

Appendix 12: Soils Assessment

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Soil and Land Use Capability classification assessment for: Maungatautari Road properties, Cambridge 3495.

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Attention: Paul Roycroft

Re: Soil and Land Use Capability classification assessment of Maungatautari Road properties, Cambridge 3495.

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1. Introduction

A soil and Land Use Capability (LUC) classification assessment of part 37 Maungatautari Road and surrounding land parcels was undertaken in order to comply with Rules of the Waipa District Plan, in relation to the protection of high class soils, and the National Policy Statement for Highly Productive Land, in relation to the protection of highly productive land.

The Site covers an area of 101 hectares (ha), bordered to the south by Maungatautari Road and to the north by the Waikato River.

The assessment covered 53.6 ha of the Site (shaded yellow in **Figure 1**). The C5 growth cell area of the Site (47.4 ha) is excluded from the assessment (shaded grey in **Figure 1**).

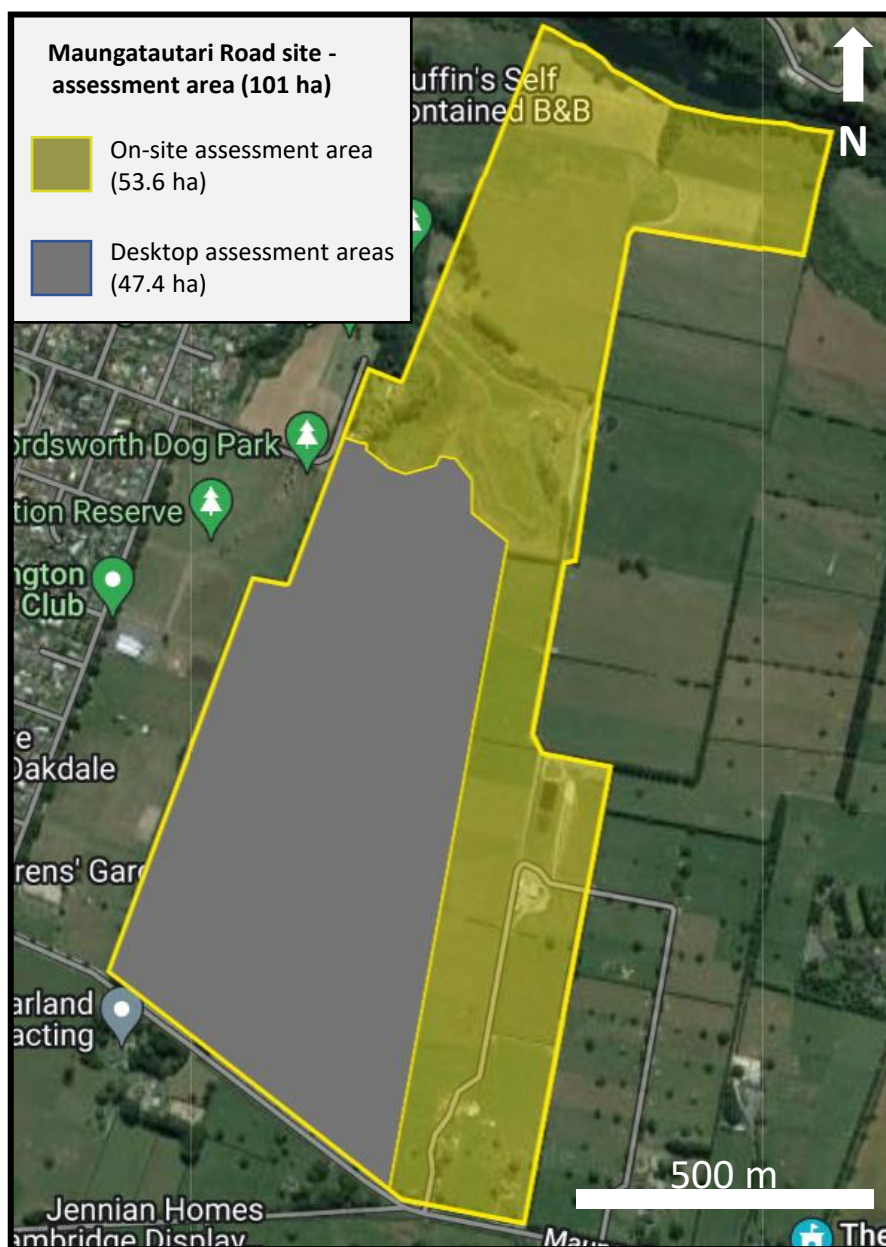


Figure 1. The Maungatautari Road site, Cambridge (on-site assessment area shaded yellow, and C5 growth cell area shaded grey).

