FRUITION

Arataki Rd

Assessment of the productive capability of the land

17 March 2025

Prepared for:

CDL Properties Limited

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Statement of Qualifications and Experience

I am the Irrigation Services Manager at Fruition Horticulture Hawkes Bay Ltd, a Horticultural services and consultancy company based in the Hawkes Bay Region. I hold a Bachelor of Agriscience (major Horticulture) from Massey University. I have approximately seven years of experience in horticultural production and my career to date has involved four years of working with soil analysis and irrigation recommendations across orchards and vineyards. My experience includes completing due diligence reports for site selection for apple orchard production and more recently preparing Land Use Capability reports analysing the potential for Subdivision of rural properties under the NPS-HPL. I confirm that, in my capacity as author of parts of this FastTrack Application, I have read and abide by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses Practice Note 2023.

Executive Summary

CDL Properties Limited is planning to lodge a FastTrack application for the subdivision of three adjoining properties located at 86, 108, and 122 Arataki Road under the FastTrack Approvals Act 2024. The proposed subdivision is located over land defined as highly productive by the National Policy Statement for Highly Productive Land (NPS-HPL).

The site is considered to be highly productive in terms of the NPS-HPL because it is LUC 3. The Government has indicated that the NPS-HPL will be amended this year (2025) so that LUC 3 land will no longer be defined as highly productive. When that occurs, the NPS-HPL will no longer apply to the site. However, as this has not yet occurred the following report assesses the proposal under the NPS-HPL.

Fruition has been engaged to assess whether the proposed subdivision will meet the exemption under Clause 3.10 of the NPS-HPL. Clause 3.10 of the NPS-HPL provides exemptions for highly productive land (HPL) to be subdivided provided certain criteria are met. A visit was conducted to confirm the soil characteristics and gain a better understanding of the potential land use options. A visual soil assessment determined the soil depth and texture across the site using a series of drill sites with a 1m soil auger in a 50m x 100m grid pattern.

This report finds that the site has the following permanent or long-term constraints that meet the criteria for an exemption to its default highly productive land classification:

Economic viability

The land is not suitable for vegetable production due to the shallow nature of the fragile soils (cultivation is unlikely due to the shallow subsoils found onsite) with the unavailability of water for irrigation further exacerbating the limitations. Due to the fragile nature of the soils, fruit production is limited to tree crops albeit at a reduced production rate as a result of the shallow soils, with apples providing the highest value. However, current unavailability of water would need to be resolved. The next highest value land uses are arable cropping, viticulture or pasture grazing. Alternative land uses have been considered with the implementation of improved land management strategies such as sheep, beef and dairy. However, due to factors such as land size, costs of essential capital investment, drainage and irrigation installation and shelter establishment none of these land uses are forecast to provide an economic return over a 30-year timeframe. The site's likely range of productive uses would also be influenced by the site's small size (which limits the ability to provide an on-site buffer from neighbouring residential activities); the site's proximity to residential properties along two boundaries (and in particular along the longer boundary on Arataki Road); and the associated risk of soil, spray and fertilizer drift impacting the nearby residential properties.

Significant loss of productive capacity

Given the range of productive uses of the land is constrained for the reasons I have set out above, I do not consider that the proposed subdivision will result in or contribute to any significant loss of productive capacity of HPL in the District. Even if it were productive, I do not consider that the removal of this land would contribute to a significant loss. The potential for any such loss to arise from this development is minimal given that it comprises only 0.02% of the identified HPL in the district.

Fragmentation

The subdivision does not cause fragmentation of large geographically cohesive areas of HPL. The site is bordered by an existing residential subdivision along one long boundary (Arataki Road) and by a steep terrace to the commercial (formerly) Te Mata Mushroom premises on the other side.

Reverse sensitivity

There is limited potential for reverse sensitivity effects on any surrounding land based primary production given the existing residential development along two boundaries, and the steep terrace between the site and the adjoining premises which creates a natural spatial buffer and boundary. The presence of this steep terrace will assist in managing the potential for reverse sensitivity effects to arise in future.

Background

To assist in the Fast Track application process, CDL Properties Limited are seeking a 'Land Use Capability Assessment' to determine whether the properties at 86, 108, 122 Arataki Road meet the exemptions under Clause 3.10 of the National Policy Statement for Highly Productive Land Act (HPS-HPL).

The site is situated in the Hastings District, on the eastern edge of Havelock North. See Figure 1 below. The site is surrounded by residential housing to the west on Arataki Road and to the north along Brookvale Road. To the south there is a small rural property and a commercial operation (Arataki Honey – Visitor Centre) and to the east a steep terrace decline.

Figure 1 - Site Location - Arataki Road

Site Description

Three titles with a combined area of 11.17 ha on Arataki Road.

- Lot2 DP 540945 Total area: 5.24 ha
- Section 10S Te Mata SETT Total area: 2.94 ha
- Lot 2 DP 546439 Total area: 2.99 ha

Soils

Most of the property is classified as 3s 1 (92%), the main limitations of this category are:

- Poorly drained
- Susceptible to drought
- Susceptible to erosion

The rest of the property is classified as 3w 2 (8%), the main limitations of this category are:

- Poorly drained

The slope is flat to gently undulating between 0 and 3°.

Based on data sourced from S-maps there are two soil types present at the site:

- Waimakariri (55a.1): A loam textured soil. (20%)
- Waimakariri (55b.2): A loam textured soil. (80%)

These soil types and percentage analysis is limited by the confidence model and resolution of S-maps data, so an onsite investigation was used to confirm the soil textures, depths and any other notable physical properties. Further detail of the soil types is described in Appendix A.

3s 1[1]

Class 3 – Land with moderate limitations for arable use, but suitable for cultivated crops, pasture or forestry.

Subclass S – Soil physical or chemical properties in the rooting zone such as shallowness, stoniness, low moisture holding capacity, low fertility, salinity, or toxicity first limits production.

Unit 1 – This unit occurs on flat river terraces with periods of severe soil moisture deficiency and poor drainage.

3w 2[1]

Class 3 – Land with moderate limitations for arable use, but suitable for cultivated crops, pasture or forestry.

Subclass W – Soil wetness resulting from poor drainage or a high-water table, or from frequent overflow from streams or coastal waters first limits production.

Unit 2 – This unit is found on flat terraces with heavily impeded drainage.

It is worth noting that LUC 3w 2 is often found on flat terraces and depressions with a high-water table. There is a high confidence level that once the Hastings District allow for more precise mapping (as per clause 3.5 of the NPS-HPL) the 3w 2 classification will be removed from this site. This classification is more characteristic of the adjoining properties on the terrace below.

1. *Noble, K. E. 1985: Land use capability classification of the Southern Hawke's Bay – Wairarapa Region. Water & Soil Miscellaneous Publication 74. Wellington, New Zealand, National Water and Soil Conservation Authority. 128p*

Water

There are no resource consents regarding water availability allocated to these properties.

Figure 2 - Current LUC Map

LUC System

The Land Use Capability (LUC) classification system was created by the New Zealand Land Resource Inventory (NZLRI) to identify the lands general versatility. The system is categorised into 8 classes based on long term capability with account for physical limitations and management requirements. Specific limitations can include susceptibility to erosion, climate, susceptibility to flooding, wetness or drought. The classes are ranked from 1 – 8, 1 having the least limitations and 8 having the most. LUC are expressed through 3 parts: class, subclass, and unit identifier. Class is explained above. Subclass is displayed as a letter (e, w, s, or c) which represents the limitations of the soil present, for example s represents one or a combination of "soil physical or chemical properties in the rooting zone such as shallowness, stoniness, low moisture holding capacity, low fertility, salinity, or toxicity first limits production". The unit identifier allows for more detailed characteristics of the land, this is obtained through an appropriate regional LUC classification bulletin.

District Level

The properties are located within the Hastings District (Territorial Authority). The district is comprised of 522,676 ha, of which 68,493 ha or 13.1% is classified as HPL (LUC 1, 2, 3), while the wider Hawkes Bay Region is only 8.4% (181,851 ha of 2,144,417 ha). The HPL within the region is comprised of 14,549 ha of horticultural land (majority being apples)[2], 7,808 ha of vegetable production[3], 4,574 ha of viticultural land[4], 16,080 ha of effective area for Dairy[5], with the pastoral, forestry and urban/commercial premises making up the rest. This breakdown is shown in full below in Table 1.

