
PRELIMINARY DESKTOP SOIL AND LAND USE CAPABILITY ASSESMENT

WELLSFORD NORTH SITE

Contents

Contents.....	1
Introduction.....	2
Map information and definitions	2
Soil Map information.....	2
Land Use Capability map information.....	3
Definition of land containing elite and prime soil.....	3
Desktop assessment - methods.....	4
Desktop LUC assessment - results.....	5
Soil and LUC map information - NZLRI.....	5
Soil and LUC map information - Smap	7
Geotechnical borehole log data.....	9
Estimate of land containing elite and prime soil	10
Comments.....	11

Assessment undertaken by Landsystems.



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INTRODUCTION

BeatsonHill Limited trading as Landsystems (“Landsystems”) has been engaged to undertake a preliminary desktop soil and Land Use Capability (LUC) assessment of the Wellsford North Site using available soil and LUC map information. The site encompasses land zoned as future urban and rural countryside living under the Auckland Unitary Plan (AUP). The purpose of the assessment is to provide an initial overview of the likely soils and LUC units on site, and the presence of land containing elite and prime soils to assist initial discussions with council.

The Wellsford North Site is located on the north-eastern boundary of Wellsford in Auckland region. The Structure Plan assessment covers an area of approximately 78 ha, and the Plan Change assessment an area of approximately 74 ha (**Figure 1**).