2. LUC background

LUC classification is the common method for assessing land in New Zealand; it uses the Land Use Capability System, which is part of the New Zealand Land Resource Inventory (NZLRI) as produced by the Water and Soil Division of the Ministry of Works, for the National Water and Soil Conservation Organization during the

1970s. In 2009 the 3rd Edition of the LUC Survey Handbook¹ was published and has been used for this assessment. The LUC uses a systematic arrangement of different kinds of land according to those properties that determine its capacity for permanent sustained production, where the word “capability” is used in the sense of “suitability for productive use” after taking into account the physical limitations the land may have.

The LUC classification is specifically designed to provide an index of versatility. There are eight land use capability classes (**Figure 2**) arranged in order of increasing degree of limitation or hazard to use; and a decreasing order of use, from Class 1 to 8.

Increasing limitations to use ↓	LUC Class	Arable cropping suitability†	Pastoral grazing suitability	Production forestry suitability	General suitability	Decreasing versatility of use ↓
	1	High ↓ Low	High ↓ Low	High ↓ Low	Multiple use land	
	2					
	3					
	4					
	5	Unsuitable	Low ↓ Unsuitable	Low ↓ Unsuitable	Pastoral or forestry land	
	6					
	7					
	8					
		Unsuitable	Unsuitable	Conservation land		

Figure 2. Increasing limitations to use and decreasing versatility of use from LUC Class 1-8.

Within each LUC Class the land is assigned a subclass according to the kind of limitation (e = Erodibility, w = Wetness, s = Soil limitations within the rooting zone, c = Climate). At the most detailed level LUC groups together those inventory units which respond similarly to the same management, and which are suitable for the same kinds of crops, pasture, or forest species with the same potential yield, and which require the application of the same conservation measures.

The LUC worksheets were compiled from all relevant databases of land resource documents available at the time, consequently some sheets suffered from a lack of information that only detailed soil and geological surveys could have provided. Therefore, there are **scale limitations**, which need to be considered, especially when interpretation is required at the individual property scale.

The LUC units displayed on the 1970s worksheets remain reasonably robust but are subject to change. For example, the second edition (1993) Northland region worksheets were mapped at the more detailed scale of 1:50 000, replacing the earlier first edition 1:63,360 maps. In the first edition, 69 LUC units were defined compared with 91 LUC units in the second edition - about 60 of the first edition classification units changed.

The average area for a map unit is 125 ha, however, at the 1:50 000 scale of mapping it is theoretically possible to delineate an unhooked inventory map unit (no vinculum) area of 60 ha (60 ha = 600 m by 1000 m) provided the geology, soil, vegetation, erosion and slope are uniform.

¹ Lynn IH, Manderson AK, Page MJ, Harmsworth GR, Eyles GO, Douglas GB, Mackay AD, Newsome PJF 2009. Land Use Capability survey handbook – a New Zealand handbook for the classification of land. AgResearch Hamilton; Manaaki Whenua Lincoln; GNS Science Lower Hutt, New Zealand.

The **purpose of this background information** is to illustrate and emphasise that the NZLRI information provides excellent physical base data for planners (a planning tool) but is not fit for purpose as a plan (map) unless undertaken at the correct scale. This assessment fulfils that purpose.

3. Non-productive land and modified soil

For an accurate assessment of LUC classification for a property, the assessment should be based on the current condition of the area (i.e. mapped in current state). This is important because some land management practices (e.g. the placement of tracks, excavation of drains, and general earthworks) result in irreversible changes to the soil (i.e. changes other than those that can be remediated by management practices and return the soil to its intrinsic state). These areas are referred to as non-productive land. Examples of non-productive land include native vegetation, wetlands and riparian areas, tracks, and buildings and curtilage. Non-productive land can include areas of modified soil. In essence, modified soil are classified as Anthropic Soils² and are no longer considered high class soil, or highly productive land if the productive capacity of the modified soil has been irreversibly reduced (e.g. mixed soil, truncated soil or placement of fill with minimal topsoil).