Hastings District			Hawkes Bay Region		
LUC	Area (ha)	%	LUC	Area (ha)	%
1	*9346*	*1.8*	*1*	*17523*	*0.8*
2	*11553*	*2.2*	*2*	*26484*	*1.2*
3	*47594*	*9.1*	*3*	*137844*	*6.4*
4	*47706*	*9.1*	*4*	*100560*	*4.7*
5	*16757*	*3.2*	*5*	*23818*	*1.1*
6	*197117*	*32.7*	*6*	*572530*	*26.7*
7	*95019*	*18.2*	*7*	*314984*	*14.7*
8	*89311*	*17.1*	*8*	*203646*	*9.5*
Unclassified/Other	*8274*	*1.6*	*Unclassified/Other*	*747028*	*34.8*
Total	**522676**		**Total**	**2144417**	

Table 1: LUC breakdown of the Hastings District and Hawkes Bay Region

[2] https://www.hortnz.co.nz/assets/Environment/RegionalUpdates/06-Hawkes-Bay/20241223_HortNZ_Sub_Draft_FDS_.pdf

[3] Fresh facts 2024. https://unitedfresh.co.nz/assets/site/Fresh-Facts-2024-—-Online-Version.pdf

[4] https://www.statista.com/statistics/1059584/new-zealand-wine-production-area-by-region/

[5] New Zealand Dairy Statistics 2023-24. https://www.dairynz.co.nz/media/bywm13d4/dairy-statistics-2023-24.pdf

NPS-HPL

The National Policy Statement for Highly Productive Land Act (NPS-HPL) came into force on 17 October 2022 with the objective that highly productive land is protected for use in land-based primary production.

Highly productive land (HPL) is defined as land that has been mapped in accordance to clause 3.4 of the NPS-HPL by the Regional Council and included in an operative regional policy statement as per clause 3.5.

During the interim period of the rezoning an operative regional policy statement the NPS-HPL provides clause 3.5(7):

Until a regional policy statement containing maps of highly productive land in the region is operative, each relevant territorial authority and consent authority must apply this National Policy Statement as if references to highly productive land were references to land that, at the commencement date:

(a) Is
- *(i) Zoned general rural or rural production; and*
- *(ii) LUC 1, 2, or 3 land; but*

(b) Is not:

(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.

NB: The Government has indicated that the NPS-HPL will be amended this year (2025) so that the definition of highly productive land is amended to delete the reference to LUC 3 land.

Clause 3.7 of the NPS-HPL was designed to avoid the rezoning of HPL as rural lifestyle, excepted as provided in Clause 3.10

Clause 3.8 was designed to avoid the subdivision of HPL except in certain situations and where specified measures are applied:

Clause 3.8 (1) *Territorial authorities must avoid the subdivision of highly productive land unless one the following applies to the subdivision, and the measures in subclause (2) are applied:*

(a) the applicant demonstrates that the proposed lots will retain the overall productive capacity of the subject land over the long term:

In addition to the exemptions specified in clause 3.8 for subdivision of HPL, a further exemption for subdivision of HPL is provided through Clause 3.10 below.

3.10 Exemption for highly productive land subject to permanent or long-term constraints

(1) Territorial authorities may only allow highly productive land to be subdivided, used, or developed for activities not otherwise enabled under clauses 3.7, 3.8, or 3.9 if satisfied that:

(a) there are permanent or long-term constraints on the land that mean the use of the highly productive land for land- based primary production is not able to be economically viable for at least 30 years; and

(b) the subdivision, use, or development:

(i) avoids any significant loss (either individually or cumulatively) of productive capacity of highly productive land in the district; and

(ii) avoids the fragmentation of large geographically cohesive areas of highly productive land; and

(iii) avoids if possible, or otherwise mitigates, any potential reverse sensitivity effects on surrounding land-based primary production from the subdivision, use, or development; and

(c) the environmental, social, cultural, and economic benefits of the subdivision, use, or development outweigh the long-term environmental, social, cultural and economic costs associated with the loss of highly productive land for land-based primary production, taking into account both tangible and intangible values.

(2) In order to satisfy a territorial authority as required by subclause (1)(a), an applicant must demonstrate that the permanent or long-term constraints on economic viability cannot be addressed through any reasonably practicable options that would retain the productive capacity of the highly productive land, by evaluating options such as (without limitation):

(a) alternate forms of land-based primary production:

(b) improved land-management strategies:

(c) alternative production strategies:

(d) water efficiency or storage methods:

(e) reallocation or transfer of water and nutrient allocations:

(f) boundary adjustments (including amalgamations):

(g) lease arrangements.

(3) Any evaluation under subclause (2) of reasonably practicable options:

(a) must not take into account the potential economic benefit of using highly productive land for purposes other than land-based primary production; and

(b) must consider the impact that the loss of the highly productive land would have on the landholding in which the highly productive land occurs; and

(c) must consider the future productive potential of land-based primary production on the highly productive land, not limited by its past or present uses.

(4) The size of a landholding in which the highly productive land occurs is not of itself a determinant of a permanent of long-term constraint.

(5) In this clause:

***Landholding** has the meaning in the Resource Management (National Environmental Standards for Freshwater) Regulations 2020*

***Long-term constraint** means a constraint that is likely to last for at least 30 years.*

Assessment under Clause 3.10

Clause 3.10 (1)(a)

The combination of the weak, shallow soils and lack of available applied water remove the possibility of high value permanent crops and intensive arable cropping. The site's likely range of productive uses would also be influenced by the site's small size (which limits the ability to provide an on-site buffer from neighbouring residential activities); the site's proximity to residential properties along two boundaries (and in particular along the longer boundary on Arataki Road); and the associated risk of soil, spray and fertilizer drift impacting the nearby residential properties This assessment for Clause 3.10 (2) below demonstrates that these constraints are long term and cannot be addressed through other reasonably practicable options.

Clause 3.10 (1)(b)(i)

Productive capacity is defined in the NPS-HPL as:

> *in relation to land, means 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); and*
>
> (a) *legal constraints (such as consent notices, local authority covenants, and easements); and*
>
> (b) *the size and shape of existing and proposed land parcels*

Given the range of constraints I have set out above, it is my view the land has a relatively limited "productive capacity", as defined in the NPS-HPL. As such, that there will be no significant loss of productive capacity of highly productive land in the district as a result of the proposed subdivision, either individually or cumulatively.

In any event, of the 68,493 ha of highly productive land in the Hastings District, the loss of highly productive land from the assessed property is 11.17 ha. This equates to 0.02%. This suggests that the potential for any such loss to arise from the subdivision (even if it were to be productive) would be minimal.

Clause 3.10 (1)(b)(ii)

Fragmentation refers to the subdivision of large, cohesive land parcels containing HPL into to smaller parcels. The property is surrounded by residential housing to the north and west along Brookvale Road and Arataki Road, a steep bank to the east, and a smaller 4ha rural property to the south, with a

commercial premises that doubles as a tourism destination adjoining. Therefore, fragmentation of large cohesive areas of highly productive land will be avoided.

Clause 3.10 (1)(b)(iii)

The development of the property will not increase the potential for reverse sensitivity effects given the proximity to existing urban areas both north and west of the property and the geographic separation to the east with the steep bank which creates a natural spatial buffer and boundary. The presence of this steep terrace will assist in managing the potential for reverse sensitivity effects to arise in future.

Clause 3.10 (1)(c)

The environmental, social, cultural and economic benefits and costs are assessed in the planning report.

Clause 3.10 (2)

The constraints identified in clause 3.10(1)(a) above are not considered to be able to be addressed through any reasonable practicable options that would retain the productive capacity of the land. A number of options are assessed under clauses 3.10(2)(a) to (g) below.

Clause 3.10 (2)(a)

Livestock Operation: According to Beef and Lamb NZ, the Eastern North Island Finishing Class has an average effective area of 376 ha[6]. Even if amalgamated with adjacent properties, land area would restrict the viability of a beef and lamb operation. There is also the cost of establishment (woolshed, cattle/sheep yards, adequate fencing etc) to consider. As such, livestock is not seen to be a reasonably practicable option on the site.

