RFI – Sunfield Fast-Track Application

Response to Auckland Council Specialist Memos:

- Annexure 17: Soil and Land Use Capability (Dr Dani Guinto)
- Annexure 16: Highly Productive Land (Ms Ruth Underwood)

Subject of Response: Soil, land use capability, and related matters

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1 Response to Annexure 17: Soil and Land Use Capability (Dr Dani Guinto)

1.1 My position is that the soils are not as versatile and productive as stated in Dr. Guinto's annexure and have significant limitations for cropping.

Response to: Site-specific mapping adequately characterises the soil

1.2 Dr. Guinto's annexure states that the site-specific mapping adequately characterises the soil and LUC units in the surveyed areas, identifying predominantly LUC Class 2 and 3 land with wetness limitations (Guinto, 2025 - para 7). I agree with this assessment of the surveyed area. However, it should be noted that the Singleton (2020) report, on which this is based, concluded that while some of the land is LUC Class 2, the majority of the site's productive land was classified as "Other productive land" because of its limitations (Singleton, 2020 - p 16). This contrasts with the idea of high versatility.

1.3 Dr Guinto noted the absence of a soil observation map in the information provided (Guinto, 2025 - para 12). I have been able to source this from Dr Singleton. The observations Dr singleton made, covered the broader mapped area including the Future Urban Zone and the Sunfield site. **Figure 1** shows the distribution of Dr Singleton's observations (including both detailed and 'confirmation' observations) used for the on-site LUC map provided in Singleton (2020).