4. Waipa District Council definition of high class soils

‘High class soils’ means those soils of Land Use Capability classes 1 and 2 (excluding Peat Soils), and soils of Land Use Capability classes 3e1 and 3e5 classified as Allophanic Soils using the New Zealand Soil Classification.

5. National Policy Statement for Highly Productive Land (NPS-HPL)

The National Policy Statement for Highly Productive Land (NPS-HPL) came into force on 17 October 2022.

The NPS-HPL requires regional councils to map highly productive land but also provides an interim definition of what will be considered highly productive land prior to this mapping occurring. This is land that is zoned general rural or rural production and is LUC 1, 2, or 3 land but is not identified for future urban development or subject to a re zoning plan change¹. LUC 1, 2, or 3 land is defined by reference to the New Zealand Land Resource Inventory or by any more detailed mapping that uses the Land Use Capability classification.

Identified for future urban development means³:

- (a) identified in a published Future Development Strategy as land suitable for commencing urban development over the next 10 years; or
- (b) identified:
 - (i) in a strategic planning document as an area suitable for commencing urban development over the next 10 years; and
 - (ii) at a level of detail that makes the boundaries of the area identifiable in practice.

The C5 growth cell has been identified for development post 2035 in Waipa 2050 and in the District Plan and is identified in Future Proof for ‘long-term’ development. However, it has not been identified within the next 10 years and therefore does not meet the NPS-HPL definition for future urban development.

² Anthropic soils – “Other soils that have been formed by the direct action of people by either truncation, drastic mixing or by deposition of material 30 cm or more thick” (Hewitt, 2010).

³ NPS-HPL 1.3 Interpretation.

The C5 Plan Change contains land that is zoned Deferred Residential and Rural in the Waipa District Plan. The NPS-HPL defines urban, as a description of a zone, means any of the following zones:

- a) low density residential, general residential, medium density residential, large lot residential, and high density residential,
- b) settlement, neighbourhood centre, local centre, town centre, metropolitan centre, and city centre,
- c) commercial, large format retail, and mixed use,
- d) light industrial, heavy industrial, and general industrial,
- e) any special purpose zone, other than a Māori Purpose zone,
- f) any open space zone, other than a Natural Open Space zone,
- g) sport and active recreation.

These zones are described in the National Planning Standards and where the zone framework standards of have not yet been implemented the nearest equivalent zone should be used⁴.

The National Planning Standards identify the future urban zone as a special purpose zone and describe the future urban zone as – “areas suitable for urbanisation in the future and for activities that are compatible with and do not compromise potential future urban use”⁵. The Deferred Residential Zone is therefore considered a special purpose (future urban zone) as this is the nearest equivalent zone. Special purpose zones are included in the definition of urban under the NPS-HPL⁶. Therefore, the Deferred Residential Zone is not a general rural or rural production zone and does not fall within the land captured by Clause 3.5(7)(a) and does not fall within the interim definition of highly productive land.

Therefore, the NPS-HPL does not apply to the Deferred Residential Zone. The NPS-HPL, however, applies to the Rural Zoned land.

6. Soils and LUC classification according NZLRI information (1:50,000 scale)

Based on the available NZLRI map information⁸ the soils and LUC units on the property are mapped as Horotiu sandy loam (LUC unit 2s1) and Waikato sand⁹ (LUC unit 3s1). LUC 2s1 is classified as high class soil and LUC 3s1 is classified as not high class soil as defined by Waipa District Plan. Under the NPS-HPL, LUC 2s1 and LUC 3s1 are considered highly productive land.

7. On-site soil and LUC classification assessment

Landsystems undertook an on-site soil and LUC assessment of the 53.6 ha area according to standard methods (Milne et al., 1993¹⁰ and Lynn et al., 2009¹¹).

Observations of slope angle, topography and soil parent material were made over the relevant area. Soil augering up to 80 cm depth was used to assess soil properties such as soil horizons, drainage, plant root depths, texture, structure, and colour. This information was used to determine soil type and soil boundaries, from which the necessary LUC classification was assigned. All soils were assessed in current condition and non-productive land and areas with modified soils were identified and mapped.