Dairy: The average effective area for dairy farms in the Napier/Hastings District is 235 ha, with average herd size of 572 cows[7]. Due to the small scale of the site along with the soil type, lack of consent for irrigation, and cost of establishment (milking shed and yards, adequate fencing etc.), a dairy operation would not be economically viable. There is insufficient scale across the site, including amalgamation with boundary sites, to be a reasonably practicable option.

Horticulture: Vegetable production is not suitable on LUC 3S 1 due to the physical characteristics of poor drainage; risk of severe seasonal moisture deficiency (without available water), the combination of weak topsoil structure and shallow soils does not allow for continuous cultivation required for vegetable production (this was confirmed with the onsite assessment in the appendices). Permanent fruit production is not suitable for this site due to the lack of available water, shelter and cost of establishment (frost protection, infrastructure, irrigation etc). Based on information received from MPI (Ministry of Primary Industries) benchmarking reports[7], the gross margin for grape production would be ($13,513) per hectare per annum. (Appendix 1). The gross margin for apple production would be ($8,602) per hectare per annum (Appendix 2). These options are not reasonably practicable as the return is unlikely to outweigh the cost of establishment, the major constraint facing the economic production return is the lack of existing infrastructure and machinery.

Arable and cropping: LUC 3S 1 is not suitable for arable and cropping production due to physical limitations including shallow soils, poor soil structure and poor drainage. Drainage limitations can be mitigated with the installation of artificial drainage but would require capital outlay. With the poor soil structure there is an increased risk of slight wind erosion during cultivation, however cultivation will be difficult given the shallow nature of the soils. Soil fertility is a fundamental aspect in arable and cropping production and despite there being no available soil test information, it is reasonable to assume that fertiliser applications are necessary to maintain soil fertility levels, constituting an ongoing

cost. Based on the information received from FAR (The Foundation of Arable Research)[8], the gross margin for maize (highest gross margin crop for this soil classification) would be ($14,486) per hectare per annum (Appendix 3). This is not a reasonably practicable option as the return of maize is unlikely to outweigh the cost of production.

Gross margins have been calculated using current 2024/2025 rates taken from the Hawkes Bay Regional Council website[9], capital costs such as installation of irrigation and drainage, and operational costs such as growing/managing and harvesting the crop. Excluded are the costs of debt servicing of land.

MPI Benchmarking report is from latest 2016 Hawkes Bay report to reflect the regional pricing, this report comparable to latest 2024 MPI Benchmarking report which is based on data from Marlborough.

FAR report is the latest North Island maize cost of production template.

[5]Eastern North Island – Class 5 Finishing. https://beeflambnz.com/industry-data/farm-data-and-industry-production/sheep-beef-farm-survey

[6]New Zealand Dairy Statistics 2023-24. https://www.dairynz.co.nz/media/bywm13d4/dairy-statistics-2023-24.pdf

[7]Viticulture Gross Margin Benchmarking Report 2016. https://www.fruition.net.nz/wp-content/uploads/2016/09/Viticulture-Gross-Margin-Benchmarking-report-2016-web.pdf

[8]Arable costs of production. https://www.far.org.nz/resources/arable-costs-of-production

[9]Hawkes Bay Regional Council Properties and Rates. https://www.hbrc.govt.nz/services/properties-and-rates/rates/

Clause 3.10 (2)(b)

Improvements can be made to the increase the capability of LUC 3S 1 including:

- The installation of artificial drainage to help alleviate the effect of the poor drainage from the compact subsoils. These improvements can cost between $6,000 - $10,000 per hectare[10]
- As the property does not have an existing Bore/well it is recommended that one is installed. For a 200mm bore for this location the cost is approximately $113,421 (excluding an application permit from Hawkes Bay Regional Council of $1,280)[11].
- The installation of irrigation systems to help alleviate the risk the severe seasonal soil moisture deficiency (explained below in clause 3.10 (2)(e)) is not a viable option. The cost of pivot irrigators can range between $4,000 - $5,000 per hectare while more complex systems such as grids can cost $15,000 - $20,000 per hectare. Operating costs of irrigation systems can range between $2,000 and $6,000 per hectare per annum[12].
- The installation of shelter to mitigate exposure to easterly winds which the site is vulnerable to at the edge of the terrace. Shelter would also act as a buffer to the residential housing opposite along Arataki Road.

These are all high capital expenses which, on a site of this small scale would likely fail to provide a return on investment, having regard to the return on investments for specific crops (discussed above in Clause 3.10 (2)(a)).

[10]Awakeri Drainage quote 2025

[11]Honnor Drilling Limited quote 2025

[11]2rrigation scheme cost survey. https://issuu.com/irrigationnz/docs/122854-inznewz-2023winter-issuu-wecaninsert/s/26282830

Clause 3.10 (2)(c)

The size, soil type and lack of available water limits the productive capabilities of the land. Best management practices such as direct drilling to assist with the avoidance of soil degradation and erosion will have a positive impact however these practices can prove an expensive option. With the limitations the best use of the land is light dry stock, however as mentioned above this is not a practical option because the site is too small to be economically viable.

Clause 3.10 (2)(d)

The TANK plan change will introduce updated allocation limits and flow rates for surface and groundwater in the TANK catchments (Tūtaekurī, Ahuriri, Ngaruroro and Karamū). Under the plan change new groundwater takes are highly restricted especially in over allocated zones (Heretaunga plains), new consents would be required to show efficient use of water and have no adverse effects on connected surface water or groundwater flows. New surface water takes are generally prohibited unless for essential non consumption uses such as firefighting. The TANK plan change is currently subject to the Environment Court appeal process; mediation hearings have commenced (expected to carry on until 2026). As also discussed above, there would be significant capital costs involved in establishing or re-establishing bores/wells on the site – even in the event takes are able to be obtained.

Note: there is an existing bore found on site however there are no council records of the bore. Therefore, without registration it is unknown the depth and function of the bore.

Clause 3.10 (2)(e)

The reallocation or transfer of water allocations from the adjacent property is not possible as the allocated resource consent for the property has expired (31 May 2022).

Clause 3.10 (2)(f)

In context of the NPS-HPL amalgamation is the process of combining smaller land parcels into a larger cohesive land parcel. As illustrated in Figure 3 the northern and western boundaries of the properties are separated by roading (Arataki Road and Brookvale Road). The eastern boundary presents a steep sloped reserve. The southern boundary contains a small 4ha rural property. The council title to the

