BEFORE THE INDEPENDENT HEARINGS PANEL

UNDER	the Resource Management Act 1991
AND	
IN THE MATTER OF	the submissions of B & A Stokes on the Waimakariri Proposed District Plan (#214) and Variation 1 (#29)

PRIMARY EVIDENCE OF VICTOR MTHAMO
ON BEHALF OF B AND A STOKES

(Soils)

4 March 2024

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1 EXECUTIVE SUMMARY

1.1 The site is located at 81 Gressons and 1375 Main North Road, Waikuku (the **Site**) and is approximately 144ha in size. The Stokes' submissions on the notified Proposed Waimakariri District Plan (**PDP**) seek to rezone the Site from a mixture of Large Lot Residential Zone (**LLRZ**), Rural Lifestyle Zone (**RLZ**) and Large Lot Residential Zone Overlay (**LLRZO**) (as notified) to General Residential / Medium Density Residential Zoning (the **Proposal**). Development of the Site in accordance with that zoning would occur in accordance with an Outline Development Plan included as Appendix A of Mr Clease's evidence.

1.2 "Highly productive land" (**HPL**) or versatile soils are regarded as the best possible land or soils for agricultural production because of their properties.

1.3 Under the National Policy Statement for Highly Productive Land 2022 (**NPS-HPL**), HPL is land which is zoned general rural or rural production and is predominantly classified as Land Use Capability (**LUC**) 1, 2 and 3.

1.4 The Site is comprised of LUC Class 1 and 2 land meaning it is completely made up of qualifying soils. However it is excluded from the NPS-HPL transitional definition of HPL because it is subject to a Council-initiated plan change, being the PDP, which proposes to zone the Site to the RLZ and the LLRZ (being a rural lifestyle zone or urban zone respectively).[1]

1.5 A memorandum prepared by Mr Mark Buckley (the s42A reporting officer) on behalf of the Waimakariri District Council (**WDC**) reached the same conclusion, determining that the NPS-HPL does not apply to the proposed two zones at the Site.[2]

1.6 The Canterbury Regional Policy Statement 2016 (**CRPS**) defines "versatile soils" as land classified as LUC 1 or 2. That definition is not bound to any zoning and, as such, the Site comprises versatile soils under the CRPS. The directions of the CRPS as they relate to versatile soils focus on avoiding, remedying or mitigating the adverse effects of

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1 National Policy Statement for Highly Productive Land, clause 3.5(7).

2 Buckley M, 30 June 2023. *Waimakariri District Plan Review – Memorandum to Hearing Panel,* S42A Reporting Officer for Rural Zones, [19].

development on the productivity or productive capacity of soils and their ability to support primary production now and into the future.[3]

1.7 In that context, there are, in my opinion, some 'constraints' which will (in some cases significantly) affect the productive capacity of the Site. These include poor drainage in some parts of the Site, nutrient limits, and the Drinking Water Protection Zone. The impacts of these factors are as follows:

(a) *Drinking Water Protection Zone*. The water supply source for Waikuku is taken from a bore opposite the Site to the north across Gressons Road. This is within a drinking water protection zone which overlays part of the Site and thus potentially reduces the area of land that is available for productive use.

(b) *Soils*. While the soils are predominantly classified as LUC 1 and 2, there are some variabilities in the nature and extent of those soils across the Site. Some spatial variability even over short distances affects the management of the land for productive purposes.

(c) *Poor Drainage*. Over 70% of the Site's soils are gley soils which are characterised by poor drainage. This has the potential to impact the Site's productive potential.

(d) *Nutrient limits*. The Site's soils are such that application of nutrients to the Site would be essential to support land-based primary production activities. However, strict nutrient limits are currently in place through the Canterbury Land and Water Regional Plan (**CLWRP**) which would significantly constrain the use of nutrients at the Site. Those limits are unlikely to ease in the short or medium term.

(e) *Available productive land*. The Site represents a reduction in the total regional and district productive or versatile soils of only 0.03% and 0.24% respectively under the CRPS definition of versatile soils.

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[3] CRPS, policy 5.3.2, supporting principal reasons and explanation; Chapter 15 – Soils, Introduction. Objective 15.3.1.

1.8 I therefore conclude that the Proposal will not result in any more than a negligible loss of LUC Class 1 and 2 soils within both the district and the region. In my opinion, the adverse effects of that loss are also negligible given the Site is subject to a number of constraints which significantly limit its productive capacity over the long term.

2 QUALIFICATIONS AND EXPERTISE

2.1 My full name is Victor Mkurutsi Mthamo and I am a Principal Consultant for the environmental science, engineering and project management consultancy Reeftide Environmental and Projects Limited (**Reeftide**). I have been in this role for almost 12 years. Prior to this, I was a Senior Associate with the surveying, environmental science and engineering, and resource management consulting firm CPG New Zealand Limited (now rebranded to Calibre Consulting Limited) where I was also the South Island Environmental Sciences Manager. I have worked in the area of environmental science and engineering for over 29 years.

2.2 I have a Bachelor's degree in Agricultural Engineering (Honours) with a major in Soil Science and Water Resources (University of Zimbabwe); Master's degree in Engineering Science in Water Resources (University of Melbourne in Victoria, Australia); and Master of Business Administration (University of Zimbabwe). I hold an Advanced Certificate in Overseer Nutrient Management modelling qualification.

2.3 I am also a member of Engineering New Zealand (MEngNZ), a Chartered Professional Engineer (CPEng) and an International Professional Engineer (IntPE). I am a past National Technical Committee Member of Water New Zealand and New Zealand Land Treatment Collective (NZLTC).

2.4 My specific experience relevant to this evidence includes:

(a) Stormwater planning, catchment hydraulic and hydrological modelling and design.

(b) Presenting evidence at an Environment Canterbury (**ECan**) hearing on catchment wide modelling that I carried out to assess the effects of flooding in the lower reaches of the Waitaki catchment in South Canterbury.

(c) Regular engagement by Christchurch City Council (**CCC**) as a Three Waters Planning Engineer. In this role as a stormwater planning engineer, I review stormwater designs and modelling by various engineers from consulting firms and I peer review their reports (concepts, calculations and detailed designs) and provide them with the required guidance for solutions that are acceptable to the CCC. As a result, I am conversant with various hydrological modelling tools, flooding assessments and flood mitigation.

(d) Designing and implementing numerous on-farm irrigation schemes, soil investigations and land use assessments. Examples of projects include the Hunter Downs Irrigation Scheme, the North Bank Hydro Project, the Mararoa-Waiau Rivers Irrigation Feasibility Study and the North Canterbury Lower Waiau Irrigation Feasibility Assessment.

(e) Assessing large subdivisions in relation to stormwater management, earthworks and the associated actual and potential impacts on soils, groundwater and surface waterways and how to effectively use erosion and management control plans to mitigate the potential impacts that may occur during the construction works.