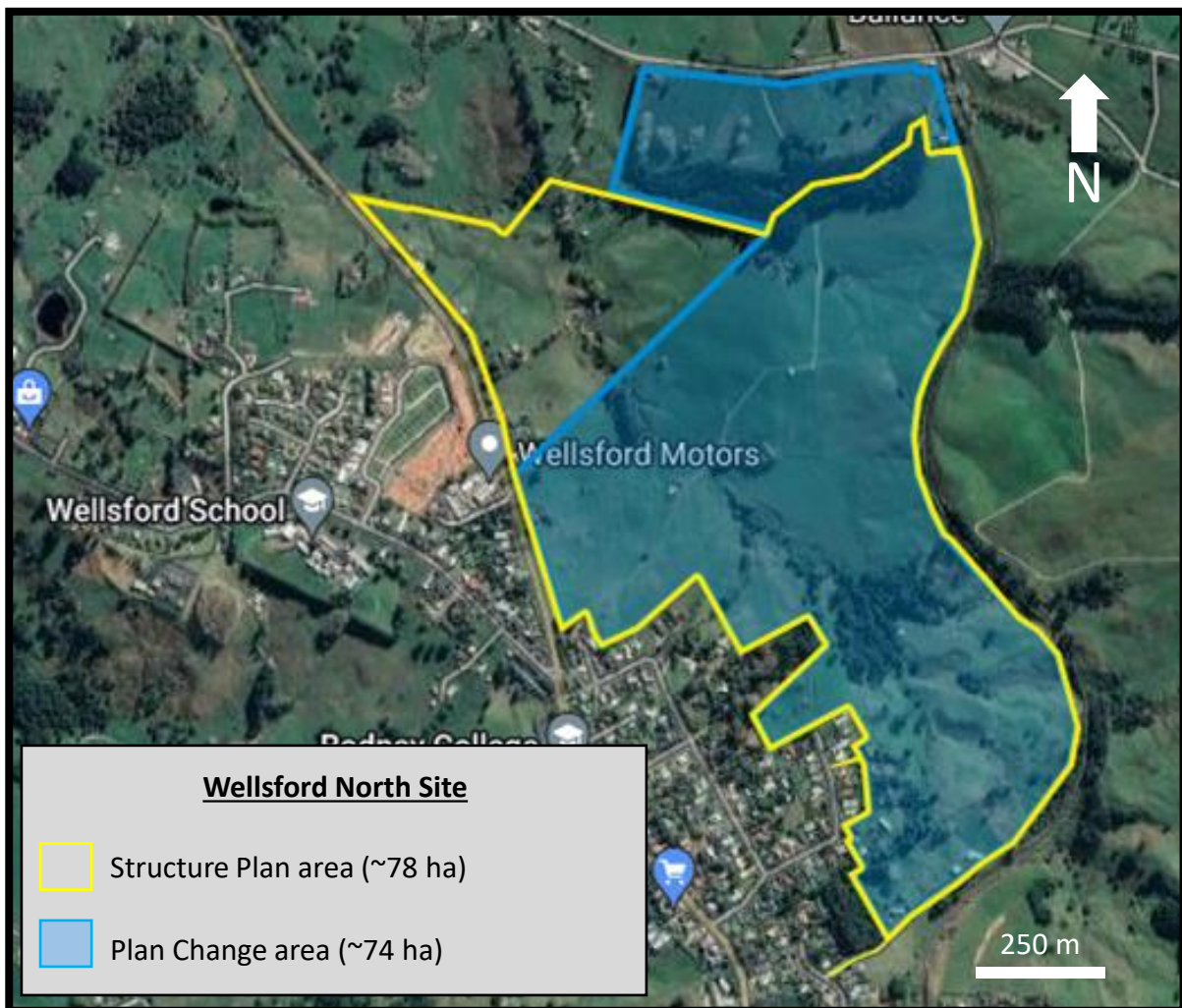


Figure 1. Location of the Wellsford North site.

MAP INFORMATION AND DEFINITIONS

SOIL MAP INFORMATION

The soils are represented on a map as map units. These map units may contain one or more soils (this varies depending on the complexity of the soil map and the scale of mapping).

Generally, there is one dominant soil in a map unit which will determine the LUC classification for that map unit.

Additionally, soil naming can vary for different sources of soil map information. This is a factor of when the soil mapping was undertaken and the soil classification that was being used nationally at the time of mapping. In most cases the soil names can be correlated across soil map information sources.

LAND USE CAPABILITY MAP INFORMATION

Land Use Capability (LUC) assesses an area's capacity for sustained productive use, considering physical limitations, soil type, management requirements and soil conservation needs.

A LUC assessment is a systematic arrangement of the different types of land according to those properties that affect its capacity for long term and sustained production. It is a system that primarily assesses the land for arable (cropping) use.

The assessment is based on a national land classification system used by soil conservators for farm planning since the 1950s. A detailed description of the system is provided in the Land Use Capability Survey Handbook, a 3rd edition of which was published in 2009 (Lynn et al., 2009)¹.

The LUC assessment identifies areas with similar rock type, soil, slope, erosion types and degree and vegetation cover. Where any one of these factors changes significantly a boundary is drawn and a new map unit created. Based on this physical inventory, together with an understanding of climate an assessment is made of each unit's capacity for long term sustained use. Thus, the property is completely covered by mapped units which identify areas having similar physical attributes.

There are eight (8) land use capability classes as recognised in the New Zealand Land Resource Inventory with limitations for use and land use versatility increasing from 1 to 8, with 8 considered unsuitable for productive use and best managed for catchment protection.

DEFINITION OF LAND CONTAINING ELITE AND PRIME SOIL

The Auckland Unitary Plan (Updated 24 October 2019) defines elite land as:-

Land containing elite soil:

Land classified as Land Use Capability Class 1 (LUC1). This land is the most highly versatile and productive land in Auckland. It is:

- *well-drained, friable, and has well-structured soils;*
- *flat or gently undulating; and*
- *capable of continuous cultivation.*

Includes:

- *LUC1 land as mapped by the New Zealand Land Resource Inventory (NZLRI);*
- *other lands identified as LUC1 by more detailed site mapping;*
- *land with other unique location or climatic features, such as the frost-free slopes of Bombay Hill;*
- *Bombay clay loam;*
- *Patumahoe clay loam;*
- *Patumahoe sandy clay loam; and*
- *Whatitiri soils.*

¹ Lynn, IH, Manderson, AK, Harmsworth, GR, Eyles, GO, Douglas, GB, Mackay, AD, Newsome, PJF (2009) Land Use Capability Handbook - a New Zealand handbook for the classification of land 3rd Ed. Hamilton, AgResearch; Lincoln, Landcare Research; Lower Hutt, GNS Science 163pp.