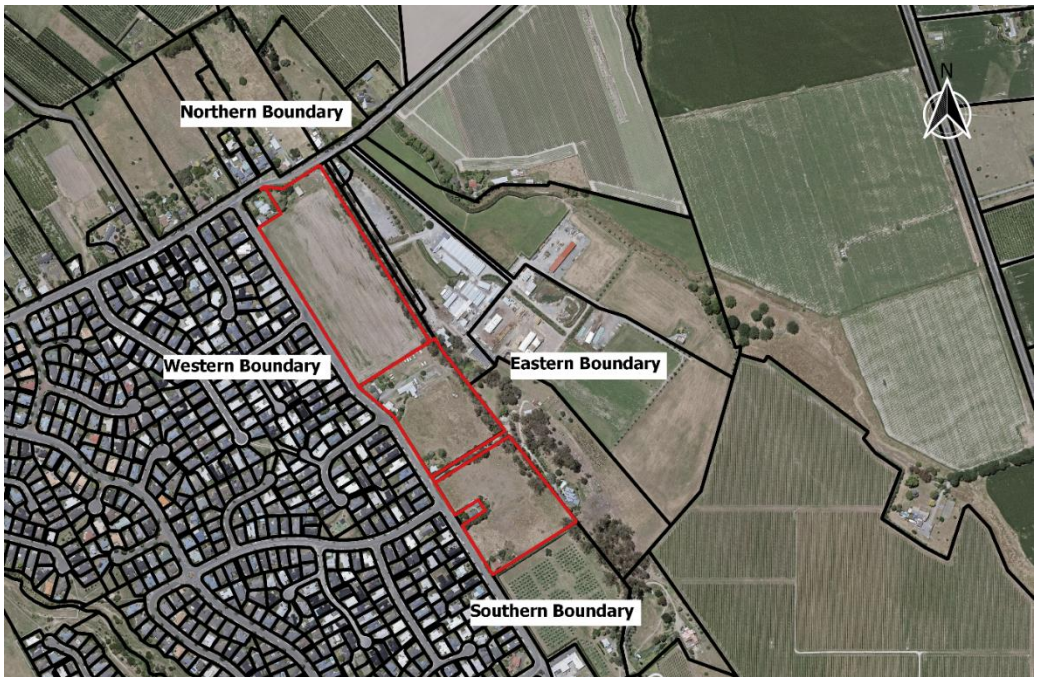


Figure 3 - Property Boundary

east is classified at LUC 3 however due to the slope of the land, it is practically unproductive as it poses challenges such as increased erosion risk, and difficulty in cultivation. Amalgamation with this property would also unlikely have any practical effect of the productive capacity of the land, earthworks on the land to minimise the slope would alter the properties of the soil and therefore alter the productivity of that land. Amalgamation is not possible along the western and northern boundaries as these are residential dwellings. The most practical option is the amalgamation with the property along the southern boundary, however, this increase in size would not improve economic viability.

Clause 3.10 (2)(g)

Leasing arrangements would not be considered a reasonably practical option. The property to the south is too small and would not offer any significant increase in economic viability.

Conclusion

With reference to Clause 3.10 of the NPS-HPL, this report concludes:

- No reasonably practicable options to continue land based primary productive in an economically viable manner at present nor for at least 30 years. Reasons include lack of available water, high capital cost to enable economically viable land use and no practical amalgamation options.
- No reasonably practicable options for addressing the constraints on viability of productive use.
- The size of the properties means there is no significant loss of HPL to the Hastings District nor the fragmentation of large geographically cohesive areas.

Appendix

Appendix 1 Grape Production

Income	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30
Yeild (2015 ave)	$0	$0	$0	$11	$11	$11	$11	$11	$11	$11	$11	$11	$11	$11	$11	$11	$11	$11	$11	$11	$11	$11	$11	$11	$11	$11	$11	$11	$11	$11
$$/tonne	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773	$1,773
Return	$0	$0	$0	$19,093	$19,093	$19,093	$19,093	$19,093	$19,093	$19,093	$19,093	$19,093	$19,093	$19,093	$19,093	$19,093	$19,093	$19,093	$19,093	$19,093	$19,093	$19,093	$19,093	$19,093	$19,093	$19,093	$19,093	$19,093	$19,093	$19,093
Expenses																														
Setup Cost (/ha)	$45,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Bore Installation	$114,701																													
Irrigation/drainage Setup	$10,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Operational costs	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102	$8,102
Interest	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879	$11,879
Rates	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059
Annual Surplus/Deficit	-$194,741	-$25,040	-$25,040	-$5,947	-$5,947	-$5,947	-$5,947	-$5,947	-$5,947	-$5,947	-$5,947	-$5,947	-$5,947	-$5,947	-$5,947	-$5,947	-$5,947	-$5,947	-$5,947	-$5,947	-$5,947	-$5,947	-$5,947	-$5,947	-$5,947	-$5,947	-$5,947	-$5,947	-$5,947	-$5,947
Total Surplus/Deficit		-$219,780	-$244,820	-$250,766	-$256,713	-$262,659	-$268,606	-$274,553	-$280,499	-$286,446	-$292,393	-$298,339	-$304,286	-$310,232	-$316,179	-$322,126	-$328,072	-$334,019	-$339,965	-$345,912	-$351,859	-$357,805	-$363,752	-$369,699	-$375,645	-$381,592	-$387,538	-$393,485	-$399,432	-$405,379
Average return per year	-$13,513																													

Appendix 2 Apple Production

Income	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30
Yeild Bins	0	0	47	93	140	167	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186
Yeild CE	0	0	800	1600	2400	2880	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200
CE/ha	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
$$/CE	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42
Return	0	0	$33,600	$67,200	$100,800	$120,960	$134,400	$134,400	$134,400	$134,400	$134,400	$134,400	$134,400	$134,400	$134,400	$134,400	$134,400	$134,400	$134,400	$134,400	$134,400	$134,400	$134,400	$134,400	$134,400	$134,400	$134,400	$134,400	$134,400	$134,400
Expenses																														
Setup Cost (/ha)	$126,339	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Irrigation/drainage Setup	$10,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Bore installation	$114,701																													
Operational costs	$23,160	$23,160	$25,579	$27,997	$30,416	$31,867	$32,834	$32,834	$32,834	$32,834	$32,834	$32,834	$32,834	$32,834	$32,834	$32,834	$32,834	$32,834	$32,834	$32,834	$32,834	$32,834	$32,834	$32,834	$32,834	$32,834	$32,834	$32,834	$32,834	$32,834
Machinery	$146,613																													
Ammenities	$86,954																													
Overheads	$5,500																													
Postharvest			$11,330	$22,660	$33,991	$40,789	$45,321	$45,321	$45,321	$45,321	$45,321	$45,321	$45,321	$45,321	$45,321	$45,321	$45,321	$45,321	$45,321	$45,321	$45,321	$45,321	$45,321	$45,321	$45,321	$45,321	$45,321	$45,321	$45,321	$45,321
Interest	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922	$33,922
Rates	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059
Annual Surplus/Deficit	-$552,248	-$62,141	-$42,290	-$22,439	-$2,588	$9,323	$17,263	$17,263	$17,263	$17,263	$17,263	$17,263	$17,263	$17,263	$17,263	$17,263	$17,263	$17,263	$17,263	$17,263	$17,263	$17,263	$17,263	$17,263	$17,263	$17,263	$17,263	$17,263	$17,263	$17,263
Total Surplus/Deficit		-$614,390	-$656,680	-$679,119	-$681,706	-$672,383	-$655,120	-$637,857	-$620,593	-$603,330	-$586,066	-$568,803	-$551,540	-$534,276	-$517,013	-$499,750	-$482,486	-$465,223	-$447,959	-$430,696	-$413,433	-$396,169	-$378,906	-$361,642	-$344,379	-$327,116	-$309,852	-$292,589	-$275,326	-$258,062
Average return per year	-$8,602																													

Appendix 3 Maize Production

Income	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30
Yeild (10yr ave total)	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10
$$/tonne	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600
Return	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760	$5,760
Expenses																														
Bore Installation	$114,701																													
Irrigation/drainage Setup	$10,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Operational costs	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125	$6,125
Interest	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729	$8,729
Rates	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059	$5,059
Annual Surplus/Deficit	-$24,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153	-$14,153
Total Surplus/Deficit		-$38,306	-$52,459	-$66,611	-$80,764	-$94,917	-$109,070	-$123,223	-$137,376	-$151,528	-$165,681	-$179,834	-$193,987	-$208,140	-$222,293	-$236,445	-$250,598	-$264,751	-$278,904	-$293,057	-$307,210	-$321,363	-$335,515	-$349,668	-$363,821	-$377,974	-$392,127	-$406,280	-$420,432	-$434,585
Average return per year	-$14,486																													

Development Nous

Arataki Road, Site Assessment

March 2022

Summary

Three titles totalling 11.17ha in Arataki Road were assessed for their suitability for horticultural production

- ID: 8022014 Lot 2 DP 540945 Total Area: 5.24 ha
- ID: 4190331 Section 10S Te Mata SETT Total Area: 2.94 ha
- ID: 8093108 Lot 2 DP 546439 Total Area: 2.99 ha

Soils

Landcare's on-line soil mapping service, S-maps, was used for an initial desktop analysis and this was followed up with an on-site survey.