⁴ NPS_HPL – urban definition (4)(b).

⁵ Section 8 NPS – Zone Framework Standard.

⁶ NPS-HPL 1.3 Interpretation.

⁸ <https://iris.scinfo.org.nz/layer/48134-nzlri-north-island-edition-2-all-attributes/>

⁹ Referred to as Esk sand in the NZLRI map information.

¹⁰ Milne JDG, Clayden B, Singleton P.L, Wilson AD. 1995. Soil Description Handbook. Lincoln, New Zealand, Manaaki Whenua Press. 157p.

¹¹ Lynn IH, Manderson AK, Page MJ, Harmsworth GR, Eyles GO, Douglas GB, Mackay AD, Newsome PJF. 2009. Land Use Capability survey handbook – a New Zealand handbook for the classification of land. AgResearch Hamilton; Manaaki Whenua Lincoln; GNS Science Lower Hutt, New Zealand.

Historic aerial photographs (available on Google Earth) were used to identify areas of modified soil. These areas were checked as part of the on-site assessment and classified accordingly (i.e. assigned a LUC unit or confirmed as modified soil).

8. Aerial photo assessment

The aerial photographs indicated the presence of borrow pits in an area of LUC 2s1 (**Figure 3**). The on-site assessment identified that the soils in the borrow pits, although different from the original surrounding Horotiu sandy loam, were in general not sufficiently modified to be classed as modified soil.



Figure 3. Borrow pits on LUC 2s1 land.

The aerial photographs indicated the presence of a sand quarry area in 2006 (**Figure 4 (a)**) which was subsequently rehabilitated by 2008 (**Figure 4 (b)**).



Figure 4. Sand quarry area (a) and rehabilitated sand quarry area (b).

The on-site assessment identified that the soils in this area was very shallow with a thin topsoil (5 cm) overlying sandy fill or gravels. The area was sufficiently modified to be classed as modified soil.

The aerial photographs indicated the presence of recontouring and earthworks in 2019 (**Figure 5**).

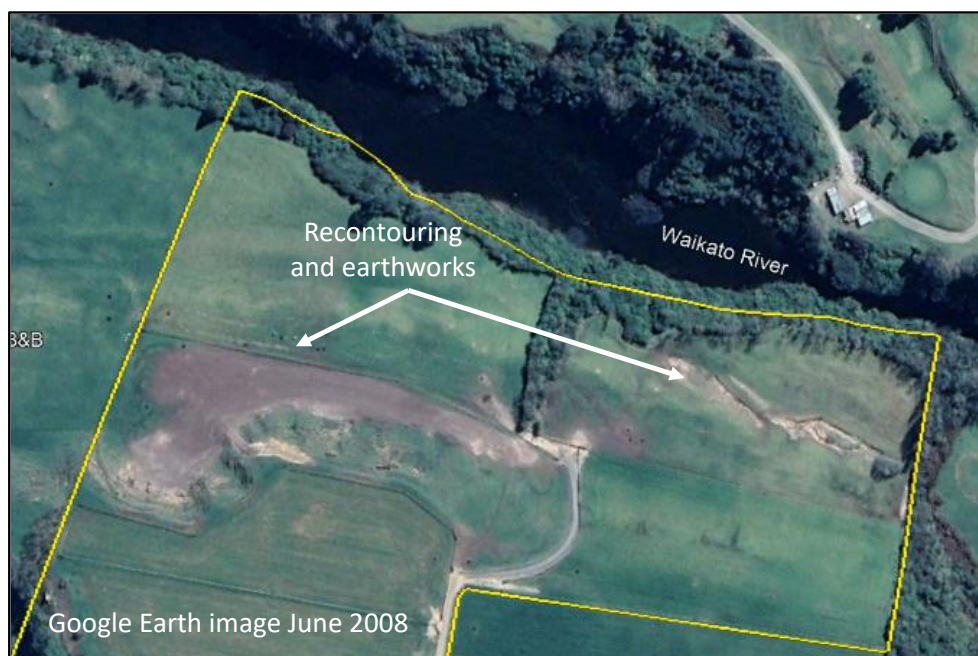


Figure 5. Land recontouring and earthworks).