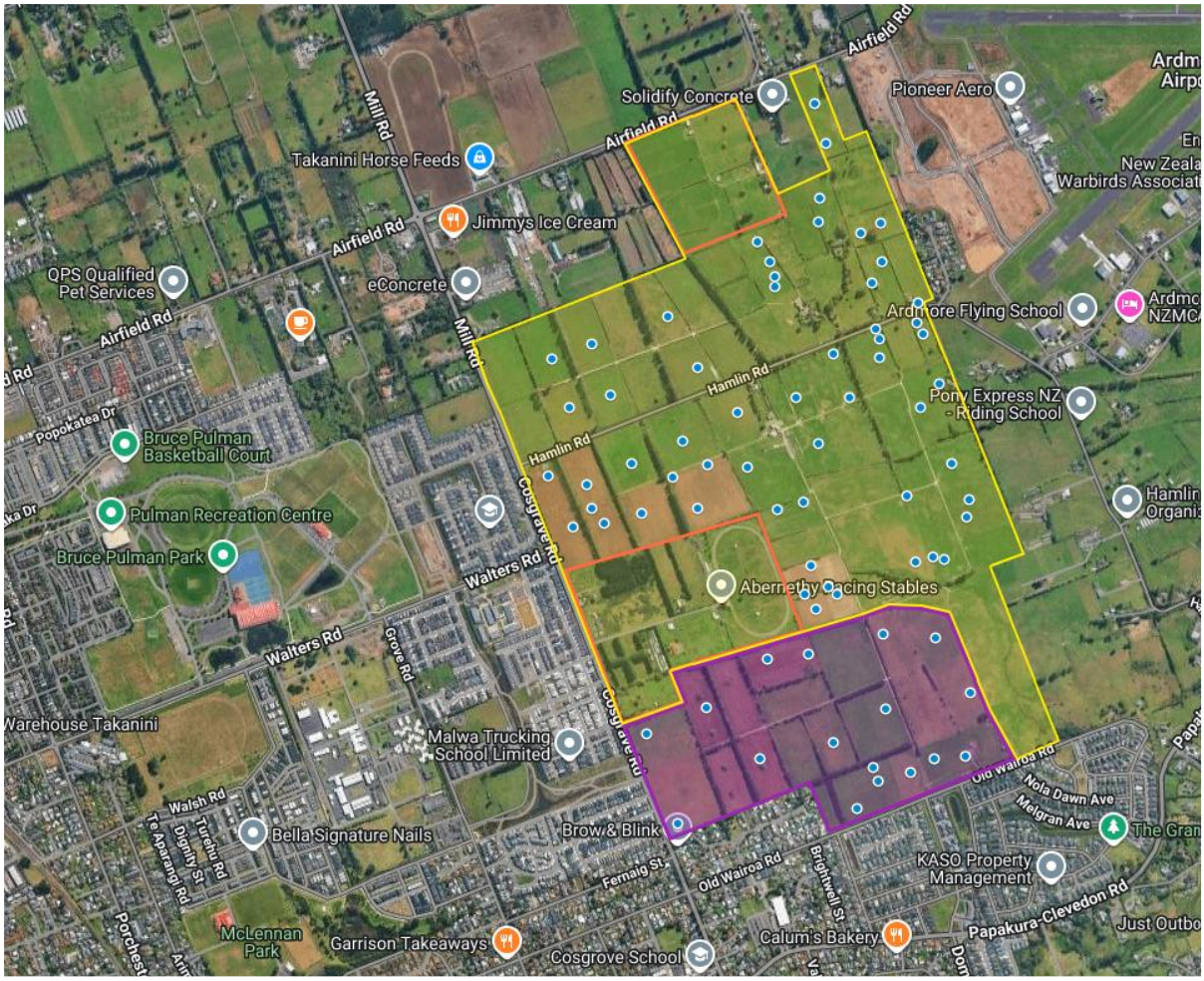

Figure 1: Distribution of Dr Singleton's observations used for the on-site LUC map provided in Singleton (2020). For reference, the different areas are coloured as follows: the Site (yellow), the FUZ (purple), desktop mapped areas (red boundary).

Response to: Land demonstrates high productivity potential despite wetness limitations

1.4 Dr. Guinto's annexure suggests the land has 'high productivity potential' with pasture yields of 10-12 tonnes per hectare per year, and that wetness limitations can be managed through proper drainage and soil management practices (Guinto, 2025 - para 8). However, the key issue is that pasture production is not the sole measure of versatility. The soils on this site, particularly the Clevedon soils have heavy clay subsoils that are hard when dry and very sticky when wet, making cultivation for cropping very difficult (Singleton, 2020 - p. 11).

1.5 The structure of Clevedon soils is not conducive to root development for fruit trees and vines, nor is it favourable for cultivation due to the poorly drained heavy clay – this is evidenced in the auger soil profile image (see Figure 1 – **Appendix 1**).

1.6 The *Manukau City Soil Survey* report (Purdie, 1981) provides an assessment suitability for different land uses and an overall rating of versatility on Clevedon soils. The ratings are based on various soil properties for each soil to rate the soil from '1' (high suitability with low management inputs) to '5' (low suitability with very high management inputs). Table 4 (p31) of the report rates Clevedon soils[1] as having low suitability for market gardening ('4' or '5'), tree crops ('4'), and intensive pasture ('4'), with an overall versatility rating of low ('4'). This supports the statements made that these soils have low suitability for intensive land uses and are most suited to pastoral use with limitations during wetter periods as stated by Singleton (2020).

1.7 When drained and fertilised, the soils are suitable for pasture growth in autumn and spring, but summer yields may be limited by dry topsoil, and winter yields can be limited by saturation and pugging. These are defining limitations that restrict the land to primarily pastoral use, unlike soils such as Patumahoe clay loam, which despite being slow-draining, is easily cultivable and retains its structure, so can be continuously cropped for vegetables (Martindale et al., 2018b – p 11). The Auckland Unitary Plan's own definition of "prime soil" requires "good drainage" and "versatile soils easily adapted to a wide range of agricultural uses", criteria the majority of the site's soils do not meet (Singleton, 2020 – p 14-15).

1.8 A more detailed comparison of the soils on the Sunfield Site with common cropping soils from Auckland and Waikato regions is provided **Appendix 1**.

[1] ACC5 and ACC6 coded soils based on Martindale et al. 2018a.

2 Response to Annexure 16: Highly Productive Land (Ruth Underwood)

2.1 My position is that the Sunfield site soils are not as versatile and productive as Ms Underwood's annexure suggests.

Response to: The land is suitable for continued use in land-based primary production (p. 3)

2.2 Ms Underwood states that the land is suitable for continued use in land-based primary production and refers to nearby land of a similar LUC class (as mapped using regional scale NZLRI-LUC data) being used for a wide range of productive uses, including horticulture (Underwood, 2025 - para 32). While this may be true for some areas, the statement overlooks the importance of site-specific soil and LUC mapping to identify and confirm limitations for land use. The soils characterised and mapped on-site, have inherent physical and chemical limitations such as poor drainage, clay texture, and acidity that restrict their versatility or long term sustainability for intensive use – both important considerations when assessing productive capacity.