Prime land is also very good land but with some minor limitations compared to elite land. The Auckland Unitary Plan defines prime land as:-

Land containing prime soil:

Land identified as Land Use Capability classes two and three (LUC2, LUC3) with slight to moderate physical limitations for arable use. Factors contributing to this classification are:

- *readily available water;*
- *favourable climate;*
- *favourable topography;*
- *good drainage; and*
- *versatile soils easily adapted to a wide range of agricultural uses.*

The definition for elite soils lists features of highly versatile and productive land. The land is described as well-drained, friable, and has well-structured soils. The topography is flat or gently undulating and the soil capable of continuous cultivation. All these conditions need to be met for the land to be elite.

The NZ Soil Description Handbook defines well drained (on p148) and friable (on p84). Flat or gently undulating slopes are defined in the Land Use Capability Survey Handbook (p21) as slopes that are 0 to 3 degrees.

'Well structured' and 'capable of continuous cultivation' are not defined. However, using LUC class 1 soil characteristics as a guide then a suitable definition for 'well structured' would be soil that is moderately or strongly pedal, or has earthy structure (Soil Description Handbook p58 & 60). The continuous cultivation definition that best suits Class 1 land is the arable use definition in the LUC Survey Handbook (on p153). This is land suitable for cultivation for cropping and able to grow at least one crop or more per season without permanently degrading the soil.

Prime land is arable, versatile, has favourable topography and good drainage. There are no serious climate or soil water storage issues. Unfortunately, these characteristics for prime land are not defined and criteria used to assess the land at the site are presented below.

The most versatile soils in New Zealand are Allophanic soils (e.g. Karaka soils). Favourable topography for arable use is commonly regarded as slopes of 0 to 15 degrees. Slopes steeper than 15 degrees have moderate to severe susceptibility to erosion when cultivated and are not ideal for arable use.

Good drainage can be defined as well drained or moderately well drained drainage classes. Under these conditions there is a minimum of 60 to 90 cm to a water table. Having a freely drained soil is required to be able to grow crops sensitive to wet soil (e.g. kiwifruit). Well drained elite soils are ideal for this (water table greater than 90 cm deep), but prime land may also be suitable. Imperfectly and poorly drained soils are too wet for some horticultural crops and the land is not as versatile as prime land.

DESKTOP ASSESSMENT - METHODS

An initial desktop LUC assessment was undertaken for the Wellsford North site. Available map information, soil reports and geospatial data included:

- New Zealand Land Resource Inventory (NZLRI) layers (providing map units of dominant soil type and LUC unit)².

² <https://koordinates.com/from/lris.scinfo.org.nz/layer/48134/metadata/>

- Smap Online (providing map units of Soil Sibling)³.
- Soil profile data from bore hole logs provided in Wellsford Residential Development Plan Change Geotechnical Assessment Report⁴.

Soil and LUC maps are provided using NZLRI “SOIL” and “LUC” attributes.

Soil maps are provided for Smap soils (soil siblings).

Geotechnical bore log data provided additional point data for checking soil profile texture and drainage characteristics.

DESKTOP LUC ASSESSMENT - RESULTS

SOIL AND LUC MAP INFORMATION - NZLRI

The soil map information provided in the NZLRI was originally sourced from the *Northland Peninsula soil survey*⁵. This soil survey was originally mapped at a scale of 1:100 000, and subsequently integrated into the NZLRI (at 1:50,000 scale). The NZLRI soil and LUC distributions for the Wellsford North Site are shown in **Figure 2**.

³ <https://smap.landcareresearch.co.nz/app/>

⁴ Tonkin and Taylor (2021) Wellsford Residential Development Plan Change Geotechnical Assessment Report.

⁵ Cox JE. et al. (1983) Northland Peninsula soil survey, scale 1:100 000.