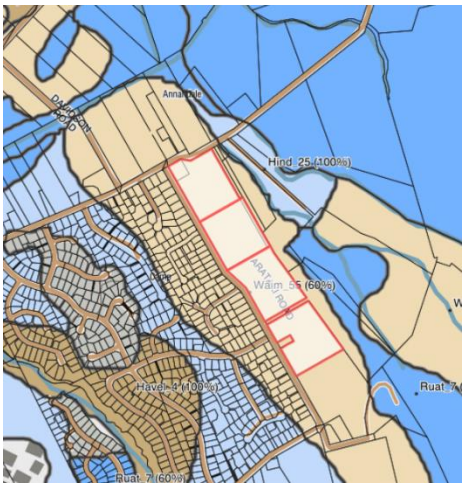
The two main soils present are:

- Waimakariri *(55a.1)*: A loam textured soil.
- Waimakariri *(55b.2)*: A loam textured soil.

Topsoil depth varied between 7cm and 14cm, below which was a subsoil of similar loamy texture which varied in depth between 33cm and 66cm. The shallow topsoil limits the versatility of the land for horticultural production but the soils on the properties are **suited** to some uses such as grapes or arable cropping.

Water

There are no water consents allocated to the properties and supplementary irrigation is considered essential for successful commercial horticultural production Without water these properties are **not suitable** for horticultural production.



Prepared by Angus Bews

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Soil Analysis

Landcare Research NZ soil information indicates there is two different soil types present at the properties.

Sibling	Area	Proportion
Waim_55b.2	9 ha	80.0%
Waim_55a.1	2 ha	20.0%

Waimakariri *(55b.2)* soil is of the recent soil order and is of fluvial origins. The soil profile texture is a loam through both the topsoil and the subsoil. The topsoil horizon can extend 10-20cm and has rapid permeability. The subsoil horizon extends 35-60cm deep and has moderate permeability. Both horizons are weakly structured and stoneless. The third subsoil horizon is a very stony compact loam with moderately slow permeability. The potential rooting depth extends below 100cm. Profile available water is moderate to high through the whole 100cm profile (120mm). The soil has a moderate to low clay percentage and a low cation exchange capacity. This soil is **suitable** for horticultural production.

Waimakariri *(55a.1)* soil is of the recent soil order and is of fluvial origins. The soil profile texture is a loam through both the topsoil and the subsoil. The topsoil horizon can extend 10-20cm and has rapid permeability. The subsoil horizon extends 40-70cm deep and has moderate permeability. Both horizons are weakly structured and stoneless. The third subsoil horizon is a very stony compact loam with moderately slow permeability. The potential rooting depth extends below 100cm. Profile available water is moderate to high through the whole 100cm profile (129mm). The soil has a moderate to low clay percentage and a low cation exchange capacity. This soil is **suitable** for horticultural production.

Visual Survey

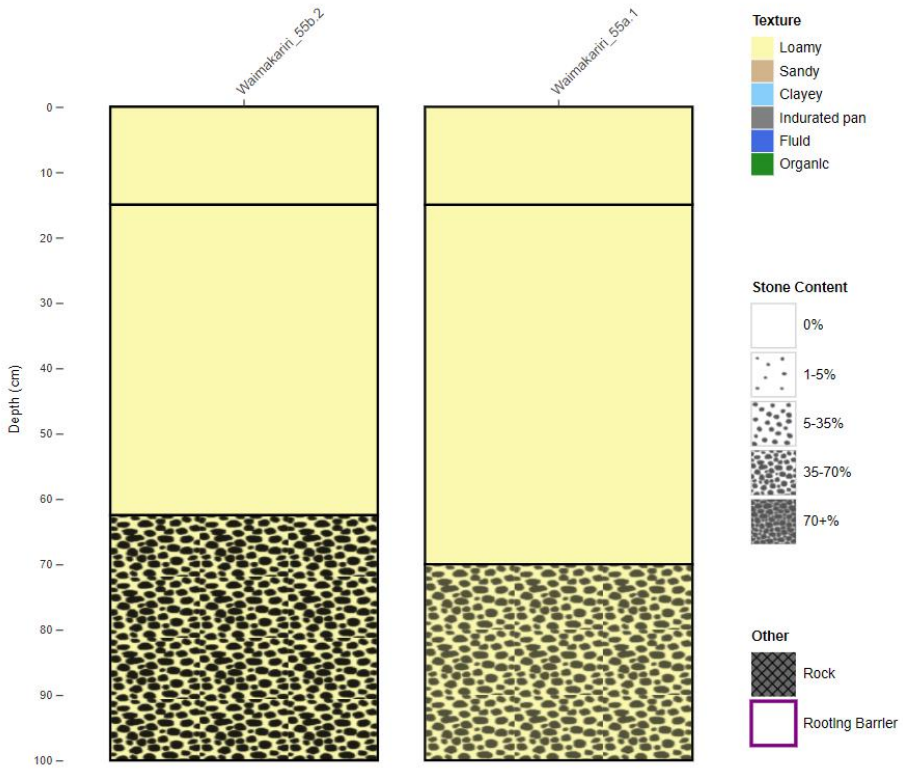
A visual soil survey was also completed on 28/03/2022 to verify the information gathered from Landcare Research. This survey assessed soil texture, topsoil depth and subsoil depth. The results of this survey are presented in the figures on the following pages.

The topsoil was seen to be a loam across the assessed area with slight variations in silt content. This topsoil varied between 7cm and 14cm, below which was a subsoil of similar loamy texture. This 1st subsoil horizon extended 33cm and 66cm of depth which was the maximum depth of the assessment.

The visual soil survey confirmed the information that was gathered from Landcare Research resources.

Resource Consent

There are no resource consents regarding water availability allocated to these properties.



Texture Graph - Landcare Research

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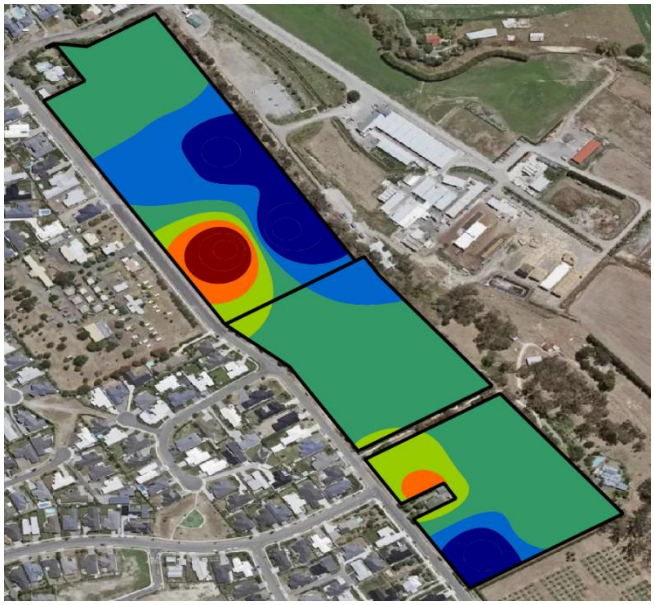
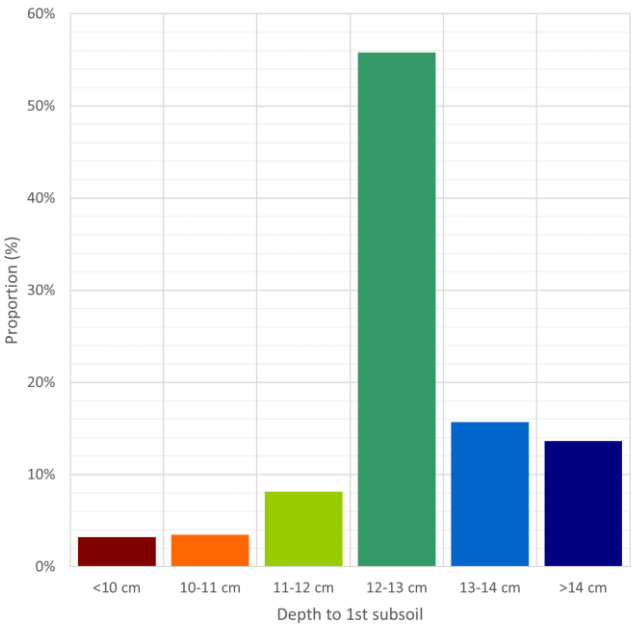
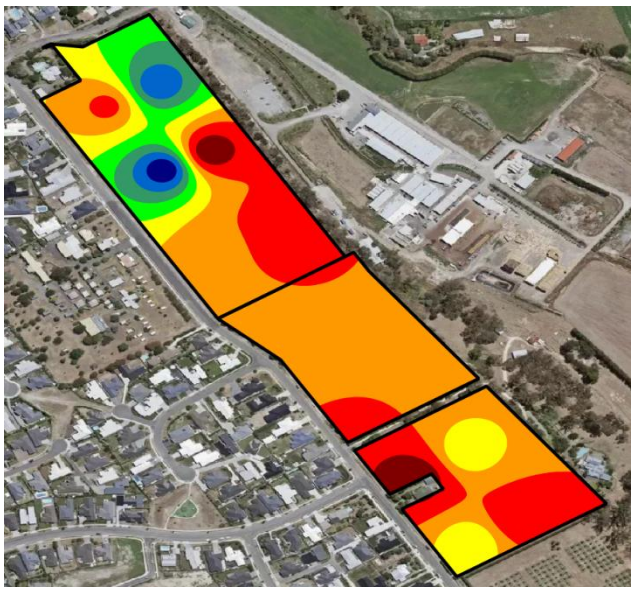
Topsoil Depth