Response to: Land has slight to moderate limitations for arable use

2.3 Ms Underwood acknowledges that on-site LUC mapping identified both LUC Class 2 and 3 land, with a small area of LUC Class 6, stating that this is consistent with the land having "slight" (LUC class 2) to "moderate" (LUC class 3) limitations for arable use (Underwood, 2025 - para 50). However, this is an overstatement of the land's potential as it does not consider the specific characteristics of the soils on the Site that impact the range of land uses (versatility) of the land, and its capability to support land uses over the long term. Imperfectly or poorly drained soil types (Ardmore, Clevedon & Brookby) made up the majority of the LUC class 2 or 3 land, meaning the majority of the Site had soils with a range of physical and chemical limitations and unsuitable for a variety of agricultural uses (Singleton, 2020 – p 14).

2.4 Only the LUC 2s4 land (Karaka soil) had good drainage and would be suitable for intensive arable or horticulture.

2.5 As referenced in Dr Singleton's report (p 13-14), the Auckland Unitary Plan defines land containing prime soil as having 'good drainage' and 'versatile soils easily adapted to a wide range of agricultural uses', criteria the majority of the site's soils do not meet.

3 Response to Desktop mapped areas and land classification

3.1 Auckland Council's annexures (16 & 17, p 15 and p 41 respectively) noted that certain parts of the site were not mapped on-site but through a desktop assessment, and in places the extent of non-productive land was overstated.

3.2 Access to the desktop mapped areas for a detailed on-site survey was not possible. In the absence of on-site survey, detailed desktop mapping was undertaken to provide the best possible estimate of the areas of predominantly productive land, predominantly non-productive land, and the soils. Areas of non-productive land and productive land using aerial imagery. Soils for these areas were mapped using the surrounding soils identified by Singleton (2020).

3.3 The internal race track area originally mapped as non-productive land has been re-examined, and the area mapped in more detail (**Figure 2**).

Figure 2: Revised detailed map of the of the non-productive land inside the race track (4.25 ha).

3.4 The more detailed mapping revealed an isolated area of approximately 4.25 ha of low quality pasture within the surrounding race track. This pasture is further fragmented by farm races, which are evident from the aerial imagery. The area is used for grazing, most likely horses and based on historic aerial photography available on Google Earth has been in Pasture since at least 2005 The fragmentation and shape of this 4.25 ha area reduce its potential for versatile agricultural production, and its isolation from other productive land makes it difficult to manage and amalgamate with surrounding productive land.

4 References

(Guinto, 2025) Auckland Council. 17. (Auckland Council) Annexure 17 - Soil and Land Use Capability Annexure - Sunfield - FINAL.pdf. Dr Dani Guinto, Senior Land & Soil Scientist, 4 August 2025.

(Hicks and Curran-Cournane, 2017) Auckland Council. tr2017-020-matching-farm-production.pdf. Douglas Hicks, Fiona Curran-Cournane, October 2017.

(Hicks, 2019) Lands & Survey. pc-45-appendix-9.2-soil-assessment-report.pdf. Dr. Douglas L. Hicks, consulting soil scientist, 7 October 2019.

(Hill, 2020) Landsystems. A review of high class soils in the Waikato District.pdf. Dr Reece Hill, August 2020.

(Martindale, Hicks, and Singleton, 2018a) Auckland Council. auckland-soils-sii-04-clevedon-waipu-oct-2018.pdf. M. Martindale, D. Hicks, P. Singleton, October 2018.

(Martindale, Hicks, and Singleton, 2018b) Auckland Council. auckland-soils-sii-16-patumahoe-oct-2018.pdf. M. Martindale, D. Hicks, P. Singleton, October 2018.

(Singleton, 2020) Natural Knowledge. Land Use Capability and Soil Assessment- Ardmore v 1.1_3.12.2020.pdf. Dr Peter Singleton, December 2020.