The on-site assessment identified that the soils in these areas were either mixed fill or very shallow with a thin topsoil (5 cm) overlying sand or gravels. Areas that were sufficiently modified were classed as modified soil.

9. Soil and LUC classification

A summary of the soils and LUC units identified in the assessment area are provided in **Table 1**. The on-site mapped distribution of soils and LUC map units is shown in **Figure 6** (a larger image is provided at the end of the report).

Table 1. Soils and LUC units identified in the on-site assessment area, 37 Maungatautari Road.

Soil type	Parent material	Slope class	Soil drainage	LUC Unit
High class soil				
Horotiu sandy loam	Alluvium	A+B (0 - 7°)	Well drained	2s1
Not high class soil				
Kirikiroa complex	Alluvium	D+C (8 - 20°)	Well drained	4e1
Tamahana soils	Recent alluvium	A+B (0 - 7°)	Poorly to very poorly drained	4w1
Waikato sand	Alluvium	A+B (0 - 7°)	Well drained	4s1
Kirikiroa complex	Alluvium	E+F (21-35°)	Well drained, with poorly drained areas	7e10
Non-productive land/modified soil	Disturbed soil and fill, excavated drains and spill, tracks, buildings, large windbreaks, and buildings and curtilage.	-	-	NPL ¹²

¹² Non-productive land/modified soil

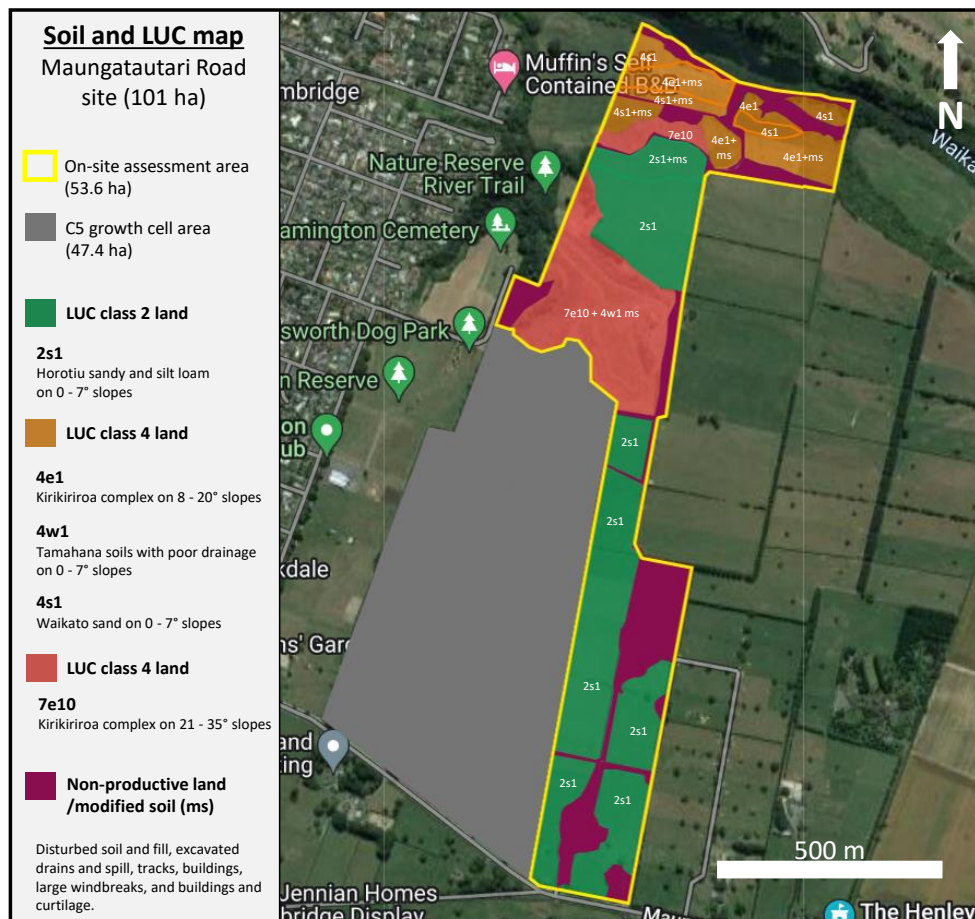


Figure 6. Map of the soils and LUC map units identified in the on-site assessment area, 37 Maungatautari Road.

