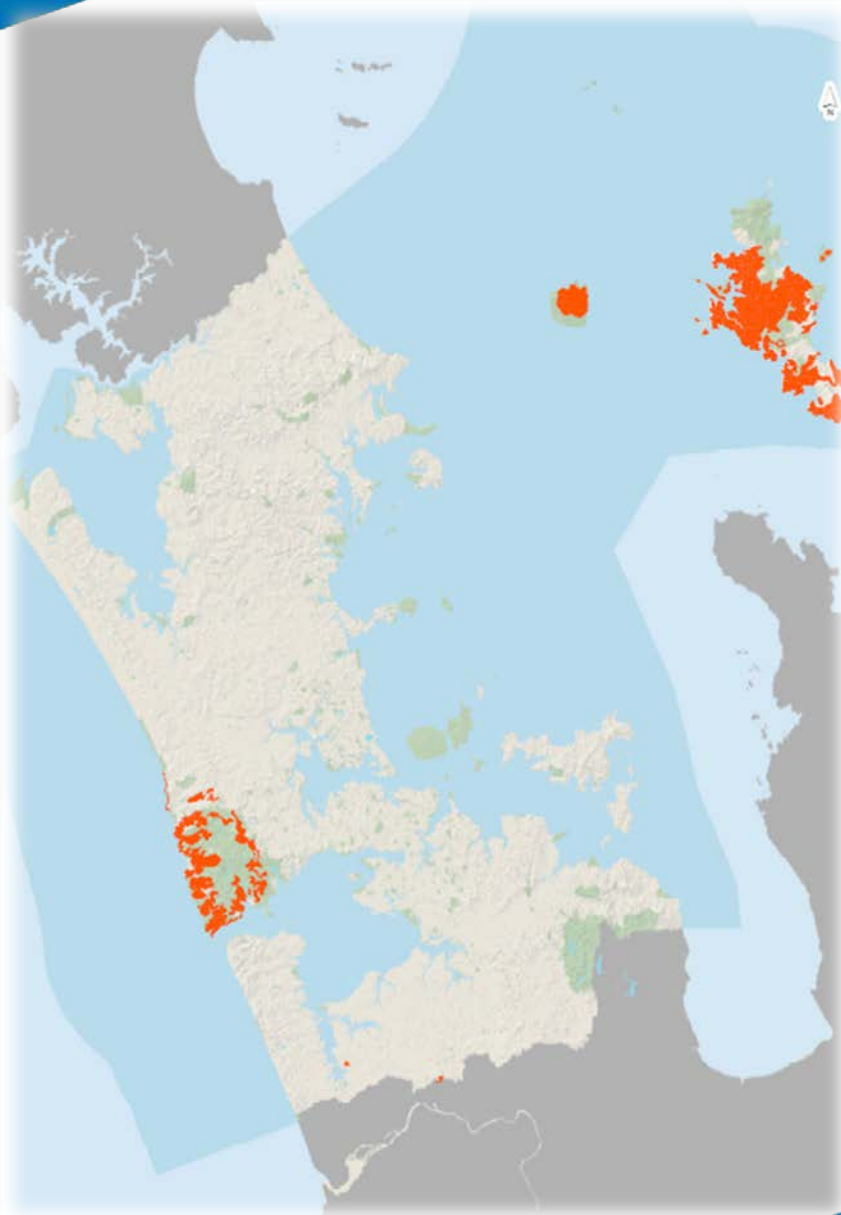


Soil Information Inventory:

Waitākere, Huia, and related soils

October 2018

Soil Information Inventory 25





Soil Information Inventory 25: Waitākere, Huia, and related soils

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Auckland Council

Soil Information Inventory, SII 25

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1 Introduction

With Auckland's expected growth from 1.7 to 2.0 million people in the next 30 years (The Auckland Plan 2050) and a goal to double New Zealand's agricultural exports by 2025 (Ministry for Primary Industries), an understanding of Auckland's soil resources is essential for planning urban growth, and sustaining if not expanding rural production, while managing the impacts of both on our region's environment.

Existing information on Auckland's soils is difficult to assess and interpret. Electronic versions of soil maps are available on research institute websites. Some have been uploaded into Auckland Council's geographic information system (GIS, GeoMaps) for use by council staff and for public viewing. However, the GIS maps and their attached attribute lists cannot be understood or used without referring to background information which is dispersed across old maps, publications, or unpublished reports. Many of these documents are now hard to find.