(Underwood, 2025) Auckland Council. 17. (Auckland Council) Annexure 16 - Highly Productive Land Annexure - Sunfield - FINAL.pdf. Ruth Underwood, Horticultural Consultant, 4 August 2025.

Appendix 1: Detailed comparison of soils on the Site with Auckland and Waikato cropping soils.

Comparison of the Hamlin Road site (the 'Site') soils with other soils commonly used for cultivation in the Auckland and Waikato regions.

1 Introduction

Part of the request was to identify what makes the soils on the Site different to Elite and Prime soils found elsewhere in the Auckland region, and high class soils found in nearby regions. No field visit or assessment was undertaken by myself and so the comments provided are solely based on the site assessment information provided in the report, additional information provided by Dr Singleton, and available soil information from existing regional scale reports.

2 Background

2.1 Land Use Capability and Soil assessment summary

The Soil and Land Use Capability report identified the soils and corresponding LUC units shown in **Table 1**.

Table 1. Soil types and correlation with Waikato (South Auckland) LUC units and Farm LUC units (from Singleton, 2020).

Soil type	Waikato LUC	Farm LUC	Features
Karaka	2s4	1c	Well to moderately well drained flat to gently undulating slopes
Clevedon			Poorly drained flat to gently undulating slopes
- Typic	3w2	3a	○ Clay
- Humose	2w2	2w	○ Humic clayey top
- Peaty	2w2	2w	○ Humic clayey top on shallow buried peat
Brookby	2e5	2p	Undulating slopes, imperfectly drained clay
Brookby	3e4	3e	Rolling slopes, imperfectly drained clay
Ardmore	2w2	2w	Poorly drained flat to gently undulating slopes, peat

In the assessment of whether each of the soils are elite or prime needs to take into consideration the property scale land characteristics including slope and local drainage conditions. A summary of the main soil and land characteristics that were used to exclude these soils as land containing prime soils is provide in **Table 2**.

Table 2. A summary of the main soil and land characteristics that were used to exclude these soils as land containing Prime soils on the Site.

Soil type	Limitations	Best land use
Karaka[2]	Well drained, friable, few limitations for cropping.	Horticulture, cropping and pastoral land uses.
Clevedon	• Poor drainage that prevents cropping throughout the year. • Clay texture that makes cropping very difficult throughout the year. • Acidic conditions which requires ongoing soil pH management to enable production.	Pastoral land uses
Ardmore	• Poor drainage that prevents cropping throughout the year. • Peat soils are prone to increased subsidence with excessive drainage and cultivation. • Acidic conditions which requires ongoing soil pH management to enable production.	Pastoral land uses
Brookby	• Imperfect drainage that makes cropping very difficult throughout the year. • Heavy clay texture that makes cropping (cultivation) very difficult.	Pastoral land uses

3 Soil characteristics

3.1 Site soil characteristics

The soils (and their characteristics) identified on the Site are provided below.

Karaka soils are Allophanic soils formed on a thin mantle of water-sorted volcanic ash, also pockets of air fall ash on high parts, over old estuarine sediments. They occupy flat to undulating, dissected estuarine terraces. Their topsoils and upper subsoils are lighter – textured (contains more sand and silt) than Patumahoe. Lower subsoil is clay rich weathered estuarine sediment, very different from the granular clay that weathers from thick airfall ash (Patumahoe soil), or the stony loam that weathers from young basalt (Ohaeawai soil)[3].

Clevedon soils are Gley soils formed on weathered sandstone alluvium in which the subsoil has weathered to clay, silty clay or sandy clay. In these respects, the soils closely resemble soil on weathered stream alluvium[4]. As a consequence of their parent material, soil development and topographic position, the resulting soils are poorly drained, have clay loam or silt loam topsoils over heavy clay subsoils with coarse or massive structure.

[2] Note that the Karaka soil was considered and elite soil (rather than a prime soil) based on these characteristics.
[3] Soil Information Inventory 7: Karaka and related soils. October 2018. Auckland Council.
[4] Soil Information Inventory 4: Clevedon, Waipu, and related soils. October 2018. Auckland Council.