Three main soil areas were identified across the assessment area.

Waikato sand occupied the flat to undulating lower terraces along the Waikato River to the north. These soils had a sandy loam topsoil of variable thickness ranging from 5 to 10 cm, over a loamy sand B horizon over sand, sandy gravels or gravelly sand from 15 to 20 cm onwards. These areas were classified as LUC 4s1 (Figure 7).



Figure 7. Examples of Waikato sand (LUC 4s1).

On rolling and strongly rolling slopes between the terraces the soils were formed in Hinuera Formation sands and gravels and commonly had seep areas. The soils predominantly had a loamy sand or sandy loam topsoil over sandy gravels from 8 to 25+ cm. These areas were classified as LUC 4e1.

Both areas have soils with very low water holding capacity and are prone to drought. Their loamy sand and sand texture means they are prone to erosion when cultivated. The risk of erosion increases with increasing slope.

Much of the area had been modified by earthworks and soil disturbance (modified soil).

The area of non-high class soil in the upper mid area of the assessment area (LUC 7e10+4w1+modified soil) occupy a large erode gully system that joins the main Waikato river. The soils include poorly drained Tamahana soils from alluvium on the flat to undulating topography (LUC 4w1) surrounded by Kirikiriroa complex soils on moderately steep to steep slopes (LUC 7e10).

Much of the area had been modified by excavated drains and spill, other earthworks and soil disturbance (modified soil).

The upper surface was predominantly Horotiu soils (silt loam) on flat to undulating slopes with some small areas with moderately well and imperfectly drained soils present. The soils generally had a 18-20 cm silt loam topsoil over a silt loam subsoil occasionally grading to sandy loam at depths greater than 70 cm. These areas were classified as LUC 4e1.

10. Waipa District Plan high class soil

A summary of the classified Waipa District Plan high class soil identified in the assessment area is provided in **Table 2**. The on-site mapped distribution of high class soil is shown in **Figure 8** (a larger image is provided at the end of the report).

Table 2. Waipa District Plan high class soil identified in the on-site assessment area, 37 Maungatautari Road.

Soil type	Parent material	Slope class	Soil drainage	LUC Unit
High class soil				
Horotiu sandy loam	Alluvium	A+B (0 - 7°)	Well drained	2s1
Not high class soil				
Kirikiriroa complex	Alluvium	D+C (8 - 20°)	Well drained	4e1
Tamahana soils	Recent alluvium	A+B (0 - 7°)	Poorly to very poorly drained	4w1
Waikato sand	Alluvium	A+B (0 - 7°)	Well drained	4s1
Kirikiriroa complex	Alluvium	E+F (21-35°)	Well drained, with poorly drained areas	7e10
Non-productive land/modified soil	Disturbed soil and fill, excavated drains and spill, tracks, buildings, large windbreaks, and buildings and curtilage.	-	-	NPL

