. Rainfalls range between 800 and 2000 mm/annum. The unit occurs mainly in the Wairarapa Valley and between Eketahuna and Tikokino.

The present average stocking rate is 12 su/ha, but grazing potential is high, 27 su/ha. The forestry site index figure for *P. radiata* is medium to high, 27-30 m.

Note that Us1 is 2s1.

LUC UNIT IIwl (37 810 ha)-Figure 8

This unit is mapped on plains and river terraces on the Heretaunga Plains, between Waipawa and Eketahuna, and in the Wairarapa Valley. In addition, small areas are mapped on river valleys in the hill country throughout the region. Annual rainfalls vary from 700 mm at Hastings to 1400 mm at Pahiatua. The flat river terraces have deep soils with a high natural fertility, but with slow natural drainage in the subsoils. A continuing slight wetness limitation to mainly horticultural land use remains after drainage. Water table levels rise seasonally, and areas of ponding can occur after heavy rain.

Both recent and gley soils have been mapped, typical soils being Kairanga silt loam, and Ahikouka silt loam.

A wide range of crops can be grown, and with appropriate drainage it is suitable for deeper rooting crops. Crops include berry fruit, market garden vegetables, asparagus, cereal crops (barley, maize, wheat), pip fruit, and root and green fodder crops. Some kiwifruit and stone fruit may be grown in sheltered or frost-free areas. Shelter is required for all cropping in the southern half of the region. Some areas of this unit south of Pahiatua, are presently used for dairying with a present average stocking rate of 1 2 su/ha. Potential stock carrying capacity is 28 su/ha, with forestry site index for *P. radiata* ranging from 28 to 33 m.

Erosion is not a problem, except near streams where streambank erosion may remove productive soils.

LUC UNIT IIIwl (44 750 ha)-Figure 9

This unit is mapped on narrow valley bottoms or on poorly-drained alluvial flats. These areas have moderately high and fluctuating water table levels, and a moderate wetness limitation continues even after drainage. Runoff from surrounding hill country and periodic flooding contribute to this continuing wetness limitation. Rainfalls range between 800 and 1600 mm/annum.

Soils are recent alluvial or gley soils, and include Kairanga silt loam, Ahikouka silt loam, and Kaiapo silt loam and heavy silt loam. These have developed under conditions of slow natural drainage, and subsoils are gleyed or mottled. These poor internal drainage characteristics restrict the potential for intensive cropping. Soil wetness also limits early cropping. This type of land is suitable for dairying, but winter feed crops for stock are limited because of practical difficulties in feeding out. Present cropping is mostly maize or fodder crops, hay, silage; grass seed, and less frequently cereals (in lower rainfall areas) and green vegetables.

Potential stock carrying capacity is 26 su/ha, although the present average rate is only 12 su/ha. The forestry'site index for P. *radiata* is estimated at 28 to 30 m.

Slight streambank erosion, flooding and deposition are potential hazards in narrow valley bottom situations.

LUC UNIT ills 1 (33 060 ha)-Figure 36

This unit is mapped on flat, loess-covered terraces occurring in the drier inland areas of Central Hawke's Bay and the Wairarapa Valley. These terraces are older than present flood plains, and occur at higher elevations. Annual rainfalls range between 700 mm and 1000 mm. A marked dry season with prolonged periods of soil moisture deficiency can be expected to occur in summer. Soils are yellow-grey earths that have poor internal drainage and poor soil structure. Typical soils mapped are Martinborough loam, and Waipukurau sandy loam. The light-textured topsoils will not withstand continuous cultivation. Slow internal drainage, caused by the compact dense subsoil, together with poor soil structure and summer droughts, impose moderate cropping limitations on this unit and make it unsuitable for most permanent horticultural and orchard crops (except for grapes and strawberries). The range of crops grown is limited to some cereals (barley, oats, wheat, maize), peas, small seeds (ryegrass, clover, pea seed) grapes, and root and green fodder cropping. Some berry fruit (strawberries) may be grown in areas with more favourable climatic and drainage conditions. A slight wind erosion problem exists with regular cultivation, and the establishment of windbreaks is recommended. Intensive subsurface drainage (tile and mole) is essential to reduce wetness limitations, and to increase the cropping versatility of this unit.

Present average carrying capacity is 14 su/ha but with drainage and intensive grazing a potential of 23 su/ha exists. The unit is also suitable for forestry, with a site index value for *P. radiata* between 26 and 30 m.

Note that ills1 is 3s1

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