(f) Assessing effects on soils and groundwater associated with onsite and community wastewater discharge systems such as the Wainui Community wastewater discharge consent.

(g) Assessing actual and potential effects on groundwater and surface water associated with groundwater and surface water takes.

(h) Providing quarry soils and rehabilitation expert evidence for the extension of the Road Metals Quarry on West Coast Road in Templeton in 2018. My evidence at the hearing covered the effect on soils and groundwater resulting from the changes to site levels post rehabilitation. I assessed the effectiveness of adopting a 300 mm topsoil layer and whether or not this was sufficient for plant growth and providing contaminant attenuation, treatment and removal to protect the underlying groundwater.

(i) Acting as a soils and rehabilitation expert witness for the proposed Roydon Quarry in Templeton in 2019 and 2020. Fulton Hogan's proposal was for the establishment of a quarry and extraction of aggregate. I provided an assessment of the soils' versatility and the effect of the requested changes to the land use on the land's productivity potential.

(j) Acting as an expert witness at the proposed Fulton Hogan Miners Road Quarry extension in 2020 and 2021. I provided an assessment of the soils, their versatility and productivity potential both with and without mitigation post quarrying.

(k) More recently, I have been involved with a number of Plan Changes across Canterbury. These include:

(i) Plan Change 66 (PC66) in Rolleston.

(ii) Plan Change 67 (PC67) in West Melton.

(iii) Plan Change 68 (PC68) in Prebbleton.

(iv) Plan Change 69 (PC69) in Lincoln.

(v) Plan Change 71 (PC71) in Rolleston.

(vi) Plan Change 74 (PC74) in Rolleston.

(vii) Plan Change 75 (PC75) in Rolleston.

(viii) Plan Change 79 (PC79) in Prebbleton.

(ix) Plan Change 80 (PC80) in Rolleston.

(x) Plan Change 31 (PC31) in Ohoka.

2.5 I have been involved with this Proposal since September 2021 when I was engaged by Mr & Mrs B & A Stokes (**the submitter**) to carry out an assessment of the potential flooding associated with the proposed development should the Proposal be granted. In October 2023 I was also engaged by the submitter to carry out a desktop assessment of the actual and potential effects of the Proposal on the productive potential of land and soils.

3 CODE OF CONDUCT

3.1 While this is not an Environment Court proceeding, I confirm that I have read the Code of Conduct for Expert Witnesses set out in the Environment Court Practice Note 2023. I have complied with the Code of Conduct in preparing this evidence and will continue to comply with it while giving oral evidence. Except where I state that I am relying on the evidence of another person, this written evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in this evidence.

4 SCOPE OF EVIDENCE

4.1 I have been requested by the submitter to provide evidence in support of the Proposal at the Site.

4.2 My evidence addresses:

(a) the effect of the Proposal on the Site's production potential by considering:

(i) the soils and environmental factors impacting the Site's productive potential; and

(ii) the effects of the Proposal on the potential loss of productive land resulting from change of land use; and

(b) the overall impact, if any, on the loss of the soil productive potential.

4.3 In preparing my evidence, I have reviewed and considered the following:

(a) Sections of the PDP and reports that are relevant to my area of expertise.

(b) The Section 42A Officer's Report: Whaitua Taiwhenua – Rural Zones Report prepared by Mark Buckley, dated 8 September 2023.

(c) The relevant submissions on the PDP relevant to the Site and to the area of expertise.

(d) The NPS-HPL.

(e) The evidence of Mr Neil Charters and Mr Andrew Hall on behalf of the submitter.

5 DESCRIPTION OF THE SITE, LAND USE, CURRENT AND PROPOSED ZONING

Location

5.1 The Site is surrounded by the Waikuku Township to the north, State Highway 1 to the east, rural farmland to the west, and Wards Road to the south with the subsequent Ravenswood development just south of Wards Road. **Appendix 1** shows the location of the Site.

Land use

5.2 The Site is an established dairy farm. There are existing buildings on the Site, notably residential dwellings and garages, farm buildings and ancillary sheds.

5.3 The Site has a flat topography with a moderate slope from north-west to east and southeast. The Site contours show an approximate ground surface elevation of approximately RL 11.5 m at the north-western boundary and a minimum elevation of approximately RL 6.5 m at the east and south-eastern boundary.

Groundwater and surface water

5.4 The bore logs in and around the Site provide data on the groundwater levels within the area. These show that:

(a) The highest groundwater level is 0-2.88 metres below ground level (mbgl) based on Wells M35/8110 and BW024/0433 respectively. These groundwater levels are consistent with those noted in the evidence of Mr Charters which states that *"The groundwater levels varied between 0 m to 2.6 m across the Site. CPTs 7, 8, 10, 11, 21, 22, 28, 29 and 30 encountered artesian conditions where water was flowing at the surface once the CPT rods had been removed from the hole (or encountered very shallow in the CPT hole)"*.[4]

[4] Evidence of Neil Charters, at [7.3].

(b) Wells M35/8110 and BW024/0433 are located close to the eastern boundary which is the lowest part of the Site.

(c) Topsoils are found in the top 0.6 mbgl.

(d) Blue/grey silty/clayey gravels from below the topsoil to 2-3 mbgl.

(e) Water bearing gravels 2-7 mbgl.

5.5 There are a number of surface water ways in and around the Site. These are shown in **Appendix 2**. These include drains and streams of various sizes:

(a) The Taranaki Stream runs south of the Site.

(b) The Waikuku Stream runs through the northern tip of the Site before it crosses Gressons Road.

(c) A farm drain known as Stokes Drain runs across the Site. Most of the flow within Stokes Drain originates from land to the west of the Site but there are additionally some on-site springs that feed into it. This is discussed in more detail in the evidence of Mr Hall.

Description of the soils

5.6 Canterbury Maps and S-Maps provide details of the soils found at the Site.[5] The main soil types and their properties are presented in **Table 1**.

Table 1 – Soil Types and Area Under Each Soil Type

Soil Name	Sibling	Soil Texture	Depth (cm)	Permeability	Area (ha)	Proportion
Temuka	Temu_49a.1	Silt over Clay	>100	Moderate/ Slow	66	48.10%
Wakanui	Waka_1a.1	Silt	>100		30	21.90%
Flaxton	Flax_1a.1	Silt	>100		30	21.80%
Templeton	Temp_1a.1	Silt	>100		4	2.90%
Wakanui	Waka_2a.1	Silt	45-90		3	2.20%
Templeton	Temp_2a.2	Silt	55-90		2	1.30%
Eyre	Eyre_4a.1	Loam	20-30	Moderate/ Rapid	1	0.80%
Eyre	Eyre_2a.1	Loam	20-45		1	0.80%
Kaiapoi	Kaia_1a.1	Silt	>100	Moderate	<1	0.20%

[5] Landcare Research, S-Map Online, *https://smap.landcareresearch.co.nz/1*

Soil Name	Sibling	Soil Texture	Depth (cm)	Permeability	Area (ha)	Proportion
Templeton	Temp_1a.2	Silt	>100	Moderate/ Slow	<1	0.00%
Total					**137**	**100%**

5.7 **Table 2** summarises the drainage properties of the Site and the areas under each drainage class.