Auckland Council has undertaken to compile old information for the region's main soils into single documents called soil information inventories (SIIs). These may be viewed on Knowledge Auckland, www.knowledgeauckland.org.nz council's research and technical publications website, downloaded and printed. It is expected that there will be gaps in each inventory. The gaps will be filled as new information becomes available. Each inventory is a repository for information old and new and will be a "living document".

Their intent is to:

- ease access to soil information
- enable better understanding of the soils' properties
- enhance public awareness about the location of productive or problematical soils
- improve awareness of the soils' potential and limitations, amongst consultants and planners
- help council staff provide better advice, and make more informed decisions.

Our role has been document compilers, not authors. We have selected information which appears useful for landowners, farm, forest, environmental or planning consultants, and the council staff who deal with them. While we regard the selected information as reliable, responsibility for accuracy of contents rests with the organisations which originally collected and published the maps or documents which we cite. Auckland Council makes the information available on the Knowledge Auckland website with this understanding.

Acknowledgments are due principally to old soil surveyors of the DSIR's Soil Bureau, who collected most of the information reproduced here, notably Charles Sutherland, Charles Wright, Norman Taylor, Edward Cox, and Gary Orbell.

Assistance from Mandy Holt (cross-section), Tyana Rowe-Kurene, Tony Edhouse and Linda Wallis (document editing and layout), Fiona Curran-Cournane (internal publication referee) and Malcolm McLeod (external publication referee) is also acknowledged.

Michael Martindale, Douglas Hicks and Peter Singleton
June 2016, October 2018

2 Published maps

On DSIR's published soil maps of North Auckland (1:100,000), soils on steep terrain within andesitic agglomerates and breccias are depicted as two series i.e. soils with distinct profiles and parent materials:

YT, YTH	Waitākere clay
HAS	Huia steepland soil (stony clay and stony silt loam)

Related steepland soils on shattered dolerites, breccias and tuffs are not separated from the series mapped on easier slopes, Awapuku clay loam (AW), Mangonui clay (MN), and Rangiuuru clay (RU).

On old volcanic rocks of Little and Great Barrier Islands, DSIR's oldest maps (1:253,840) are depicted as one of the above series, plus two extras:

88,88H	Waitākere clay
127b	Tangatara stony and bouldery clay loam
130	Te Kie clay loam and stony loam

On a more recent medium-scale map (1:50,000) they are given local series names:

HM, HMH	Hirakimata bouldery clay loam
HBS	Mt. Hobson steepland soil
FR, FRH	Fitzroy clay loam and bouldery clay loam
BAS	Barrier steepland soil

On small areas of old volcanic terrain south of Auckland, no related steepland soils are separated from the series mapped on easier slopes, Awapuku hill soil (87H) or Bald Hill hill soil (95cH).

Sourced from:

Soil maps of Maungaturoto-Kaipara area; Mangawhai-Warkworth area;

Helensville-Waitākere area; Whangaparaoa-Auckland area

NZ Soil Bureau

maps 189, 190, 220, 221

Soil map of the North Island, sheets 2 and 3 (Auckland and Waikato)

NZ Soil

Bureau maps 11/2, 11/3

Soil map of part Franklin county

NZ Soil Bureau map

149/1

Soil map of Great Barrier Island

NZ Soil Bureau map un-

numbered

3 Online maps

Landcare Research's online soil map (S-map, 1:50,000) re-names and re-labels the soils as follows:

YT, YTH	No family name or sibling number
HAS	No family name or sibling number
88 etc.	No family names or sibling numbers
HM etc.	No family names or sibling numbers

Reasons for the basis of S-map can be found in the S-map database manual. The names and numbers were assigned by computer-matching local soil properties with different soils in other parts of the country.

Sourced from S-map Online – Home <http://smap.landcareresearch.co.nz/home>

4 Farm-scale maps

North of Auckland, any published map polygon labelled as YT, HAS etc. turns out to be a mosaic of Waitākere and Huia plus other soil types when investigated in the field by local soil mappers. On farm-scale soil maps (1:5,000 - 1: 10,000) the soils on elevated plateaux or steep terrain are labelled as:

Yt	Waitākere clay
Ha	Huia stony clay loam or stony loam

The polygons also include moderate hillslopes and rolling footslopes. Here the soils are re-mapped as shallow phases of Parau, Awapuku, Cornwallis or Mangonui series (see Soil Information Inventory for Parau and related soils).