Brookby soils are Ultic soils formed on weathered alluvium from quartzitic sandstone. On the most weathered sites, clay has washed out of the lower topsoil leaving behind a silty or sandy eluvial horizon. The washed-down clay has almost sealed the upper subsoil creating an illuvial perch-gley layer.
They commonly have a silt loam topsoil over heavy firm clay subsoils with coarse structure. These yellow clay soils are hard in summer and wet in winter. Generally, the soil is imperfectly or poorly drained with very high vulnerability of water logging in non-irrigated conditions. It should be noted that these clays are heavier and stickier than those of the Patumahoe soils which in contrast are favourable for continuous cultivation because of their strong and persistent structure. This difference in clay is most likely due to differences in clay mineralogy associated with differing parent material.

Ardmore soils are Organic soils formed on peat and alluvium. These soils are dominated by organic matter, have low bulk densities, are poorly drained and strongly acidic (very low pH). Additionally, when drained to allow for productive use, the peat is prone to subsidence[5].

Example soil profiles for these soils are shown in **Figure 1**[6].

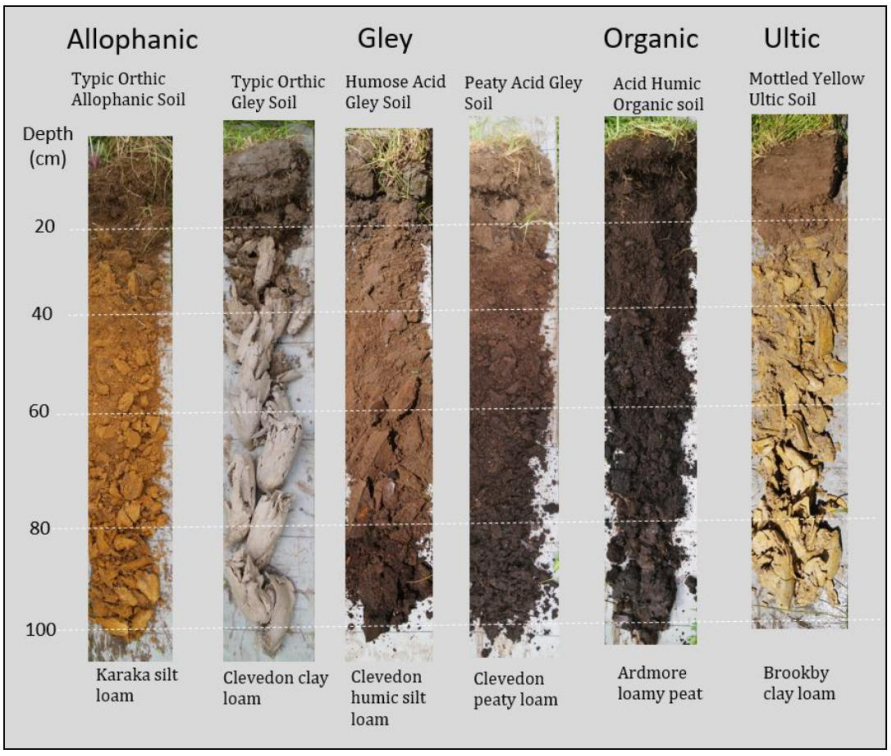

Figure 1. Example soil profiles for soils identified on the Site (from Singleton 2020).

3.2 Other soils commonly used for cropping

Examples of soils (and their characteristics) commonly used for cropping in the Auckland and Waikato regions are provided below.

[5] Peat subsidence is the shrinking and lowering of the peat due to drainage. Subsidence will occur on all drained peat land and is exacerbated by excessive drainage and cultivation.
[6] From: Singleton P 2020. Land Use Capability And Soil Assessment – Hamlin Rd, Ardmore.

Patumahoe clay loam is a Granular soil formed on weathered volcanic ash. It is dark reddish brown, moderately acidic, sticky, and clay rich. The clays dry to form strongly developed aggregates that give the soils their distinctive granular structure and resilience to long term cultivation[7].

Pukekohe clay loam is a Granular soil formed on weathered volcanic rock and ash. It has the same good properties for cultivation and vegetable growing as Patumahoe soils, with extra advantages. Its gritty subsoil is free-draining. It's easy, even slopes allow long cultivation passes. They are mostly north-facing and elevated, so almost frost-free[8].

These soils have strong soil structure that persists despite continuous long term cultivation. Soil drainage is moderately well drained to well drained, which allows cultivation for all but wet months, despite their clay subsoil.