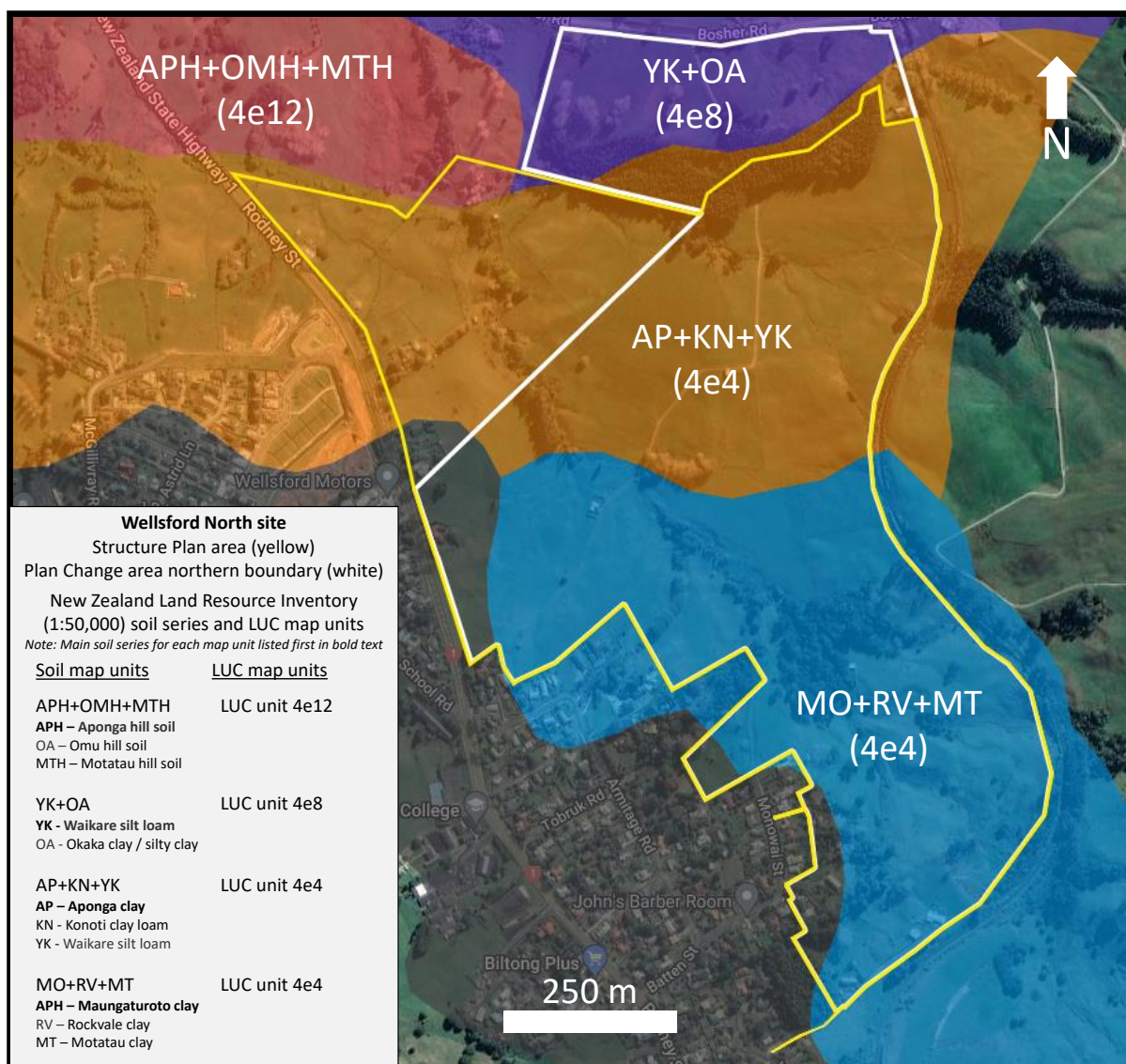


Figure 2. NZLRI soil and LUC map units for the Wellsford North site.

Table 1 provides a summary of the NZLRI soil and LUC map unit characteristics mapped for the site.

Table 1. Summary of the NZLRI soil and LUC map unit characteristics on the Wellsford North site.