Table 2 – Drainage Properties of the Soils

Drainage Description	Area (ha)	Percentage (%)
Poorly Drained	96	70.1%
Imperfectly Drained	33	24.0%
Moderately Well Drained	6	4.4%
Well Drained	2	1.5%
Total Area	**137**	**100**

5.8 Tables 1 and 2 show that 70% of the soils have poor drainage and over 98% of the Site's soils have moderate to slow permeability.

5.9 Generally, poor drainage can have a significant detrimental impact on the soil's productive potential and crop/plant yields unless the crop types grown are suited to wet feet (that is, a flooded or soggy root zone).

6 LAND USE CAPABILITY CLASSIFICATION AND THE SITE SOILS

LUC classification

6.1 LUC Classification is a land categorisation system in use in New Zealand which seeks to achieve sustainable land development and management on farms. The LUC Survey Handbook (Lynn et al. (2009))[6,7] provides a qualitative evaluation system which has been widely applied in New Zealand for land use planning, especially for management and conservation.

6.2 The LUC classification system defines eight LUC classes (refer **Figure 1**). Classes 1–4 are classified as arable land, while LUC Classes 5–8 are non-arable. The best soils or arable farming are those soils in Class 1,

[6] Lynn IH, Manderson AK, Page MJ, Harmsworth GR, Eyles GO, Douglas GB, Mackay AD, and Newsome PJF, 2009. *Land Use Capability survey handbook: a New Zealand handbook for the classification of land,* 3rd ed. Hamilton, AgResearch; Lincoln, Landcare Research; Lower Hutt, GNS Science. 163 p.

[7] Lynn et al., (2009), *Land Use Capability Survey Handbook*, 3rd Edition, https://www.tupu.nz/media/jzbjrpy4/land-use-capability-luc-survey-handbook-3rd-edition.pdf

2, or 3 as delineated by the New Zealand Land Resource Inventory (New Zealand Soil Bureau amended 1986). As I also noted in paragraph 1.6 and discuss in more detail in paragraphs 7.11-7.13, under the CRPS versatile soils are soils in LUC Classes 1-2.

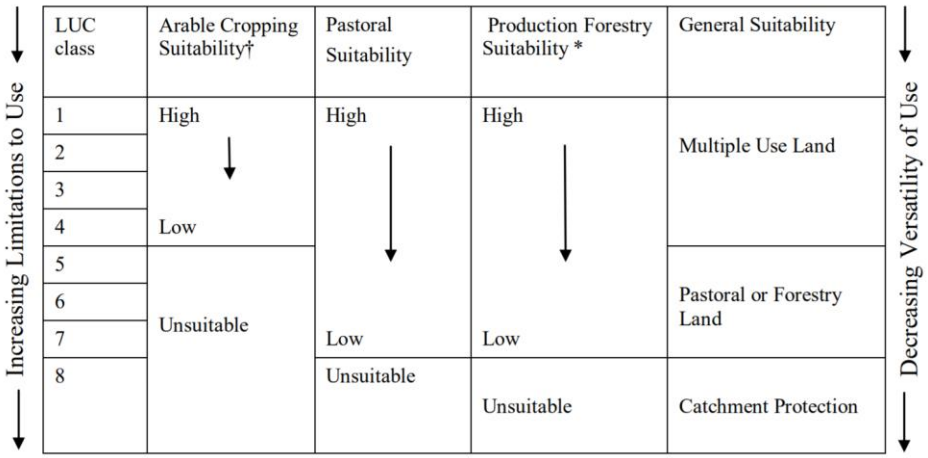

Figure 1 – Relationship between the Versatility and LUC Classes (Lynn et al, 2009[8])

LUC classes of the soils within the Site

6.3 The LUC Classes of the soils within the Site are mapped on Canterbury Maps[9], and Land Resource Information System (**LRIS**) Portal.[10] Based on the LRIS, all 136.7 ha of the Site is comprised of LUC Classes 1 and 2 soils. The proportions of LUC 1 and 2 soils are presented in **Table 3** below. **Appendix 3** shows the locations and areas of the LUC Classes in and around the Site.

Table 3 – Gross Default LUC Classes within the Site

LUC Class	**Area (ha)**	**%age**
LUC 1w	6.38	4.7%
LUC 2w	130.32	95.3%
Total	**136.7**	**100%**

7 RMA DOCUMENTS

National Policy Statement for Highly Productive Land

7.1 The NPS-HPL came into effect on Monday 17 October 2022. The NPS-HPL seeks to protect HPL for use in land-based primary production, both

8 *https://www.tupu.nz/media/jzbjrpy4/land-use-capability-luc-survey-handbook-3rd-edition.pdf*
9 Canterbury Maps Viewer, https://mapviewer.canterburymaps.govt.nz
10 https://soils.landcareresearch.co.nz/soil-data/the-lris-portal/

now and for future generations. "*Land-based primary production*" encompasses production from agricultural, pastoral, horticultural, or forestry activities that are reliant on the soil resource of the land.[11] To achieve this, the NPS-HPL requires the identification of HPL at a regional level, and imposes varying levels of constraint on the rezoning, subdivision, land use and development of that land.

Highly Productive Land

7.2 Until that regional identification (through mapping) occurs, the NPS-HPL (including its various constraining provisions) will only apply to land that, at the commencement date of the NPS-HPL, meets the transitional definition of "highly productive land".[12] The two inclusionary criteria for that definition are that the Site is:

(i) zoned general rural or rural production; and

(ii) LUC 1, 2 or 3 land.

7.3 Clause 3.5(7)(b) excludes land from the definition of HPL where it is:

(i) identified for future urban development; or

(ii) subject to a Council initiated, or an adopted, notified plan change to rezone it from general rural or rural production to urban or rural lifestyle.

7.4 The intent of Clause 3.5(7)(b) is to ensure future urban development areas are only excluded from being classed as HPL (under the transitional definition and mapping) when there is a high level of certainty the land will be developed for urban use in the next 10 years.[13]

7.5 As noted in paragraph 6.3, the LRIS mapping shows that the Site is comprised of 136.7 ha of LUC Class 1 and 2 soils. Consequently, if the Site meets criteria *(i)* (and is not otherwise excluded by the remaining criteria, discussed below)[14], it will meet the definition of "*highly productive land*" in clause 3.5(7)(a).