Helvetia clay loam is a Gley soil formed on weathered volcanic ash. They do not have quite as good properties for vegetable growing or pasture grazing as Patumahoe clay loam. They occupy hollows on undulating ground, is where water drains towards and down through the soil, so silt and clay particles accumulate and reduce subsoil permeability. Surface ponding can occur following heavy rainfall, preventing passage of machinery, and causing pasture to pug if grazed. Nonetheless the soil aggregates quickly as it dries, so has good structure for crop and pasture growth[9].

Hamilton soils are Granular soils formed on strongly weathered volcanic ash. They are moderately well drained to well drained with a moderate to strong polyhedral structured firm clay loam topsoil, over strongly developed blocky clay loam and clay subsoils[10].

Ohaupo soils are Allophanic soils formed on younger less weathered volcanic ashes. They are well drained, friable (easily worked) yellow brown silt loams with moderate structure that does not crack on drying[11].

Example soil profiles for these soils are shown in **Figure 2**.

[7] Hewitt A.E., Balks M.R., Lowe D.J. (2021) Granular Soils. In: The Soils of Aotearoa New Zealand. World Soils Book Series. Springer, Cham.
[8] Soil Information Inventory 16: Patumahoe and related soils. October 2018. Auckland Council.
[9] Soil Information Inventory 16: Patumahoe and related soils. October 2018. Auckland Council.
[10] Bruce JG 1979. Soils of Hamilton City, North Island, New Zealand. NZ Soil Survey Report31. DSIR, Wellington.
[11] Bruce JG 1979. Soils of Hamilton City, North Island, New Zealand. NZ Soil Survey Report31. DSIR, Wellington.

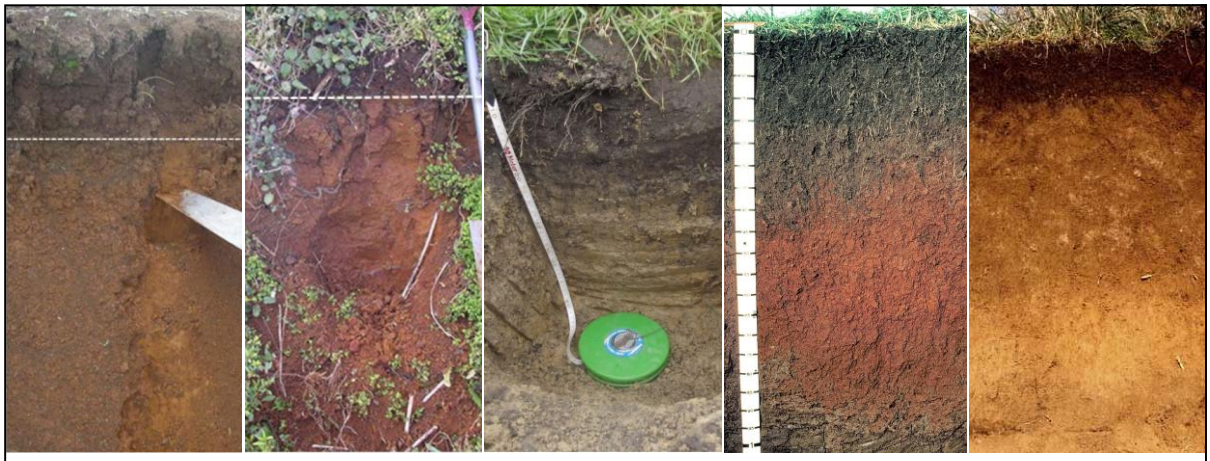

Figure 2. Example soil profiles for soils commonly used for cropping in the Auckland and Waikato regions.

4 Comparison of soils for cultivation suitability

The main soil characteristics that distinguish their suitability of the soils for cultivation are parent material, soil drainage, soil texture and soil structure.

The clay soils of the Site are formed from sandstone alluvium, which over time has weathered to produce to clay, silty clay or sandy clay subsoils. Soils formed from this parent material have lower natural fertility than soils (such as Patumahoe soils) formed from weathered volcanic rocks and ash.