Dominant soil series (soil map unit)	NZSC Soil Order	Parent material	Soil drainage	Slope class	LUC limitation
Waikare (YK+OA)	Ultic	Sheared mixed lithologies	Imperfectly drained	C+B (4 - 15°)	Erosion (e)
Aponga hill soil (APH+OMH+MTH)	Ultic	Sheared mixed lithologies and limestone	Imperfectly drained	E+D (16 - 25°)	Erosion (e)
Aponga (AP+KN+YK)	Ultic	Sheared mixed lithologies and limestone	Imperfectly drained	C+D (8 - 20°)	Erosion (e)
Maungaturoto (MO+RV+MT)	Melanic	Limestone and sheared mixed lithologies	Imperfectly drained	C+D (8 - 20°)	Erosion (e)

SOIL AND LUC MAP INFORMATION - SMAP

The Smap soil map information is sourced from Smap Online and is mapped at 1:50,000 scale. Smap soil map polygons are only available on the Smap Online website⁶. The soil names for each map unit are “soil siblings”, with a probability of occurrence (%) in each map unit. The Smap Online soil map information for the Structure Plan area and the Plan Change area for the Wellsford North Site are shown in **Figure 3** and **Figure 4** respectively.

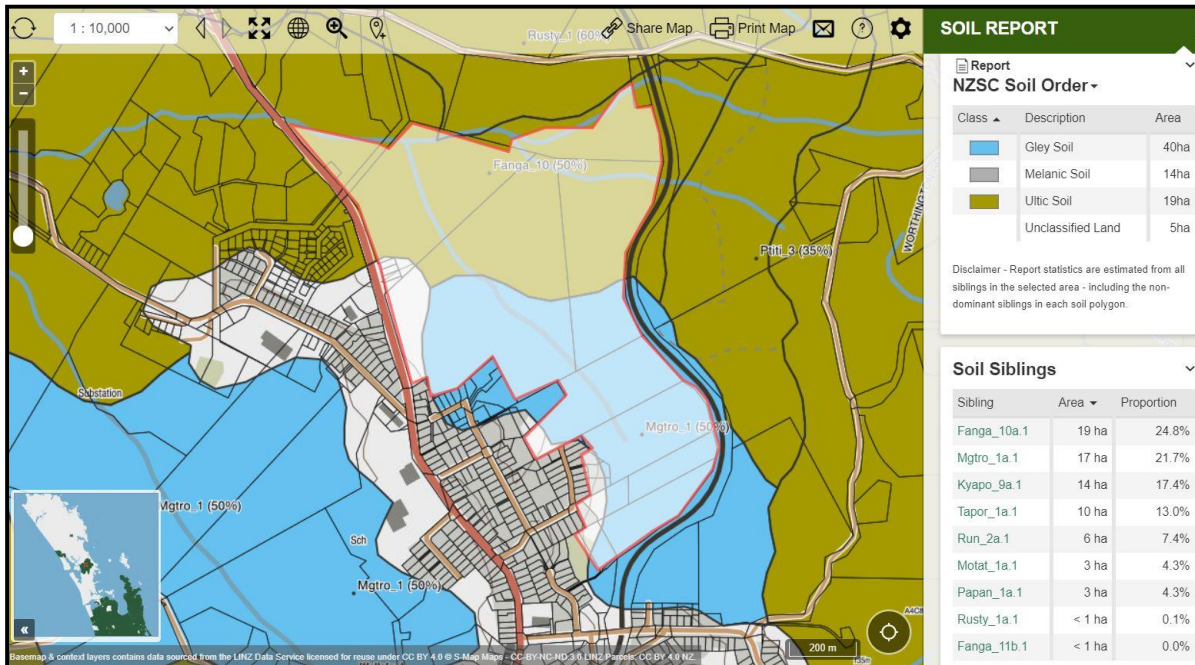


Figure 3. Smap Online soil map information for the Structure Plan area, Wellsford North site.