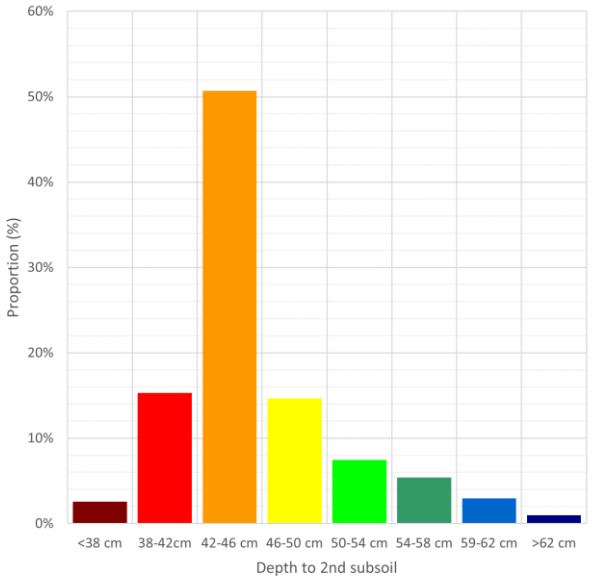
<10 cm	0.4 ha	3.22%
10-11 cm	0.4 ha	3.47%
11-12 cm	0.9 ha	8.15%
12-13 cm	6.2 ha	55.81%
13-14 cm	1.8 ha	15.70%
>14 cm	1.5 ha	13.65%



Subsoil Depth



	<38 cm	0.3 ha	2.59%
	38-42 cm	1.7 ha	15.29%
	42-46 cm	5.6 ha	50.68%
	46-50 cm	1.6 ha	14.68%
	50-54 cm	0.8 ha	7.43%
	54-58 cm	0.6 ha	5.38%
	58-62 cm	0.3 ha	2.96%
	>66 cm	0.1 ha	1.00%



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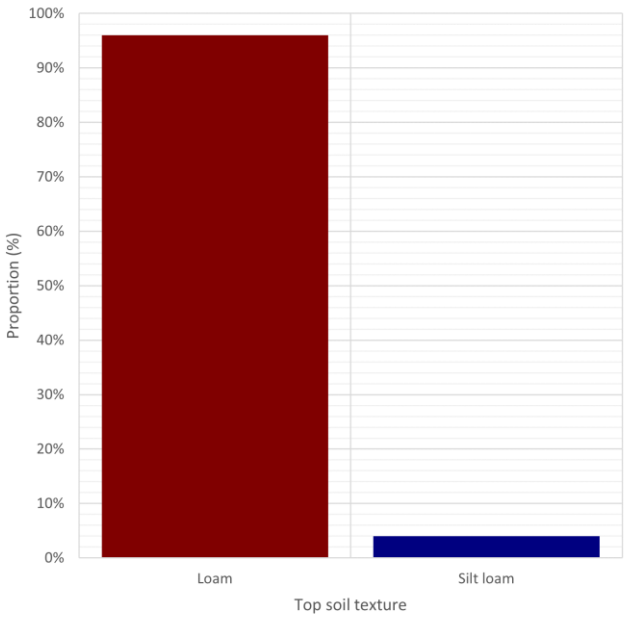
Soil Texture

Loam	10.7 ha	96.03%
Silt loam	0.4 ha	3.97%



Manaaki Whenua
Landcare Research

SOIL REPORT

Hawkes Bay Regional Council

Waimakariri_55a.1

Report generated: 18-Mar-2022 from https://smap.landcareresearch.co.nz

Waim_55a.1 (20% of the mapunit at location (1934778, 5602880), Confidence: Medium)

This information sheet describes the typical average properties of the specified soil to a depth of 1 metre, and should not be the primary source of data when making land use decisions on individual farms and paddocks. S-map correlates soils across New Zealand. Both the old soil name and the new correlated (soil family) name are listed below.

Capture of the base soil information in this region was funded by Hawkes Bay Regional Council and Manaaki Whenua.

Soil Classification

Soil Classification:
Weathered Fluvial Recent Soils (RFW)

Family Name:
Waimakariri (Waim)

Sibling Name:
Waimakariri_55a.1 (Waim_55a.1)

Soil profile material
Soil with stones (non contras

Depth class (diggability)
Moderately deep (50 - 80 cm)

Profile texture
loam

Parent Material

Stones/rocks
hard sandstone rock

Soil material
hard sandstone rock

Origin
Alluvium

Soil Sibling Concept

This soil belongs to the Recent soil order of the New Zealand soil classification. Recent Soils are weakly developed, showing limited signs of soil-forming processes although a distinct topsoil is present, a B horizon is either absent or only weakly expressed. It is formed in alluvial sand silt or gravel deposited by running water, from hard sandstone parent material.

The topsoil typically has loam texture and is stoneless. The subsoil has dominantly loam textures, with gravel content of more than 3% but below 35% for most part of the soil. The plant rooting depth extends beyond 1m.

Generally the soil is well drained with very low vulnerability of water logging in non-irrigated conditions, and has moderate to high soil water holding capacity. Inherently these soils have a high structural vulnerability and a moderate N leaching potential, which should be accounted for when making land management decisions.

About this publication

- This information sheet describes the *typical average properties* of the specified soil.
- For further information on individual soils, contact Landcare Research New Zealand Ltd: www.landcareresearch.co.nz
- Advice should be sought from soil and land use experts before making decisions on individual farms and paddocks.
- The information has been derived from numerous sources. It may not be complete, correct or up to date.
- This information sheet is licensed by Landcare Research on an "as is" and "as available" basis and without any warranty of any kind, either express or implied.
- Landcare Research shall not be liable on any legal basis (including without limitation negligence) and expressly excludes all liability for loss or damage howsoever and whenever caused to a user of this factsheet.