The Clevedon soils are Gley soils, poorly drained because of their topographic position on the flats, compared with Patumahoe soils which generally occupy undulating to rolling hills which provide for better soil drainage. Frequent waterlogging of the Clevedon soils is exacerbated by the low permeability of the clay subsoil. As a result, these soils are characterised by to reduced subsoil conditions (lack of aeration on the subsoil) and are strongly acidic. Cultivation Poor drainage restricts cultivation to only part of the year, provided soil drainage can be rectified.

Brookby soils are Ultic soils that are formed following extensive long term leaching. They are characterised by a silty fine grained massive eluvial horizon (E horizon) overlying a clay enriched subsoil, with a coarse structure. This clay movement results in a sealed upper subsoil creating an illuvial perch-gley layer with restricted drainage and cause low permeability. These soils are strongly acidic as a result of the leaching. They also have dispersible surface horizons susceptible to livestock treading damage and are prone to erosion if cultivated. When dry, the heavy clay subsoil is very hard, and when wet the subsoil is very sticky and plastic. Under both conditions the soil is difficult to cultivate. Additionally, the silty upper soil is prone to erosion on rolling slopes when cultivated.

In contrast the Patumahoe (also the Hamilton and Pukekohe soils) are formed from volcanic ash which has produced strongly structure and stable clay subsoils high in aluminum and iron oxides. Their subsoil does become sticky when wet and difficult to cultivate but the structure reforms once dry and suitability for cultivation is maintained.

The Helvetia soils are limited by their imperfect to poor drainage. These soils have similar soil drainage limitations to the clayey soils on the Site.

The Ohaupo soils are similar to the Karaka soils in that they are Allophanic soils formed from less weathered younger tephra (volcanic ash). They have textures dominated by allophane clay and silt, fine weak to moderately developed structure, and are well drained. The soils are very friable making them very suitable for cultivation on flat to undulating slopes. Similar to the karaka soils, on steeper slopes (rolling hills) they are prone to erosion if cultivated.

These differences in characteristics and limitations are summarised in **Table 3** (Site soils) and **Table 4** (other soils commonly used for cultivation in the Auckland and Waikato regions).

Table 3. Soil characteristics and limitations for the Site soils.

Site	Soil name	NZSC (soil order)[12]	Parent material	Soil drainage	Soil texture	Soil structure	Defining limitations
Site	Karaka	Allophanic	Younger ash over strongly weathered volcanic ash	Well drained	Silt loam over clay loam	Fine weak polyhedral, over moderate to strong blocky.	Good drainage, friable, good workability, good pH, good permeability, prone to erosion if cultivated on steeper slopes.
	Clevedon	Gley	Strongly weathered sandstone alluvium	Poor	Clay loam over clay	Fine moderate polyhedral, over moderate coarse blocky or prismatic or massive.	Poor drainage, moderate structure, low workability, low pH, low permeability, subsoil structure and winter wetness severely limits cultivation.
	Brookby	Ultic		Imperfect	Silt loam over clay	Single grained and loose when moist, massive and hard (but non-indurated) when dry, over coarse blocky or prismatic or massive.	Poor drainage, moderate structure, low workability, low pH, low permeability, subsoil structure and winter wetness severely limit cultivation.
	Ardmore	Organic	Peat and sandstone alluvium	Poorly drained	Peat over clay	Organic, over coarse blocky or prismatic or massive.	Poor drainage, moderate structure, moderate workability, low pH, moderate permeability, winter wetness severely limits cultivation, drainage causes subsidence[13].

[12] Based on Smap Online factsheets; (https://smap.landcareresearch.co.nz/maps-and-tools/factsheets/) and Hewitt, A.E. 2010. New Zealand Soil Classification 3rd edition. Landcare Research Science series No 1.Manaaki Whenua Press.

[13] Peat subsidence is the shrinking and lowering of the peat due to drainage. Subsidence will occur on all drained peat land and is exacerbated by excessive drainage and cultivation.

Table 4. Soil characteristics and limitations for other soils commonly used for cultivation in the Auckland and Waikato regions.