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11 National Policy Statement for Highly Productive Land 2022, clause 2.1.
12 National Policy Statement for Highly Productive Land 2022, Clause 3.5(7).
13 National Policy Statement for Highly Productive Land 2022, section 1.3.
14 That is, land which is identified for future development or is subject to a Council initiated, or an adopted, notified plan change to rezone it from general rural or rural production to urban or rural lifestyle, is excluded from the transitional definition of highly productive land.

Rural lifestyle or urban zoning

7.6 The notified PDP splits the Site into two zones (refer **Appendix 4**). These are the:

(a) **RLZ - Rural Lifestyle Zone**. This is for areas primarily used for residential lifestyle with a rural environment, on lots smaller than those of General Rural and Rural Production zones, whilst still enabling primary production to occur. The size of this area on the Site is approximately 103.5 ha.

(b) **LLRZ - Large Lot Residential Zone**. The purpose of the zone is to provide residential living opportunities for predominantly detached residential units on lots larger than other Residential zones. The size of this area on the Site is approximately 33.2 ha.

7.7 The LLRZ is an 'urban zone' within the NPS-HPL definition.

7.8 The Site is therefore excluded from the definition of HPL under the NPS-HPL on the basis that it is subject to a Council-initiated notified plan change (being the PDP) which proposes to rezone it to rural lifestyle or an urban zone.

7.9 A WDC memorandum prepared by Mr Mark Buckley (the s42A reporting officer) to help with the interpretation and the relevance of the NPS-HPL on the proposed rural zones concluded that the NPS-HPL did not apply to the zoning proposed for the Site.[15]

7.10 I therefore conclude that the NPS-HPL does not apply to the Site because it is excluded from the definition of HPL land in clause 3.5(7)(b)(ii).

Canterbury Regional Policy Statement 2016

7.11 The CRPS defines "versatile soils" as land classified as LUC 1 or 2. That definition is not tied to any zoning nor does it identify any exclusions (for example, where the land in question is identified for future development).

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[15] Buckley M, 30 June 2023. *Waimakariri District Plan Review – Memorandum to Hearing Panel,* S42A Reporting Officer for Rural Zones, [19].

7.12 On that basis, the Site (which comprises LUC 1 and 2 soils) is versatile land under the CRPS.

7.13 The CRPS directions focus on avoiding, remedying or mitigating the adverse effects of development on the productivity or productive capacity of soils and their ability to support primary production now and into the future.[16] In that context (and noting that those directions should, as I understand it, be read in the context of the NPS-HPL), I address the productive capacity of the Site soils below and the extent to which they would be compromised by the Proposal.

8 PRODUCTIVE CAPACITY OF THE SITE SOILS

Introduction

8.1 "Productive capacity" can generally be defined as the ability of the land to support land-based primary production over the long term, based on an assessment of:

(a) physical characteristics (such as soil type, properties, and versatility);

(b) legal constraints (such as consent notices, local authority covenants, and easements); and

(c) the size and shape of existing and proposed land parcels.

8.2 Similar guidance has previously been given by the Environment Court on factors which indicate productive capacity (illustrated in **Table 4** below).[17]

Table 4 – List of Factors Determining Versatility (Treadwell, 1997[18])

Soil texture	Soil structure	Soil water holding capacity
Soil organic matter stability	Site's slope	Site's drainage
Temperature of the site	Aspect of the site	Stormwater movements
Floodplain matters	Wind exposure	Shelter planted
Availability of irrigation water	Transport, both ease and distance	Effect of the use on neighbours

16 CRPS, policy 5.3.2, supporting principal reasons and explanation; Chapter 15 – Soils, Introduction. Objective 15.3.1.
17 *Canterbury Regional Council v Selwyn District Council* [1997] NZRMA 25 at Appendix II.
18 Above n16.

Access from the road	Proximity to airport	Proximity to port
Supply of labour	Previous cropping history	Soil contamination
Sunlight hours	Electricity supply	District scheme
Economic and resale factors		

8.3 Based on my desktop analysis, observations from my Site visit and discussions with Mr and Mrs Stokes (11th of October 2023), a number of the factors in Table 4 affect or are relevant to the Site which I consider constrain land-based primary production at the Site.

8.4 I now discuss the relevant factors and the extent to which the limitations may or may not be able to be managed.

Existing Site areas/features

8.5 The areas in my Tables 1-3 above identify the gross areas of the Site which contain LUC 1-2 soils; however, it is important to note that not all of the soils comprising this area are productive.

8.6 For example, parts of those areas include the homesteads, fenced waterways and riparian areas. Those are not currently being, nor are capable of being, grazed or farmed and, as such, they cannot be said to have productive capacity. I estimate the non-productive area of the Site to consist of 10-25% based on the high-level maps on Canterbury Maps. For this Site, with numerous drains and a large waterway, I have adopted a conservative 15% as a reasonable estimate of the unproductive areas. This was confirmed by Mr and Mrs Stokes during a meeting at the Site on the 11th of October 2023.

8.7 Therefore, I estimate the unproductive area of the Site conservatively to consist of approximately 21 ha. The resultant net productive area is estimated at 115.7 ha. Most (just over 95%) of these unproductive areas are within the LUC Class 2 soils. The productive LUC Class 1 and 2 soils are therefore 5.3 ha and 110.4 ha respectively.

Soils

8.8 As outlined above, the soils are LUC Classes 1 and 2 with LUC Class 2 soils making up over 95% of the Site. However, as outlined in paragraph 8.7, after excluding the unproductive areas within LUC Class 1 and 2 soils the area of productive land is 115.7 ha. The LUC 1 and 2

classifications theoretically indicate their suitability for arable cropping (paragraphs 6.2 and 6.3). Table 1 shows that soil properties such as depth and permeability vary within each soil type and between soil types. For example:

(a) The soils have various textures and these have different management requirements if their capacity is to be maximised. However, for convenience they are generally treated the same with the restrictions imposed by the worst soil type often determining the management requirements at the expense of the other soil types.

(b) The variability in soil properties has implications for the management of the soils and crops if the soil's productivity potential is to be achieved. This can result in an additional management burden as the different soil units can lead to differences in germination times, irrigation needs during the growth of crops, and differences in optimal harvest dates. It can also lead to variability in overall yields, which could impact the economic viability of primary production on what is already a small area of land.

Groundwater

8.9 The Temuka and Flaxton soils are of the Gley Soil Order and are defined as poorly drained. They make up over 70% of the Site's soils. The Temuka and Flaxton soil reports on S-Maps provide the following descriptions for the soils:

(a) Gley soils are strongly affected by waterlogging, have been chemically reduced, have light grey subsoils, and usually have reddish brown or brown mottles.