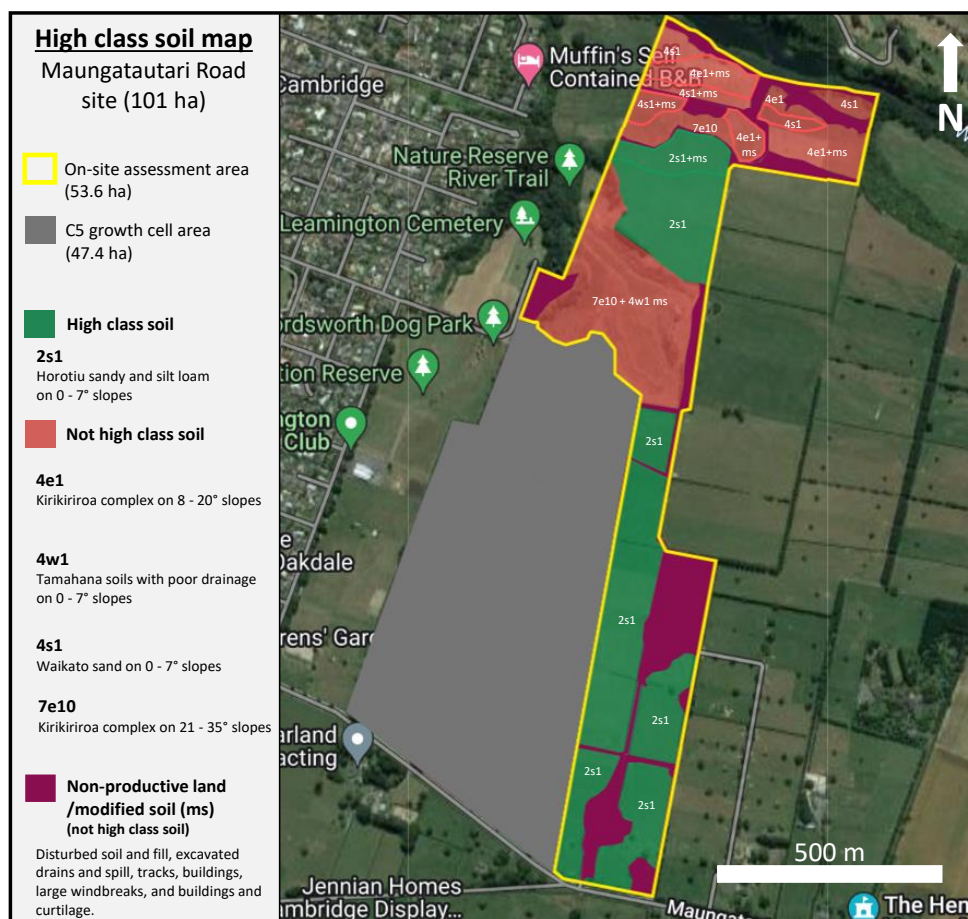


Figure 8. Map of Waipa District Plan high class soil identified in the on-site assessment area, 37 Maungatautari Road.

11. NPS-HPL classification

A summary of NPS-HPL highly productive land identified in the assessment area are provided in **Table 3**. The on-site mapped distribution of highly productive land is shown in **Figure 9** (a larger image is provided at the end of the report).

Table 3. NPS-HPL highly productive land identified in the on-site assessment area, 37 Maungatautari Road.

Soil type	Parent material	Slope class	Soil drainage	LUC Unit
Highly productive land				
Horotiu sandy loam	Alluvium	A+B (0 - 7°)	Well drained	2s1
Not highly productive land				
Kirikiroa complex	Alluvium	D+C (8 - 20°)	Well drained	4e1
Tamahana soils	Recent alluvium	A+B (0 - 7°)	Poorly to very poorly drained	4w1
Waikato sand	Alluvium	A+B (0 - 7°)	Well drained	4s1
Kirikiroa complex	Alluvium	E+F (21-35°)	Well drained, with poorly drained areas	7e10
Non-productive land/modified soil	Disturbed soil and fill, excavated drains and spill, tracks, buildings, large windbreaks, and buildings and curtilage.	-	-	NPL