Commonly cultivated soils (location/region)	Soil name	NZSC (soil order)[14]	Parent material	Soil drainage	Soil texture	Soil structure	Defining features/limitations
Auckland and Waikato regions	Patumahoe	Granular	strongly weathered volcanic ash	Moderately well to well drained	Clay loam over clay	Weak fine polyhedral, over moderate to strong medium blocky.	Good drainage, persistent structure, moderate workability, good pH, moderate permeability
	Pukekohe	Granular	Strongly weathered sandstone alluvium	Well drained	Clay loam over clay	Weak fine polyhedral, over moderate to strong medium blocky.	Good drainage, persistent structure, moderate workability, good pH, moderate permeability
	Helvetia	Gley		Poorly drained	Clay loam over clay	Weak fine polyhedral, over weak to moderate coarse blocky.	Poor drainage, moderate structure, moderate workability, good pH, moderate permeability
	Hamilton	Granular	Peat and sandstone alluvium	Moderately well to well drained	Clay loam over clay	Moderate to strong fine polyhedral, over strong coarse blocky.	Good drainage, persistent structure, moderate workability, good pH, moderate permeability
Waikato region	Ohaupo	Allophanic	Recent airfall ash	Well drained	Silt loam	Moderate fine polyhedral, over moderate medium blocky.	Good drainage, friable, good workability, good pH, good permeability, prone to erosion if cultivated on steeper slopes.

[14] Based on Smap Online factsheets; (https://smap.landcareresearch.co.nz/maps-and-tools/factsheets/) and Hewitt, A.E. 2010. New Zealand Soil Classification 3rd edition. Landcare Research Science series No 1.Manaaki Whenua Press.

5 Comparison of limitations

For property scale LUC classification and identification of land containing elite and prime soils it is necessary to consider the characteristics of the land on the property being assessed. These land characteristics in combination with the soil characteristics will determine the limitations for land use, specific to the site. This is important as the definitions of land containing elite or prime soils allow for this, especially in relation to their suitability for cultivation and vegetable growing.

For land containing elite soils, generally LUC class 1 soils and those soils named in the definition will only fail to meet the definition criteria if the slopes are greater than 15 degrees.

For land containing prime soils, local occurrence of unfavourable climate (such as frost hollows), slopes greater than 15 degrees, poor soil drainage, and other characteristics such flooding, heavy clay subsoils, naturally occurring acid soil conditions, and peat subsidence all reduce the versatility of the soils on the site, and limit the range of possible land uses to primarily pastoral use.

The matrix presented in **Table 5** shows the possible occurrence of these land and soil characteristics for the soils presented in **Table 3** and **Table 4**. The soils occurring on the Site are assessed on the soil and land characteristics provided in the soil and LUC assessment report provided by Dr Singleton. The other soils provided for comparison, are generalised, based on my expert knowledge and available information sources.

Table 5. Matrix of soil limitations for the Site soils and other soils commonly used for cultivation.

Soil	Possible occurrence of unfavourable characteristics (Yes/No)						
	Slope	Climate	Soil drainage	Flooding	Heavy clay subsoils	Low pH	Peat subsidence
Karaka	Yes	Yes	No	No	No	No	No
Clevedon	No	Yes	Yes	Yes	Yes	Yes	Yes[15]
Brookby	Yes	Yes	Yes	No	Yes	Yes	No
Ardmore	No	Yes	Yes	Yes	Yes	Yes	Yes
Patumahoe	Yes	Yes	No	No	No	No	No
Pukekohe	Yes	Yes	No	No	No	No	No
Helvetia	No	Yes	Yes	Yes	Yes	No	No
Hamilton	Yes	Yes	No	No	No	No	No
Ohaupo	Yes	Yes	No	No	No	No	No

The main point to note is that the limitations associated with the soils on the Site are greater in number than for the comparison soils. This is essentially the basis for the soils on the site being predominantly not classified as Prime soils despite them being classified as LUC 2 and LUC 3.

[15] Some Clevedon soils overly peat on the Site.

6 Conclusions

The assessment of land containing elite dan prime soils should be undertaken based on the soil and land characteristics on the site as these can determine whether the site specific land containing the soil meets all the criteria required to be elite and prime soil.

Compared with other soils used for cropping in the Auckland and Waikato regions, the soils on the Site have greater limitations for use, which excludes them from being suitable for cropping and limits them to primarily pastoral use.

The main differences between the soils on the Site and other soils used for cultivation and cropping, are a factor of parent material, soil genesis (soil development), topographic position, soil texture and structure, and soil drainage.