(b) Waterlogging occurs in winter and spring, and some soils remain wet all year.

(c) The topsoil typically has silt or clay texture and is stoneless. The subsoil has dominantly clay textures.

(d) Generally the soil is poorly drained with very high vulnerability to water logging in non-irrigated conditions and has moderate to high soil water holding capacity.

(e) Inherently these soils have a moderate structural vulnerability and a very low nitrate leaching potential, which should be accounted for when making land management decisions.

8.10 Therefore, while the Site's soils may be LUC 1 and 2, soil drainage can have an effect on crop/plant productivity as some crops/plants do not do well in poorly drained soils. Reid and Morton (2019) carried out surveys of commercial crops in Hawke's Bay and Gisborne in 1998–1999 and 1999–2000 and concluded that:[19]

> *…70% lost yield because of insufficient or poorly timed irrigation, and 84% lost yield because of inadequate nutrition. The nutrients most usually in short supply were nitrogen (N) and phosphorus (P). However, extra fertiliser will not compensate for poor crop establishment, water stress, or waterlogging due to heavy rain, excessive irrigation or poor drainage*.

8.11 This means that plants/arable crops that do not tolerate waterlogged soils may not do well on some parts of the Site. Common crops that do not tolerate wet feet include swedes, barley, chicory, lucerne, pipfruit, stonefruit, berryfruit, avocadoes, carrots and onions.

Effects of the Drinking Water Protection Zone

8.12 The Waikuku Township water supply comes from Well M35/7340. The Canterbury Map GIS shows the drinking water protection zone for this bore. **Appendix 5** shows the extent of the protection zone which is over an approximate gross area of 22.8 ha (or an approximate net area of 19.4 ha) of the Site. 3.1 ha of the net 19.4 ha is LUC Class 1 and the remainder (16.3 ha) is LUC Class 2 soil.

8.13 The purpose of the protection zone is to ensure that activities that might have adverse effects on the drinking water supply are restricted so as to protect the community water supply. This means that intense agricultural activity within the protection zone would be limited. The following are examples of provisions in the CLWRP and the associated

[19] https://www.vri.org.nz/dmsdocument/93-nutrient-management-for-vegetable-crops-in-nz-recommendations

sub-regional plan (Section 8 – Waimakariri) that may directly or indirectly affect the possible use of the land within a drinking water protection zone:

(a) Policy 4.14 which relates to "*Any discharge of a contaminant into or onto land where it may enter groundwater"* and ensuring that *"there is sufficient distance between the point of discharge, any other discharge and drinking-water supplies to allow for the natural decay or attenuation of pathogenic micro-organisms in the contaminant plume*."

(b) Policies 4.23 and 4.23A which seek protection of the drinking water supply sources by implementing a protection zone.

(c) Policy 4.31 which relates to livestock exclusion from water bodies.

(d) Rule 5.22 which relates to "*The discharge of an agrichemical, or agrichemical equipment or container…into or onto land*."

(e) Rule 5.31 which is for stock holding areas and animal effluent.

(f) Rule 5.33 which relates to "*The use of land for the collection, storage and treatment of animal effluent*."

(g) Rule 5.36 which relates to "*The discharge of animal effluent or water containing animal effluent*."

(h) Rule 5.71 which relates to "*The use and disturbance of the bed (including the banks) of a lake or river by any farmed cattle, farmed deer or farmed pigs and any associated discharge to water*."

8.14 The effect of these rules which apply to the protection zone would, in my opinion, limit the productive capacity over the part of the Site to which that zone applies. Accounting for that area, the net productive areas under both LUC Classes 1 and 2 would be reduced to 2.2 ha and 94.1 ha respectively.

8.15 In **Table 5** below I summarise the net areas (excluding the drinking water protection zone, the tracks, riparian areas and other unproductive areas identified above) under LUC Classes 1 and 2 within the Site.

Table 5 – Net productive area within the Site (after considering non-productive areas and the Drinking Water Exclusion Zone)

LUC Class	Area (ha)	Percentage
LUC 1w	2.2	2.3%
LUC 2w	94.1	97.7%
Total	**96.3**	**100%**

Effects of the CLWRP provisions on land productivity

Canterbury Land and Water Regional Plan and Plan Change 7

8.16 The CLWRP and Plan Change 7 to the CLWRP seek to manage and require reductions in diffuse discharges of nitrogen, phosphorus, sediment and microbial pathogens from land use activities including commercial vegetable production through rules. For example:

(a) Policies 4.34 to 4.36 which relate to management of nutrient loss from farming among other activities. For example:

(i) Policy 4.36A relates to vegetable production requirements to achieve certain nutrient requirements.

(b) Policies 4.37 to 4.38H which apply to individual farming activities, nutrient user groups and farming enterprises. More specific to the Site, Policy 4.38 which applies to areas that are within the Orange Nutrient Allocation Zone. The Site is within the Ashley-Waimakariri Nutrient Allocation Zone which is Orange. Policy 4.38 seeks improved water quality outcomes by:

(i) avoiding the granting of any resource consent that will allow nitrogen losses from a farming activity to exceed the Baseline Good Management Practice (**GMP**) Loss Rate, except where Policy 4.38C applies; and

(ii) including on any resource consent granted for the use of land for a farming activity, conditions that;

- limit the nitrogen loss calculation for the farming activity to a rate not exceeding the Baseline GMP Loss Rate;

- require farming activities to operate at or below the GMP Loss Rate, in any circumstance where that GMP

Loss Rate has not been influenced by severe extraordinary events (including but not limited to droughts or floods) and is less than the Baseline GMP Loss Rate; and

- requiring a Farm Environment Plan as part of any application for resource consent to use land for a farming activity, and requiring that Farm Environment Plan to be prepared in accordance with Schedule 7 of this Plan.

(c) Rules 5.42CA to 5.42CD which set out the rules for vegetable production on a regional basis.

(d) Sub-regional Rules 8.5.21 to 8.5.26 which relate to the use of land >5 ha for farming activities and set out conditions for permitted to non-complying activities depending on the nitrate loss rates for the farming activity.

8.17 The nutrient requirements set out in the various rules seek to address excessive groundwater nutrient concentrations in the catchment over which the Site lies.

8.18 The CLWRP requires that baseline nutrient budgets be established based on the farming activities during the period of 2009-2013. For the land parcels which make up the Site, productivity has always been historically low. Therefore, the baseline nitrogen leaching rates are also very low.

Permanency of the nutrient limit constraints

8.19 Future nitrogen leaching rates are required to not exceed the baseline rates and where they do these must be reduced. I consider the nutrient limits to be a long-term constraint on the following basis:

(a) The groundwater nutrient concentrations being observed now within the groundwater catchment are primarily from activities of the 1970s, 80s, 90s and early 2000s. The effects of the more recent (1980s to the present day) intensification in dairying and other farming activities will manifest over the next several decades (approximately 20 to 40 years). The effects will be considerably

worse than what the catchment is experiencing now because of this intensification.