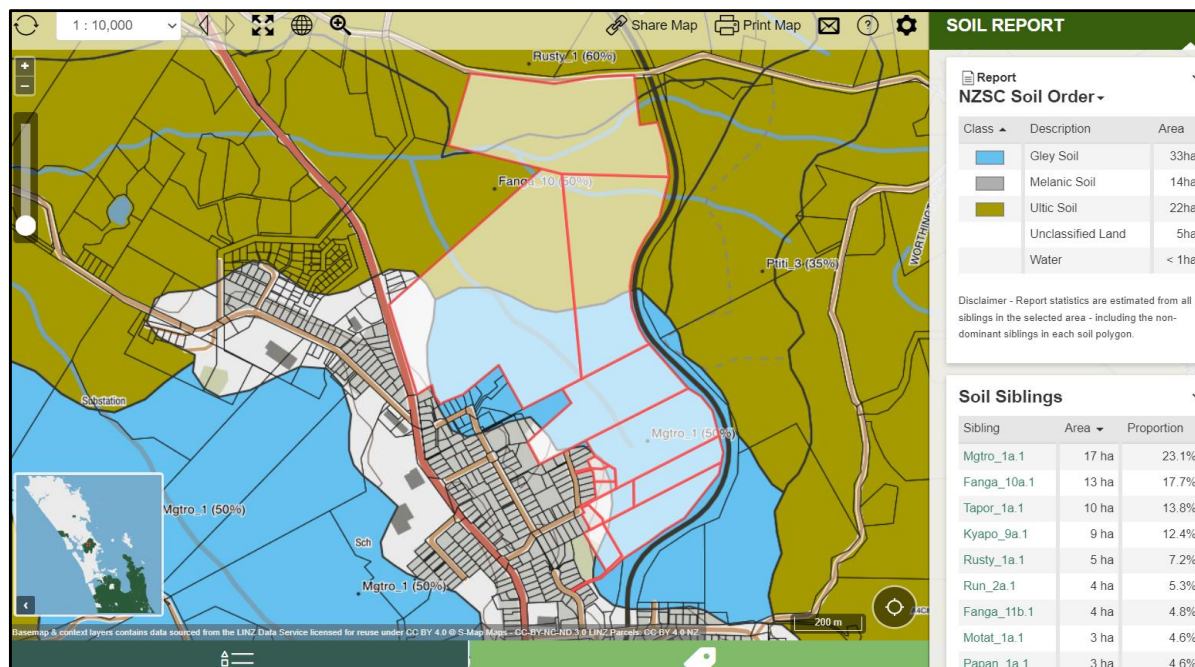


Figure 4. Smap Online soil map information for the Plan Change area, Wellsford North site.

⁶ <https://smap.landcareresearch.co.nz/maps-and-tools/app/>

Based on the Smap Online soil map information, there are nine soil siblings represented across the Wellsford North Site. A simplified map is provided in **Figure 5**.