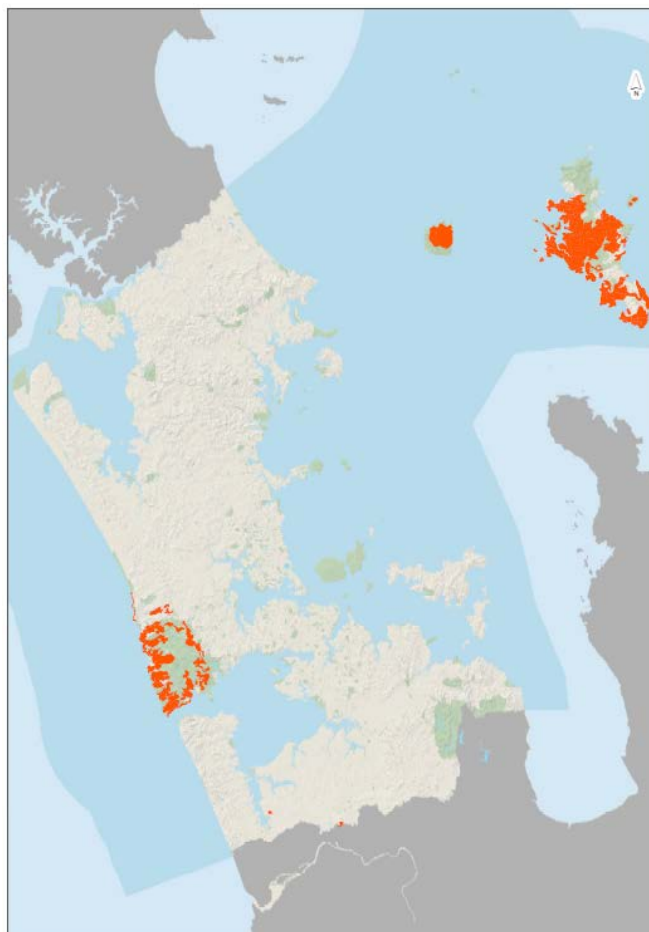
Appropriate map labels have not been determined for similar soils on Great Barrier Island, where as yet no farm-scale maps have been prepared.

Local series names for Waitākere, Huia and related soils have been retained on Auckland Council's farm-scale maps for continuity with published nomenclature.

Sourced from 1995-2015 farm-scale maps and soil notes prepared for private landowners, Auckland Regional Council or Auckland Council

5 Where the soils occur

Extensively through central and western parts of the Waitākere Ranges. Extensively on Little and Great Barrier islands. Within small patches on the region's southern boundary, from Bald Hill to Mt. William.



Location of Waitākere, Huia, and related soils

Waitākere, Huia and related soils are mapped on 24,900 hectares (5% of Auckland region). About 9,000 hectares (36% of the area mapped) are in productive use, as drystock pasture or forest plantations (estimated from overlay of Agribase 2010 on Fundamental Soils Layer). <http://intermaps.arc.govt/AucklandCouncilViewer/>

5.1 On what landform



Waitākere clay underlies ridges and easy upper slopes either side of the reservoir. Huia steepland soil is on valley sides beneath the dam. Photo: D Hicks

Waitākere soils are found on elevated, rolling ridges and plateaux, and Huia soils on steep bluff faces, within Manukau Group andesite or andesitic breccia; sea-floor lava flows and lahars erupted during the Miocene epoch (8 to 25 million years ago). Uplifted from the sea, only the volcano's eroded eastern flank now remains as the Waitākere Ranges.

Out in the Hauraki Gulf, related soils occur in similar landscape positions on younger andesite from volcanoes that built islands above sea level during the Pliocene epoch (8 to 2 million years ago). Te Kie clay loam or stony loam (re-named Barrier steepland soil) is on steep faces; Fitzroy bouldery clay loam on the moderate upper slopes or ridges between. Where the andesite is capped by old rhyolite flows, Mt. Hobson steepland soil is on steep faces, and Tangatara series (re-named Hirakimata bouldery clay loam) on broad ridges or elevated plateaux.

South of Auckland, just a few outcrops of old basalt date to the Pliocene/Pleistocene boundary (about 2 million years ago). Where dissected into steep faces, similar steepland soil here is undifferentiated from the Awapuku or Bald Hill series mapped on surrounding moderate slopes (see Soil Information Inventory for Parau and related soils).