(b) Mitigation measures being implemented in compliance with the CLWRP will be unlikely to restore the nutrient levels to the pre-intensification levels. For these reasons, I consider that limits on nutrient use and applications will be a permanent constraint.

(c) It is also not unreasonable to expect further policies and regional rules to be tightened to reduce the use of nutrients.

8.20 Therefore, nutrient limiting policies and rules are a permanent long-term constraint for the Site.

Impacts of nutrient limits on productivity and farm economics

8.21 Any reductions in nitrogen fertilisers or limited use is accompanied by a decrease in yields, revenues and profitability. There is literature that supports this, including:

(a) A Landcare Research study called "*Modelling Economic Impacts of Nutrient Allocation Policies in Canterbury: Hinds Catchment*" in 2013 prepared for the Ministry for the Environment.[20] That research concluded that loss in productivity could result in revenue reductions of up to 41% with an average of 14% across the farming systems studied.

(b) Reports prepared by the Agribusiness Group (2014) (together the **Agribusiness Reports**) found significant reductions in yield and profitability resulting from nutrient reductions.[21,22]

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[20] Landcare Research (2013). *Modelling Economic Impacts of Nutrient Allocation Policies in Canterbury: Hinds Catchment.* Prepared for the Ministry for the Environment. https://environment.govt.nz/assets/Publications/Files/modelling-economic-impacts-of-nutrient-allocation-policies-canterbury.pdf

[21] The Agribusiness Group (2014). *Nutrient Performance and Financial Analysis of Lower Waikato Horticulture Growers.* Prepared for Ministry for Primary Industries and Horticulture NZ. https://www.waikatoregion.govt.nz/assets/WRC/Council/Policy-and-Plans/HR/Section-32/Part-E3/AgriBusiness-Group-2014.-Nutrient-performance-and-financial-analysis-of-lower-Waikato-horticulture-growers.-Document-8727329.pdf

[22] The Agribusiness Group (June 2014). *Nutrient Performance and Financial Analysis of Horticultural Systems in the Horizons Region.* Prepared for Horticulture NZ. https://www.horizons.govt.nz/HRC/media/Media/One%20Plan%20Documents/Nutrient-Performance-and-Financial-Analysis-of-Horticultural-Systems-in-Horizons-Region-2014.pdf?ext=.pdf

8.22 **Figure 2** below has been extracted from the Agribusiness Reports. It shows the corresponding yield reductions associated with reductions in nitrogen.

Appendix One: Average Estimated Reduction in yield with reduction in applied N.

Reduction in N	Potato (Summer), Onions, Carrots,	Squash, Broccoli, Lettuce,	Cabbage, Spinach, Cauliflower	Potato (Winter)	Barley
10%	10%	15%	15%	25%	25%
20%	20%	25%	30%	35%	35%
30%	30%	40%	40%	50%	45%

Figure 2 – Yield Reductions Due to Reductions in N Applications

8.23 The Agribusiness Reports also include budgets showing losses for some crops with the conclusion that "*At the 10% reduction in the amount of N applied the Gross Margin result is reduced to approximately one third to a half of that under the Status Quo situation and from there it dips towards a close to breakeven scenario which means that it would not be economic to grow the crop. This reflects the relatively tight margins which these crops are grown under*."[23]

8.24 Therefore, any natural capital from the remaining 96.3 ha of LUC Classes 1 and 2 land on the Site is negated by the statutory constraints relating to nutrient application limits imposed by the statutory planning rules.

Positive benefits of the Proposal

8.25 The Proposal seeks to convert dairy agricultural land to residential land. This means that any nutrient leaching into groundwater and flows into surface waterways from the farming activities which may be occurring as a result of the existing/historical uses of the Site would cease. The resultant adverse impacts on groundwater and surface water quality would also cease.

8.26 The Proposal will change the nature and character of the discharges from the Site so that:

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[23] The Agribusiness Group (June 2014). *Nutrient Performance and Financial Analysis of Horticultural Systems in the Horizons Region.* Prepared for Horticulture NZ. https://www.horizons.govt.nz/HRC/media/Media/One%20Plan%20Documents/Nutrient-Performance-and-Financial-Analysis-of-Horticultural-Systems-in-Horizons-Region-2014.pdf?ext=.pdf

(a) Wastewater will be reticulated and pumped to the Woodend Wastewater Treatment Plant.

(b) Stormwater will be the main source of discharges. Typical contaminants associated with stormwater are sediment, heavy metals and hydrocarbons. Nutrients (nitrates and phosphorus) and pathogens will also be likely contaminants. As noted below, the Proposal will encompass an extensive stormwater treatment system. As such,, any contaminants in stormwater discharge will be at levels significantly less than those discharged from dairy farming activities.

(c) Stormwater from the Proposal will be subject to the following management/treatment as discussed in the evidence of Mr Hall:[24]

> *The stormwater system for the Proposal involves a series of pipes and secondary flow paths that will drain to an integrated stormwater treatment and storage facility at the eastern end of the Site, being the Eastern SMA / Open Space…*
>
> *It is expected that each of the three parts of the Eastern SMA / Open Space will contained a first flush basin, treatment wetland and overflow storage to contain the 1 in 50-year storm event…*
>
> *Following treatment and attenuation, the stormwater flows will discharge to existing culverts under SH1.*

(d) Given the proposed stormwater management, I expect the removal of various contaminants associated with stormwater from the Proposal to levels below the limits in Schedule 8 of the CLWRP. Therefore, those discharges to the waterways will have no more than minor or less than minor effects on the receiving environments.

8.27 Another positive benefit of the Proposal is that the change in land use will mean:

(a) Any excess water from the irrigation consents, if not required for potable water supply at the Site, can be made available (transferred) to alternative sites with less constraints than the Site. This means that those alternative sites might become more productive as they will have access to more water for irrigation.

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[24] Evidence of Andrew Hall, at [9.1], [9.5] and [9.6].

(b) Any water that is not required at the Site for the development can be surrendered altogether which will assist ECan with the overallocated groundwater within the zone.

(c) The nitrate discharges under the Site will cease and this will help reduce the nitrate load with the Orange Zone Nutrient Allocation Area.

9 SCALE OF THE PROPOSAL AND REDUCTION IN VERSATILE SOILS

9.1 The estimated quantities of LUC Classes 1 and 2 soil based on information from various sources is summarised below:

(a) The Canterbury Region has 293,700 ha of Class 1 and 2 soils.[25]

(b) There are approximately 39,478 ha of LUC Class 1 and 2 within Waimakariri District.[26]

9.2 In **Table 6** below I give a sense of the proportional reduction in HPL within the district and the region as a result of the Proposal for the Site under the CRPS definition of versatile soils.