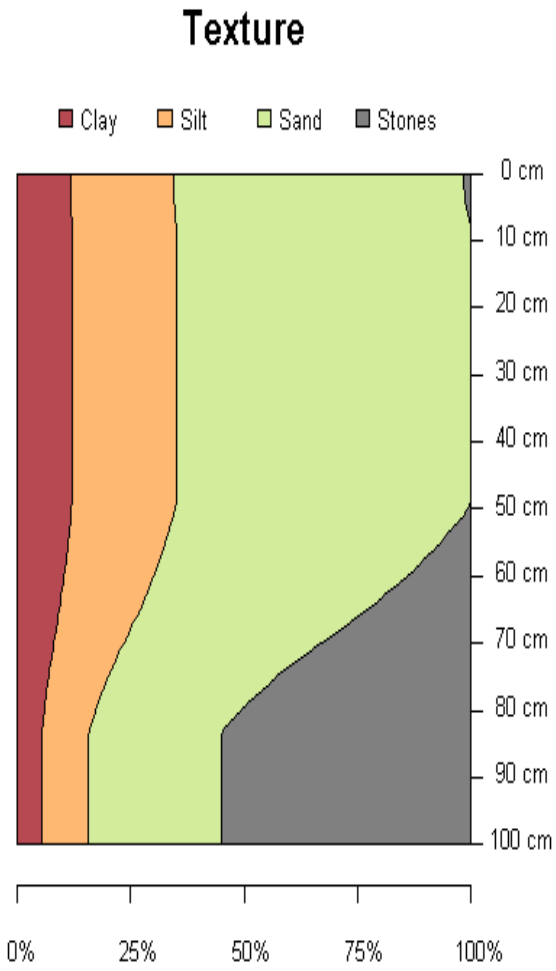
Waimakariri_55a.1

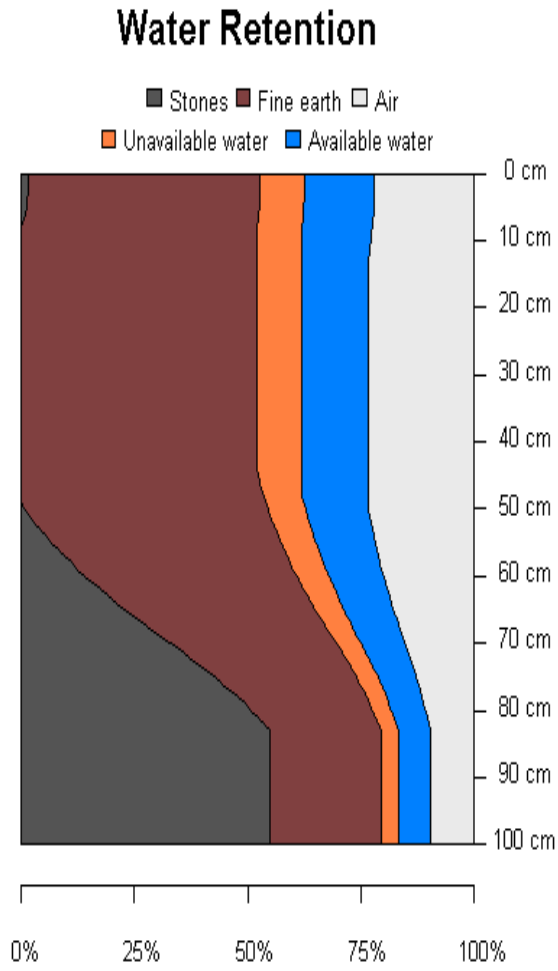
Soil horizons

Characteristics of functional horizons in order from top to base of profile:

Functional Horizon	Thickness	Stones	Clay*	Sand*	Permeability
Loamy Weak	10 - 20 cm	0 %	10 - 14 %	60 - 70 %	rapid
Loamy Weak	40 - 70 cm	0 %	10 - 14 %	60 - 70 %	moderate
Very Stony Loamy Compact	10 - 50 cm	50 - 60 %	10 - 14 %	60 - 70 %	moderately slow

* clay and sand percent values are for the mineral fines (excludes stones). Silt = 100 - (clay + sand)





The values for the graphs above have been generated from horizon and pedotransfer data. These values have then been splined to create continuous estimates of soil water holding capacity and particle size distribution the soil profile. These curves express the particle size distribution and water retention of the soil however there may be barriers to rooting depth that are not necessarily represented in these properties directly. It is advisable to check the potential rooting depth and rooting barrier fields in the soil physical properties section on page three of this factsheet.

Waimakariri_55a.1

Soil physical properties

Depth class (diggability)
Moderately deep (50 - 80 cm)

Potential rooting depth
Unlimited

Rooting barrier
No significant barrier within 1 m

Depth to hard rock
No hard rock within 1 m

Depth to soft rock
No soft rock within 1 m

Depth to stony layer class
Moderately deep

Texture profile
Loam

Topsoil stoniness
Stoneless

Topsoil clay range
10 - 14 %

Drainage class
Well drained

Permeability profile
Moderate

Depth to slowly permeable horizon
-200 - 400 (cm)

Permeability of slowest horizon
Moderate (4 - 72 mm/h)

Aeration in root zone
Slightly limited

Profile available water

(0 - 30cm or root barrier)	(0 - 60cm or root barrier)	(0 - 100cm or root barrier)
Moderate (45 mm)	Moderate (87 mm)	Moderate to high (129 mm)

Dry bulk density

topsoil	subsoil
1.09 g/cm³	1.30 g/cm³

Soil chemical properties

Topsoil P retention
Low (19%)

Soil management factors

Vulnerability classes relate to soil properties only and do not take into account climate or management

Soil structure integrity

Structural vulnerability
High (0.69)

Pugging vulnerability
not available yet

Septic tank installation category
A1 if slope > 15 deg otherwise B3

Contaminant management

N leaching vulnerability
Medium

P leaching vulnerability
not available yet

Dairy effluent (FDE) risk category
D

Water management

Water logging vulnerability
Low

Drought vulnerability - if not irrigated
Low

Bypass flow
Low

Hydrological soil group
A

Relative Runoff Potential

Slope	0-3°	4-7°	8-15°	16-25°	>25°
Risk	VL	VL	VL	VL	L

SINDI - Soil quality Indicators

SINDI - Soil Quality Indicators

A suite of soil quality indicators is available from http://sindi.landcareresearch.co.nz/

- Compare your soil with information from our soils databases.
- Assess the intrinsic resources and biological, chemical and physical quality of your soil
- See how your soil measures up against current understanding of optimal values.
- Learn about the effect each indicator has on soil quality and some general management practices that could be implemented to improve soil quality.

Waimakariri_55a.1

Soil information for OVERSEER

The following information can be entered in the OVERSEER® Nutrient Budget model. This information is derived from the S-map soil properties which are matched to the most appropriate OVERSEER categories. Please read the notes below for further information.

Soil description page

1. Select **Link to S-map**
2. Under S-map sibling data enter the S-map name/ref: **Waim_55a.1**

Considerations when using Smap soil properties in OVERSEER

- The soil water values are estimated using a regression model based on soil order, parent rock, soil functional horizon information (stone content, soil density class), as well as texture (field estimates of sand, silt and clay percentages). The model is based on laboratory - measured water content data held in the National Soils Database and other Manaaki Whenua datasets. Most of this data comes from soils under long-term pasture and may vary from land under arable use, irrigation, etc.

- Each value is an estimate of the water content of the whole soil within the target depth range or to the depth of the root barrier (if this occurs above the base of the target depth). Where soil layers contain stones, the soil water content has been decreased according to the stone content.

- S-map only contains information on soils to a depth of 100 cm. The soil water estimates in the > 60 cm depth category assume that the bottom functional horizon that extends to 100 cm, continues down to a depth of 150cm. Where it is known by the user that there is an impermeable layer or non-fractured bedrock between 100 and 150 cm, this depth should be entered into OVERSEER. Where there is a change in the soil profile characteristics below 100 cm, the user should be aware that the values provided on this factsheet for the > 60 cm depth category will not reflect this change. For example, the presence of gravels at 120 cm would usually result in lower soil water estimates in the > 60 cm depth category. Note though that this assumption only impacts on a cropping block, as OVERSEER uses soil data from just the top 60 cm in pastoral blocks.

- OVERSEER requires the soil water values to be non-zero integers (even though zero is a valid value below a root barrier), and the wilting point value must be less than the field capacity value which must be less than the saturation value. The S-map water content estimates supplied by the S-map web service have been rounded to integers and may be assigned minimal values to meet these OVERSEER requirements. These modifications will result in a slightly less accurate estimate of Available Water to 60 cm (labelled PAW in OVERSEER) than that provided on the first page of this factsheet, but this is not expected to lead to any significant difference in outputs from OVERSEER .

Manaaki Whenua
Landcare Research

S O I L R E P O R T

Hawkes Bay Regional Council

Waimakariri_55b.2

Report generated: 18-Mar-2022 from https://smap.landcareresearch.co.nz

Waim_55b.2 (20% of the mapunit at location (1934778, 5602880), Confidence: Medium)

This information sheet describes the typical average properties of the specified soil to a depth of 1 metre, and should not be the primary source of data when making land use decisions on individual farms and paddocks. S-map correlates soils across New Zealand. Both the old soil name and the new correlated (soil family) name are listed below.

Capture of the base soil information in this region was funded by Hawkes Bay Regional Council and Manaaki Whenua.