Sourced from Edbrooke, S. W., 2001, Geology of the Auckland Area, Institute of Geological and Nuclear Sciences 1: 250,000 map 3 and accompanying bulletin

5.2 How they differ from other soils

Huia and related soils have shallower profiles than the old volcanic soils on easy slopes. Weathered rock fragments are visible in subsoil, and un-weathered rock protrudes as outcrops or bluffs. Compared with steepland soils weathered from sedimentary rocks (see Soil Information Inventories for Puhoi and Te Ranga soils), Huia and related soils have brighter red-brown colour, caused by iron and magnesium oxides which weather out of dark volcanic rock fragments.

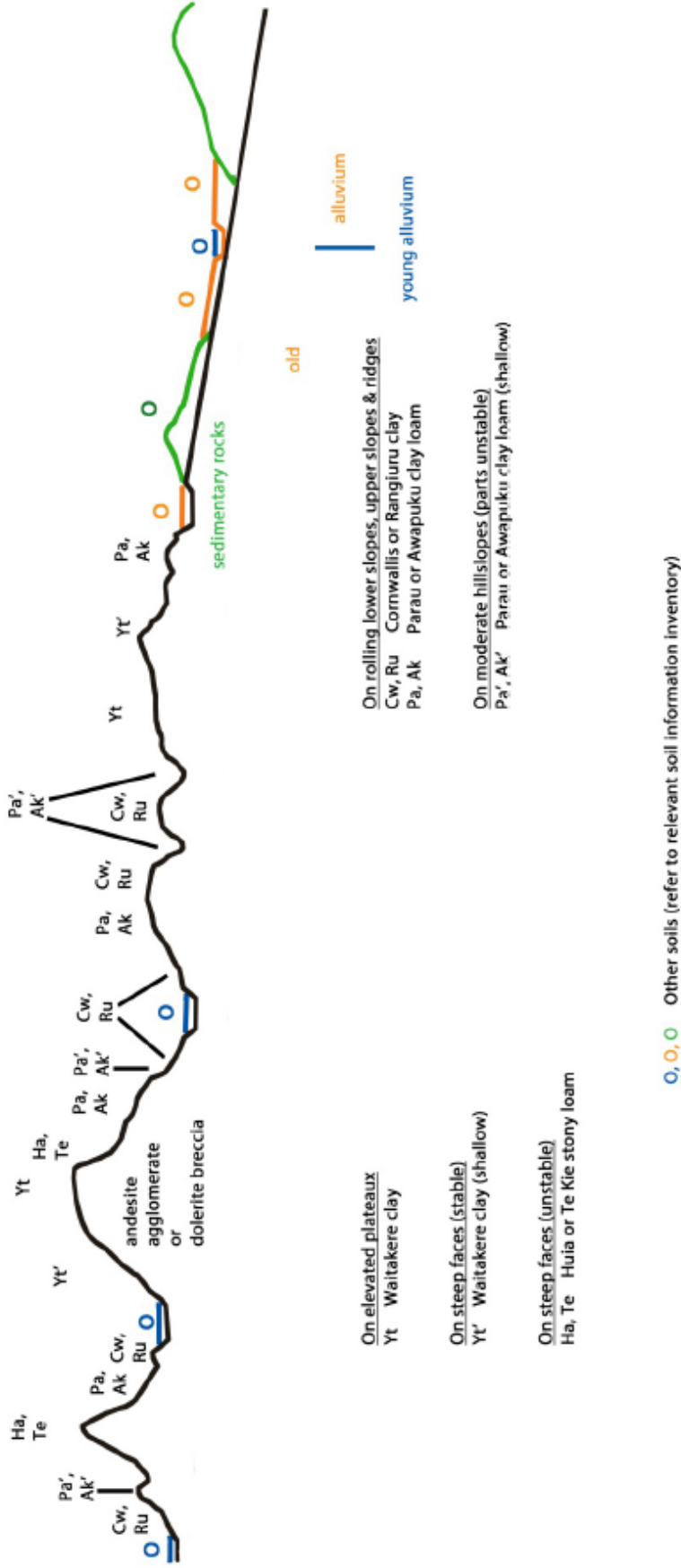
Sourced from: Wilson, A.D. and Cox, J.E., Soils of Rodney County, Unpublished report, Soil Bureau DSIR; Molloy, L., 1987, Soils in the New Zealand landscape, New Zealand Society of Soil Science