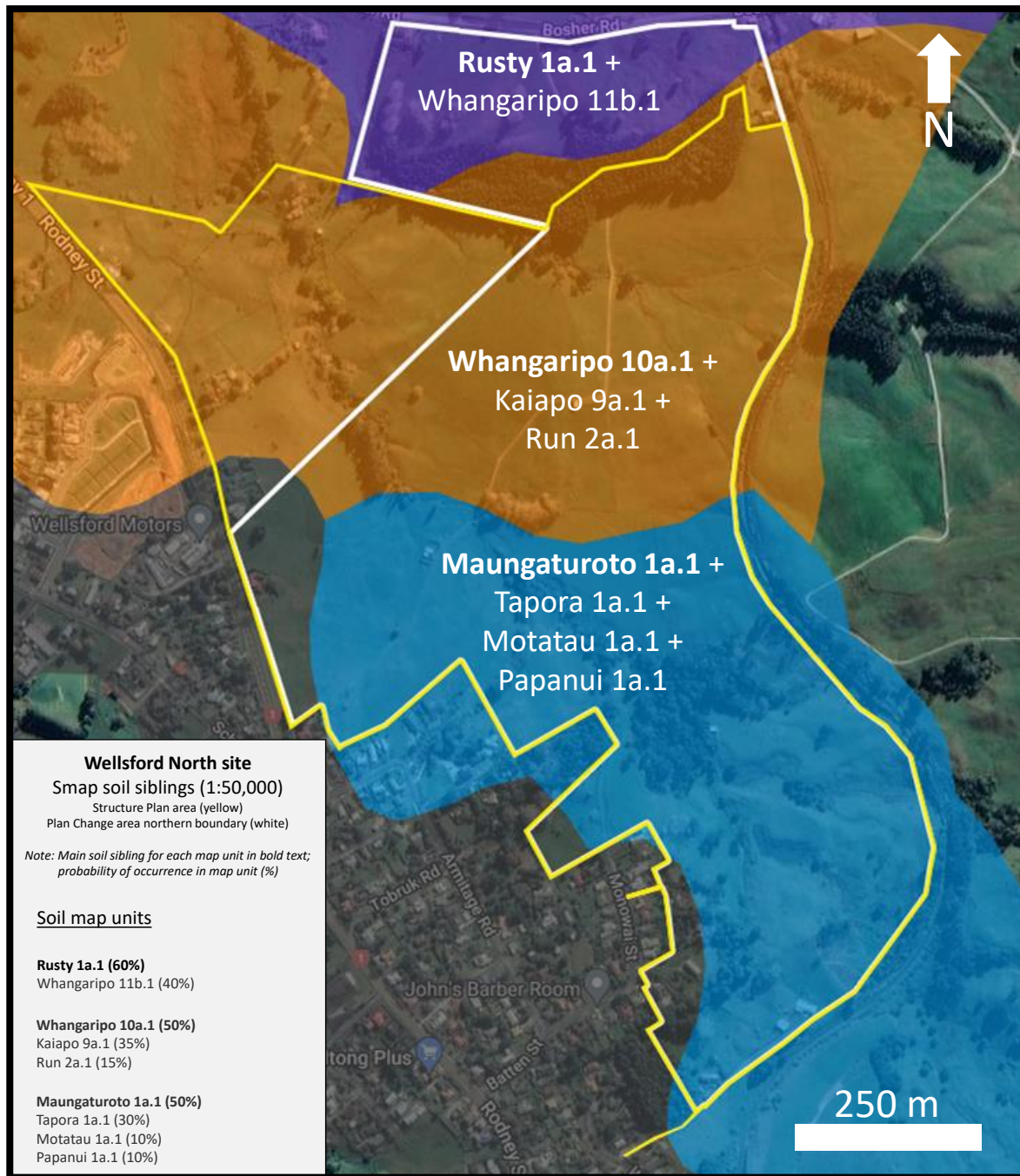


Figure 5. Smap soil sibling map units for the Wellsford North Site.

Table 2 provides a summary of the Smap soil sibling map unit characteristics for the Wellsford North Site.

Table 2. Smap soil sibling map unit characteristics for the Wellsford North site.

Smap soil map unit (soil siblings)	New Zealand Soil Classification	Parent material	Soil drainage	Correlated soil series name
Rusty 1a.1 +	Typic Perch-gley Ultic Soils	Soft sandstone rock	Poorly drained	Waikare clay loam
Whangaripo 11b.1	Mottled Yellow Ultic Soils	Soft sandstone rock	Imperfectly drained	Aponga clay
Whangaripo 10a.1 +	Mottled Yellow Ultic Soils	Hard sandstone rock	Imperfectly drained	Aponga clay
Kaiapo 9a.1 +	Typic Orthic Gley Soils	Soft mudstone rock	Poorly drained	Aponga clay
Run 2a.1	Ultic Acid Gley Soils	Hard mudstone rock	Poorly drained	Waikare silt loam
Maungaturoto 1a.1 +	Acidic Orthic Gley Soils	Limestone rock	Poorly drained	Maungaturoto clay
Tapora 1a.1 +	Argillic Orthic Melanic Soils	Limestone rock	Moderately well drained	Rockvale clay
Motatau 1a.1 +	Weathered Rendzic Melanic Soils	Limestone rock	Poorly drained	Motatau clay
Papanui 1a.1	Melanic Orthic Gley Soils	Limestone rock	Poorly drained	Motatau clay

The Smap soil map information provides a more detailed representation of the soils on the site than the NZLRI soil map information. However, because of the absence of land characteristics information (e.g. slope) for the soil map units, it is not possible to assign LUC units. Given that most of the Smap soil map units correlate to the soils identified by the NZLRI map information, it is likely the LUC units will be similar. To correctly identify and map the LUC units a property scale assessment using the LUC classification criteria described in Lynn et al. (2009) would be required.