Table 6 – Proportion of the Site's HPL Under the CRPs

LU Class	**Canterbury (ha)**	**Waimakariri (ha)**	**Proposal Area (ha)**	**Potential Reduction in HPL Under the CRPS**	
				Canterbury	**Waimakariri**
LUC1	23,200	39,478.00	2.20	**0.03%**	**0.24%**
LUC2	270,500		94.10		
Area	**293,700**	**39,478.00**	**96.30**		

9.3 Using the CRPS definition of versatile soils, the reduction in versatile soils would be 0.03% and 0.24% in Canterbury and in the Waimakariri District, respectively. Therefore, the reduction in versatile soils as a result of the Proposal would be insignificant.

9.4 If LUC Class 3 land is included in the above, the reduction of HPL in the district and region would be less than 0.03% and 0.24% respectively.

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[25] LR Lilburne, IH Lynn & TH Webb (2016) *Issues in using Land Use Capability class to set nitrogen leaching limits in moisture-deficient areas—a South Island case study*, New Zealand Journal of Agricultural, Research, https://www.tandfonline.com/doi/full/10.1080/00288233.2015.1092996

[26] Waimakariri District Council, *In the matter of the Proposed National Policy Statement on Highly Productive Land,* 1 October 2019, https://www.mpi.govt.nz/assets/dmstemp/HPL_submissions/2-3-21/E6.-Waimakiriri-DC-Attachment-Redacted.pdf

10 SUMMARY AND CONCLUSION

10.1 In summary, I consider that there are a number of significant constraints on the productive capacity of the Site to be used for primary production. In that context (and noting the very minor contribution that the Site makes to versatile soils in Canterbury generally), I do not consider that the productive capacity potential of the Site should preclude it from being rezoned for residential development.

10.2 To that end, I support the submitter's Proposal to rezone the Site for residential development on the basis that:

(a) The Site is excluded from the NPS-HPL definition of HPL under Clause 3.5.

(b) There are multiple long-term constraints on the capacity of the Site to support primary production activities. In light of these constraints, the overall benefits of retaining this land for primary production are, in my opinion, negligible.

(c) The proportional reductions in HPL/versatile soils in the district and the region as a result of the Proposal are insignificant.

(d) The Proposal has significant positive benefits which include reducing nutrient applications to land. This will reduce the adverse effects on the waterways and groundwater.

Victor Mthamo
4 March 2024

APPENDIX 1 – LOCATION OF THE SITE

APPENDIX 2 – GROUNDWATER AND SURFACE WATER

Figure A2.1 – Aquifer Systems Below the Site

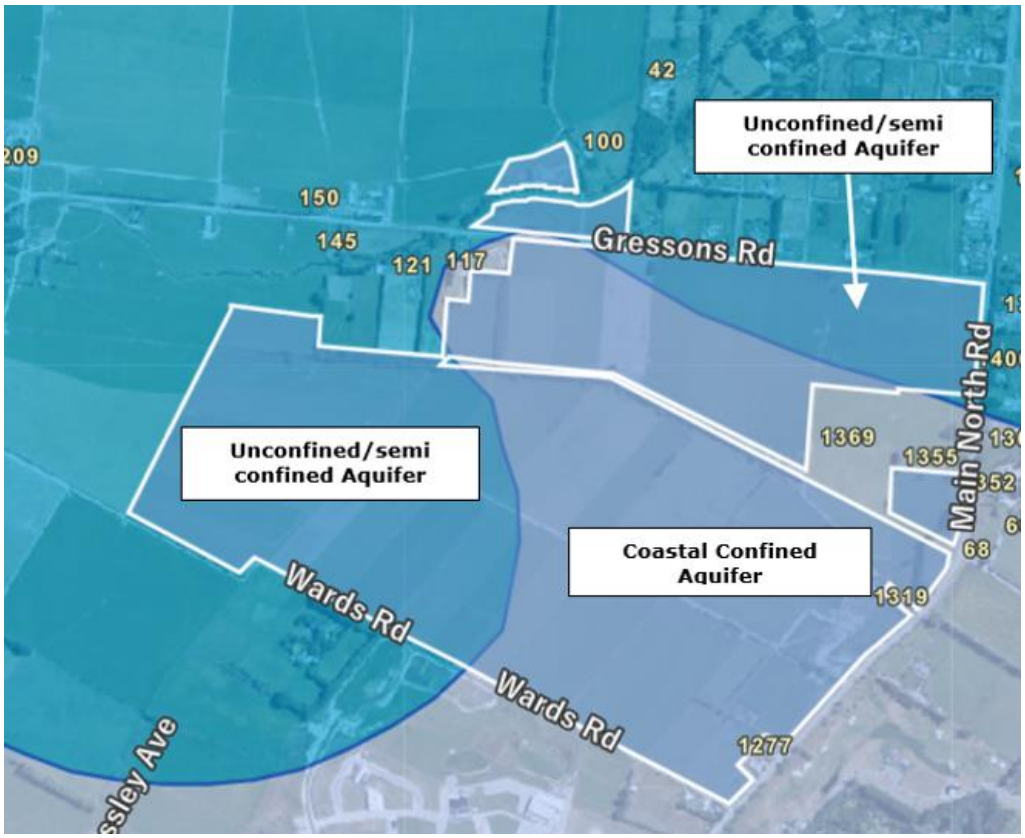
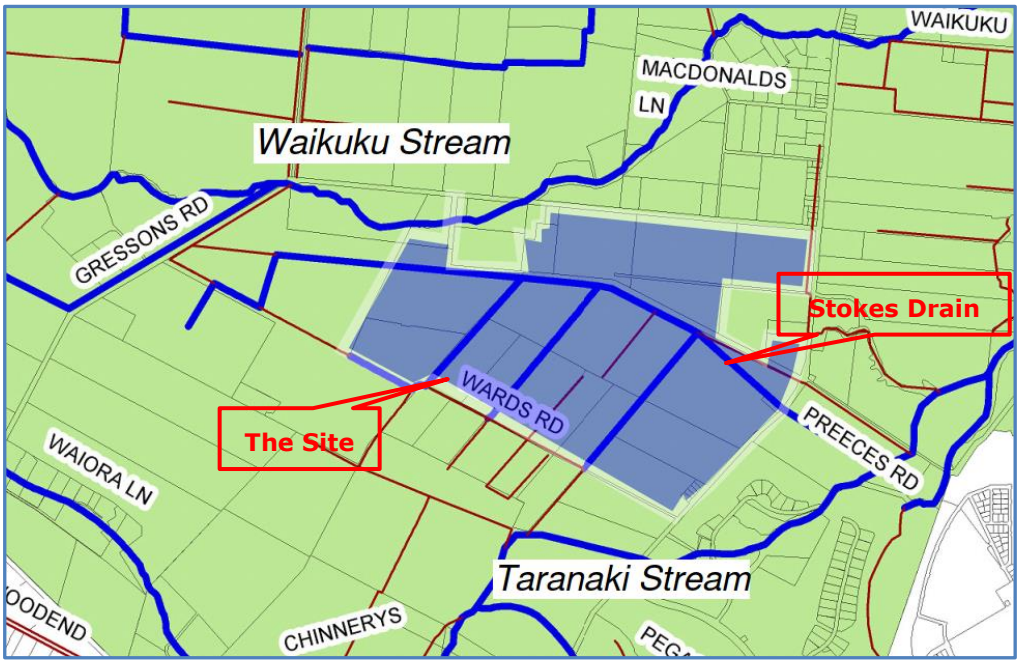
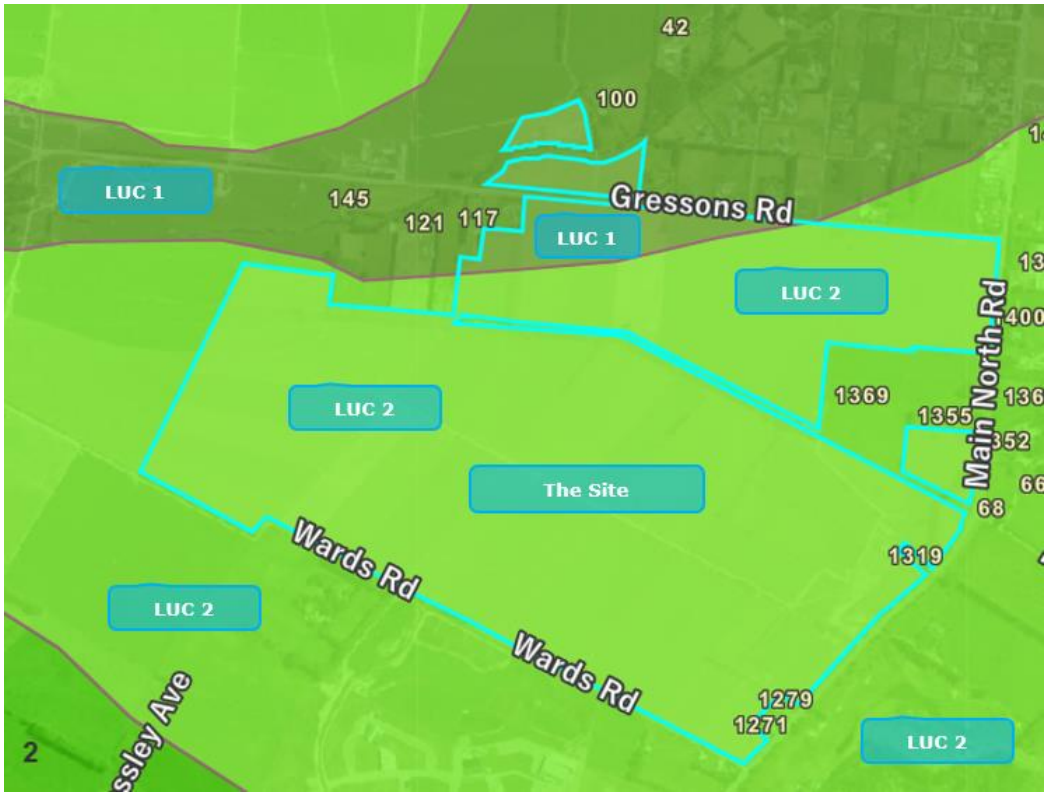