6 Classifications

NZ genetic (NZG):	brown granular clay
NZ soil (NZSC):	typic orthic granular, acid or perch-gley orthic brown, typic or raw orthic recent http://soils.landcareresearch.co.nz/contents/SoilNames_NZSoilClassification_SoilOrders.aspx
Soil Taxonomy (USDA):	udox (Waitākere etc.), udept (Huia etc.) http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051544.pdf
World Soils (FAO):	oxisol (Waitākere etc.), leptosol (Huia etc.) http://www.fao.org/3/a-i3794e.pdf

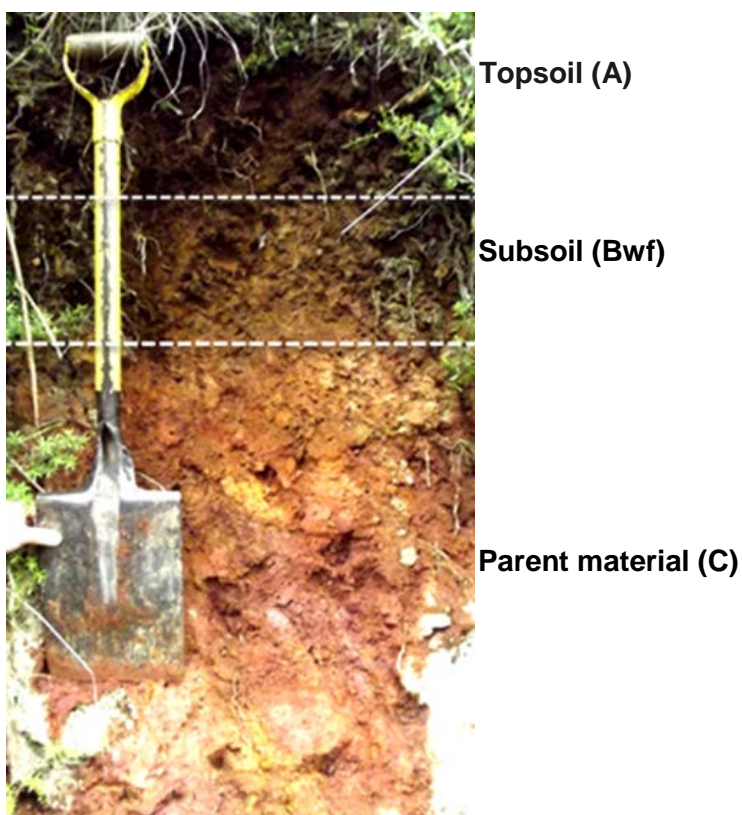
DSIR replaced the New Zealand genetic classification dating from 1930s with the New Zealand soil classification in 1990s. DSIR's soil scientists considered that Soil Taxonomy did not work well in New Zealand, nor did World Soils. Soil Taxonomy and World Soils remain internationally accepted classifications.

Cross section showing Waitākere, Huia, and related soils' position in the landscape



Soil type labels on the cross-section are sourced from Auckland Council's farm-scale maps

7 Soil profile descriptions



Waitākere clay Photo: D Hicks

DSIR's type profile description is:

Waitākere clay

Horizon	Depth (cm)	Description
A	0-8	Very dark brown (7.5YR 3/2) clay; friable; moderate to strongly developed fine angular and medium subangular polyhedral structure; peds firm; some worm casts; abundant roots; diffuse boundary.
Bw(f)1	8-18	Dark reddish grey clay; faint, dusky red and dark red (2.5YR 3/2 - 3/6) mottling on the faces of some aggregates; firm, but friable in the mass; strongly developed medium and fine angular and some subangular polyhedral structure, all breaks to very fine angular polyhedral; dark reddish brown, thin coatings of iron along the root channels; spherical worm casts and abundant roots; diffuse boundary.
Bw(f)2	18-38	Reddish brown (5YR 4/3) clay; common dark reddish brown thin iron coatings on the faces of aggregates and along the root channels; strongly developed fine angular polyhedral structure; few spherical worm casts; very high packing in place, but the mass disintegrates readily when disturbed; many roots; diffuse boundary.