GEOTECHNICAL BOREHOLE LOG DATA

Geotechnical data for the Wellsford North Site was provided by Tonkin and Taylor⁷. The data consisted of description logs from 11 hand auger (HA) boreholes and 26 test pits (TP) excavations. Log descriptions for the upper one metre (0-1 m) were used to identify soil texture. Additionally 19 locations had photos that could be used to visually estimate soil profile drainage.

The log descriptions indicated the soil texture to be predominantly silt, clayey silt or clay within the top 1m. The associated photos indicated that soil profile drainage was predominantly either imperfectly drained or poorly drained (**Table 3**).

⁷ Tonkin and Taylor (2021) Wellsford Residential Development Plan Change Geotechnical Assessment Report.

Table 3. A summary of visually assessed soil profile drainage for geotechnical description log locations with an associated photo, Wellsford North site.

Location	Soil profile drainage class (visually assessed from associated photo)
HA01	Imperfectly drained
HA02	Poorly drained
HA03	Imperfectly drained
HA04	Imperfectly drained
HA05	Imperfectly drained
HA06	Imperfectly drained
HA07	Imperfectly drained
HA08	Imperfectly drained
HA09	Imperfectly drained
HA11	Imperfectly drained
TP03	Poorly drained
TP05	Poorly drained
TP06	Poorly drained
TP13	Imperfectly drained
TP15	Imperfectly drained
TP16	Imperfectly drained
TP18	Poorly drained
TP19	Imperfectly drained
TP20	Poorly drained

ESTIMATE OF LAND CONTAINING ELITE AND PRIME SOIL

Based on the soil map information provided by the NZLRI and Smap, the soils are predominantly imperfectly to poorly drained across the site. There may be small areas of moderately well drained soil, however, there are likely to be limited in extent.

The slope classes provided by the NZLRI indicated slopes are predominantly greater than 7 degrees.

For land to be considered land containing elite soils, the LUC Class must be LUC 1, slopes must be flat to gently undulating (0-3° slopes) and have good soil drainage (moderately well to well drained).

Based on the information available and used in this preliminary desktop assessment, it is very unlikely that the Wellsford North Site has land containing elite soil, due to slopes being greater than 0-3° and/or imperfect and poor soil drainage.

For land to be considered land containing prime soils, the LUC Class must be either LUC 2 or LUC 3, and slopes must be flat to gently undulating, undulating, or rolling (0-15° slopes) and have good soil drainage (be moderately well to well drained).

Based on the information available and used in this preliminary desktop assessment, it is unlikely that the Wellsford North Site has land containing prime soil, due to areas with slopes greater than 15 degrees, soil drainage limitations and the predominance of clay subsoils.

Based on the information available and used in this preliminary desktop assessment, it is most likely that the Wellsford North Site is classed as other productive land according to the AUP definition of land containing elite and prime soil.

COMMENTS

- The NZLRI soil and LUC map information is regional scale and only provides a general representation of the likely soils and LUC map units for the site. The indicated map unit boundaries should not be considered spatially accurate at property scale, however, the range of soils indicated is likely to be similar to those that would be observed if mapping at property scale.
- Compared with the NZLRI map information, the Smap map information is more detailed in that it identifies more soils present (soil siblings), but its spatial accuracy is not improved.
- The NZLRI LUC map information maps the entire site as LUC sub-class 4e, indicating an erosion limitation (due to both steep slopes and high erosion potential).
- The Smap map information does not have the land characteristics information to allow the classification of LUC units. However, given that most of the Smap soil map units correlate to the soils identified by the NZLRI map information, it is likely the LUC units will be similar to those indicated by the NZLRI map information.
- Property scale mapping of the site may identify additional LUC units (farm scale LUC units), primarily based on finer scale assessment of slope and soil observations. However, given the predominance of imperfectly and poorly drained soils indicated by the soil map information and geotechnical log descriptions, it is unlikely any significant areas of land containing elite or prime soil would be identified on site.