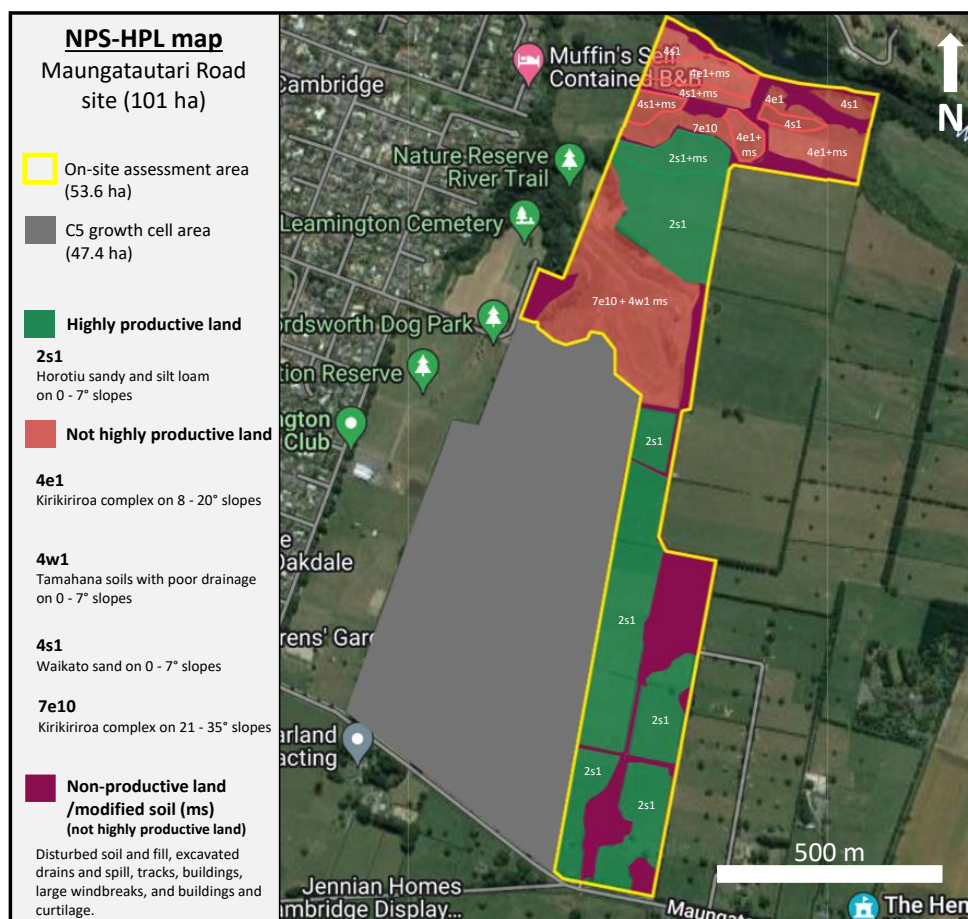


Figure 9. Map of NPS-HPL highly productive land identified in the on-site assessment area, 37 Maungatautari Road.

12. Comments

Three main soil areas were identified across the assessment area.

The upper surface has predominantly Horotiu soils (predominantly silt loam) on flat to undulating slopes with some small areas with moderately well and imperfectly drained soils present (LUC 2s1).

Waikato sand occupied the lower terraces along the Waikato River to the north. The soils were loamy sand over sand or sandy gravels. They occurred on flat to undulating slopes and were classified as LUC 4s1. On rolling and strongly rolling slopes between the terraces the soils were formed in Hinuera Formation sands and gravels and commonly had seep areas. These areas were classified as LUC 4s1.

Both the LUC 4s1 and 4e1 areas have soils with very low water holding capacity and are prone to drought. Their loamy sand and sand texture means they are prone to erosion when cultivated. The risk of erosion increases with increasing slope. Additionally, much of the area had been modified by earthworks and soil disturbance (modified soil).

The area of non-high class soil in the upper mid area of the assessment area (LUC 7e10+4w1+modified soil) occupy a large erode gully system that joins the main Waikato river. The soils include poorly drained Tamahana soils from alluvium on the flat to undulating topography (LUC 4w1) surrounded by Kirikiriroa complex soils on moderately steep to steep slopes (LUC 7e10). Much of the area had been modified by excavated drains and spill, other earthworks and soil disturbance (modified soil).

The remainder of the assessment area is non-productive land and modified soil areas. Some modified soil areas do contain small areas of high class soil. These areas are isolated from the larger areas of high class soil by modified soil areas and highly fragmented. They are not available to contribute as productive land and have been included with the surrounding modified soil areas. Collectively, these areas are classified as non-productive land (NPL) and are not high class soil or highly productive land.

NPS-HPL highly productive land areas include areas mapped as LUC 2s1. A large portion of the LUC 2s1 land is contiguous and suitable for intensive horticulture. The remaining LUC units (LUC 4e1, 4w1, 4s1, and 7e10) and the areas of non-productive land and modified soils are not classed as high class soil or highly productive land.

Within the site, there are highly productive land areas (predominantly LUC 2s1 land closer to Maungatautari Road) that are fragmented by surrounding areas that are not highly productive land (buildings, curtilage and tracks). Individually, these small (<1.0 ha) fragmented areas of highly productive land are not easily useable for intensive primary production. This reduces the productive potential of these highly productive land areas and the site as a whole.

The site is bordered the north by the Waikato River, to the west by rural residential development and residential development close by, and to the south by Maungatautari Road. This means that the highly productive land on the site is not easily amalgamated with nearby highly productive land on several property boundaries [relevant to NPS-HPL clause 3.9(3)(a) and mentioned in NPS-HPL clause 3.10(2)(f)].