Soil information inventory 25: Waitākere, Huia, and related soils

Horizon	Depth (cm)	Description
Bw(f)3	38-48	Reddish brown (5YR 5/4 - 4/4) clay; common distinct dark reddish brown, thin iron coatings on aggregates and along some root channels; strongly developed fine angular polyhedral structure; firm, high packing in place but the mass disintegrates readily when disturbed; few fine roots; diffuse boundary.
C	on	Red (7.5R 5/6) clay; moderately developed fine angular polyhedral structure; firm; contains many particles of parent material that is strongly weathered, very few fine roots.

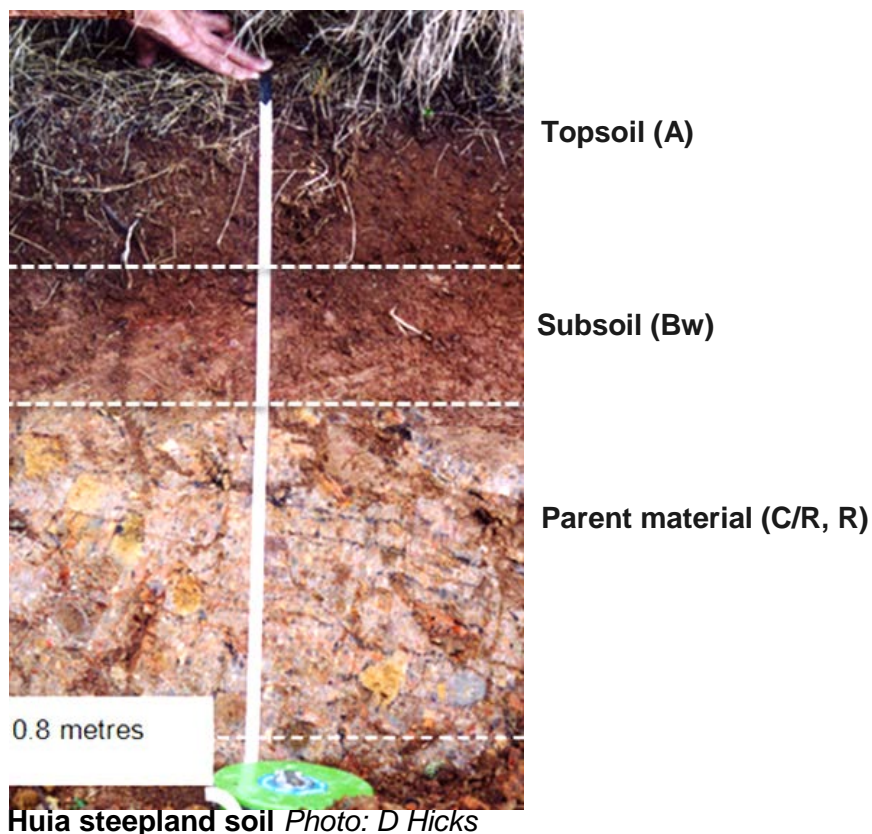
A second type profile is described as “with an iron pan, only occurs in scattered and very small areas; the pan has the form of the egg-cup podsols, shallow at either end and deep in the centre”. As the DSIR mappers clearly state that this profile is not widespread, its description is not reproduced here. A local mapper (DLH) considers it may be worth separating as a series, except that if assigned its own name this soil would almost always be recorded as a complex with Waitākere clay, even at farm scale.

Soil Bureau Bulletin 5 (General Survey of the Soils of North Island) contains the following brief description of a related soil mapped on Great Barrier Island:

Tangatara stony and bouldery clay loam

Horizon	Depth (cm)	Description
A		Light brown and greyish clay loam.
CR	on	Weathered rhyolite and dacite.

Soil information inventory 25: Waitākere, Huia, and related soils



DSIR’s soil mappers describe Huia steepland soil as occurring on “intrusive breccia, andesite, basalt, phonolite, most of which is shallow weathering” on “steep to very steep slopes, outcropping rocks and the vertical bluffs”. Its type profile is:

Huia steepland soil

Horizon	Depth (cm)	Description
A	0-15	Very dark brown (10YR 2/2) slightly gravelly clay loam; weakly developed fine and very fine subangular and subrounded polyhedral structures; friable; few fine and medium gravels and particles of soft and hard parent material; abundant grass roots; indistinct boundary.
Bw	15-30	Very dark brown to very dark greyish brown (10YR 2/2 - 3/2) slightly gravelly clay loam; weakly developed fine and very fine subangular polyhedral and fine spheroidal cast structures; friable; few fine and medium gravels and many finer particles of soft and hard parent material; common grass roots; diffuse boundary.
C/R	30-55	Very dark brown (10YR 3/2) slightly gravelly clay loam; weakly and moderately developed fine and medium subangular polyhedral structure and some spheroidal cast structures; common fine and medium gravels and many finer particles of soft and hard parent material; friable; common grass roots; diffuse irregular boundary.
R	on	Hard and slightly softened andesitic breccia.