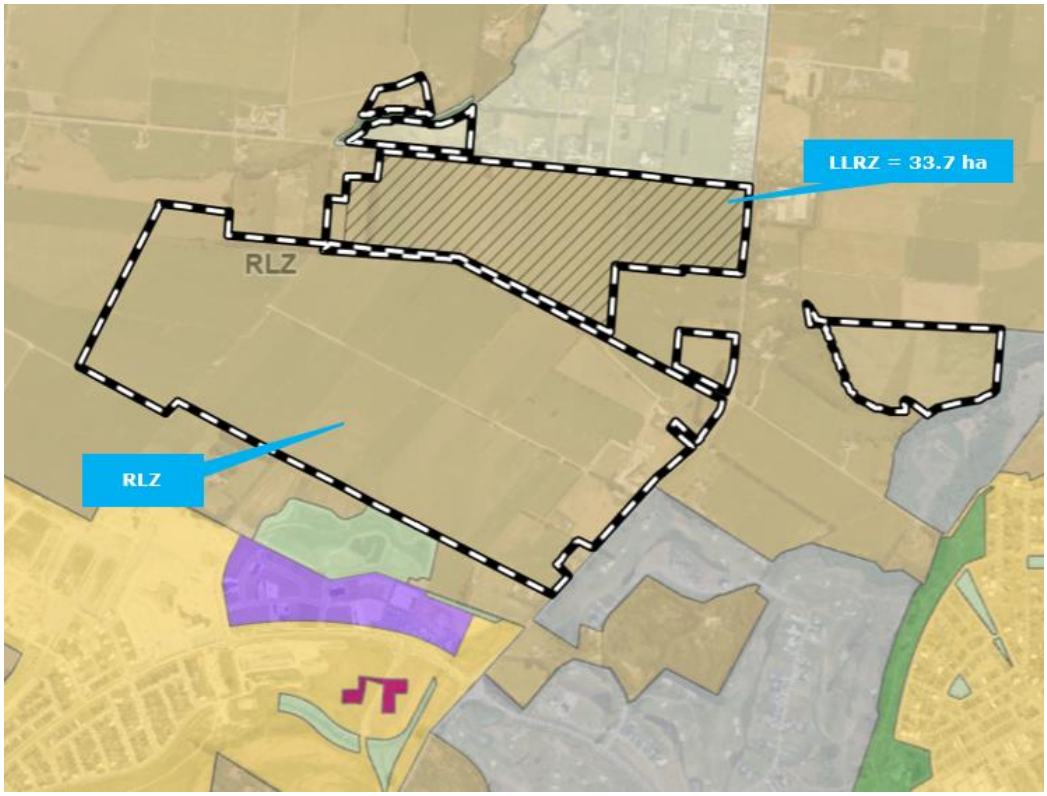
Figure A2.2 – Existing Drainage in and Around the Site



APPENDIX 3 – LUC CLASSES OF THE SOILS WITHIN THE SITE



APPENDIX 4 – PROPOSED DISTRICT PLAN ZONING



APPENDIX 5 – DRINKING WATER PROTECTION ZONE