Soil Classification

Soil Classification:
Weathered Fluvial Recent Soils (RFW)

Family Name:
Waimakariri (Waim)

Sibling Name:
Waimakariri_55b.2 (Waim_55b.2)

Soil profile material
Moderately deep soil

Depth class (diggability)
Moderately deep (75 - 95 cm)

Profile texture
loam

Parent Material

Stones/rocks
hard sandstone rock

Soil material
hard sandstone rock

Origin
Alluvium

Soil Sibling Concept

This soil belongs to the Recent soil order of the New Zealand soil classification. Recent Soils are weakly developed, showing limited signs of soil-forming processes although a distinct topsoil is present, a B horizon is either absent or only weakly expressed. It is formed in alluvial sand silt or gravel deposited by running water, from hard sandstone parent material.

The topsoil typically has loam texture and is stoneless. The subsoil has dominantly loam textures, with a very gravelly layer that starts at or below 45 cm soil mineral depth and extends continuously to 100 cm. The plant rooting depth extends beyond 1m.

Generally the soil is well drained with very low vulnerability of water logging in non-irrigated conditions, and has moderate to high soil water holding capacity. Inherently these soils have a high structural vulnerability and a moderate N leaching potential, which should be accounted for when making land management decisions.

About this publication

- This information sheet describes the *typical average properties* of the specified soil.
- For further information on individual soils, contact Landcare Research New Zealand Ltd: www.landcareresearch.co.nz
- Advice should be sought from soil and land use experts before making decisions on individual farms and paddocks.
- The information has been derived from numerous sources. It may not be complete, correct or up to date.
- This information sheet is licensed by Landcare Research on an "as is" and "as available" basis and without any warranty of any kind, either express or implied.
- Landcare Research shall not be liable on any legal basis (including without limitation negligence) and expressly excludes all liability for loss or damage howsoever and whenever caused to a user of this factsheet.

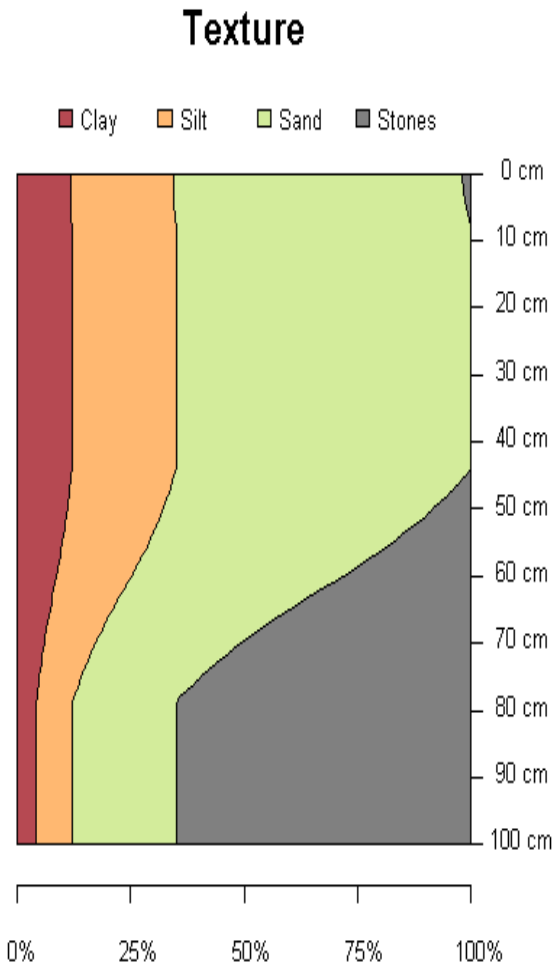
Waimakariri_55b.2

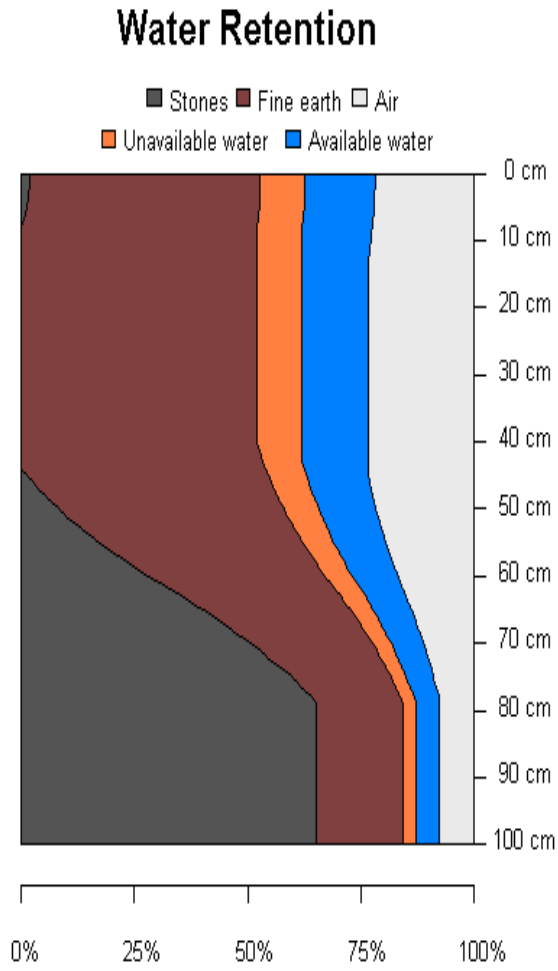
Soil horizons

Characteristics of functional horizons in order from top to base of profile:

Functional Horizon	Thickness	Stones	Clay*	Sand*	Permeability
Loamy Weak	10 - 20 cm	0 %	10 - 14 %	60 - 70 %	rapid
Loamy Weak	35 - 60 cm	0 %	10 - 14 %	60 - 70 %	moderate
Very Stony Loamy Compact	30 - 45 cm	60 - 70 %	10 - 14 %	60 - 70 %	moderately slow

* clay and sand percent values are for the mineral fines (excludes stones). Silt = 100 - (clay + sand)





The values for the graphs above have been generated from horizon and pedotransfer data. These values have then been splined to create continuous estimates of soil water holding capacity and particle size distribution the soil profile. These curves express the particle size distribution and water retention of the soil however there may be barriers to rooting depth that are not necessarily represented in these properties directly. It is advisable to check the potential rooting depth and rooting barrier fields in the soil physical properties section on page three of this factsheet.

Waimakariri_55b.2

Soil physical properties

Depth class (diggability)
Moderately deep (75 - 95 cm)

Potential rooting depth
Unlimited

Rooting barrier
No significant barrier within 1 m

Depth to hard rock
No hard rock within 1 m

Depth to soft rock
No soft rock within 1 m

Depth to stony layer class
Moderately deep

Texture profile
Loam

Topsoil stoniness
Stoneless

Topsoil clay range
10 - 14 %

Drainage class
Well drained

Permeability profile
Moderate

Depth to slowly permeable horizon
No slowly permeable horizon

Permeability of slowest horizon
Moderate (4 - 72 mm/h)

Aeration in root zone
Unlimited

Profile available water

(0 - 30cm or root barrier)	(0 - 60cm or root barrier)	(0 - 100cm or root barrier)
Moderate (44 mm)	Moderate (87 mm)	Moderate to high (120 mm)

Dry bulk density

topsoil	subsoil
1.09 g/cm³	1.30 g/cm³

Soil chemical properties

Topsoil P retention
Low (19%)

Soil management factors

Vulnerability classes relate to soil properties only and do not take into account climate or management

Soil structure integrity

Structural vulnerability
High (0.69)

Pugging vulnerability
not available yet

Septic tank installation category
A1 if slope > 15 deg otherwise B4

Contaminant management

N leaching vulnerability
Medium

P leaching vulnerability
not available yet

Dairy effluent (FDE) risk category
D

Water management

Water logging vulnerability
Very low

Drought vulnerability - if not irrigated
Low

Bypass flow
Low

Hydrological soil group
A

Relative Runoff Potential

Slope	0-3°	4-7°	8-15°	16-25°	>25°
Risk	VL	VL	VL	VL	L

SINDI - Soil quality Indicators

SINDI - Soil Quality Indicators

A suite of soil quality indicators is available from http://sindi.landcareresearch.co.nz/

- Compare your soil with information from our soils databases.
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