Soil information inventory 25: Waitākere, Huia, and related soils

Soil Bureau Bulletin 5 contains the following brief description of a related soil mapped on Great and Little Barrier Islands:

Te Kie clay loam and stony loam

Horizon	Depth (cm)	Description
A	0-8	blackish crumbly clay loam.
CR	on	brown flecked stony clay and weathered rock.

Sourced from:

Sutherland C.F., Cox, J.E., various dates, Type profile descriptions for North Auckland Soil Survey, Unpublished documents, Soil Bureau, DSIR

Gibbs, H. (ed), 1954, General Survey of Soils of North Island, Soil Bureau Bulletin 5, DSIR

8 Properties of typical profile

Properties of typical profiles are best indicated by analysis results for the type profiles i.e. sites where Huia and Waitākere series were defined and described. Data for other sites will vary somewhat, particularly where different types within each series are found. Properties of the related soils may differ from those reported below.

8.1 Chemical <http://soils.tfrec.wsu.edu/mg/chemical.htm>

No chemical analyses appear in the online version of National Soils Database (NSD). The following data are sourced from Soil Bureau Bulletin 5:

Waitākere clay

Property	Topsoil	Subsoil	Units
Acidity	5.5	5.5	pH
Total carbon	7.5	-	%
Total nitrogen	0.44	-	%
Available phosphorus	0.002	0.001	mg %
P retention	-	-	%
Available sulphur	-	-	%
Cation exchange capacity	42.9	38.8	me %
Base saturation	25	14	%
Calcium	5.0	2.5	me %
Magnesium	6.1	2,7	me %
Potassium	-	-	me %
Sodium	-	-	me %

Sourced from laboratory analysis SB0802, DSIR Soil Bureau

Soil information inventory 25: Waitākere, Huia, and related soils

Te Kie steepland soil

Property	Topsoil	Subsoil	Units
Acidity	6.3	5.9	pH
Total carbon	6.2	-	%
Total nitrogen	0.41	-	%
Available phosphorus	0.003	0.003	mg %
P retention	-	-	%
Available sulphur	-	-	%
Cation exchange capacity	55.5	44.7	me %
Base saturation	76	67	%
Calcium	26.3	15.3	me %
Magnesium	15.3	10.4	me %
Potassium	-	-	me %
Sodium	-	-	me %

Sourced from laboratory analysis SB3239, DSIR Soil Bureau

8.2 Physical <http://soils.tfrec.wsu.edu/mg/chemical.htm>

No physical analysis appears in the online version of National Soils Database (NSD). The following estimates are sourced from the Fundamental Soils Layer (FSL):

Waitākere clay

Property	Topsoil	Subsoil	Units
Stones	-	0-4	%
Sand	-	-	%
Silt	-	-	%
Clay	-	-	%
Dry bulk density	-	-	g/cm ³
Total porosity	-	-	%
Macroporosity	5.0-14.9	-	%

Sourced from FSL table, Landcare Research

Huia steepland soil

Property	Topsoil	Subsoil	Units
Stones	5-69	-	%
Sand	-	-	%
Silt	-	-	%
Clay	-	-	%
Dry bulk density	-	-	g/cm ³
Total porosity	-	-	%
Macroporosity	0-9.9	0	%

Sourced from FSL table, Landcare Research

8.3 Irrigation and drainage

<http://irrigationefficiency.co.nz/assets/Uploads/Farmers-Guide.pdf>

No soil moisture analysis appears in the online version of National Soils Database (NSD). The following estimates are sourced from the Fundamental Soils Layer (FSL):

Waitākere clay

Property	Topsoil	Subsoil	Units
Field capacity			% w/w
Wilting point			% w/w
Plant-available water			% w/w
Plant-available water	75-250		mm
Depth to slowly permeable layer	0.60-1.19		m
Perm. at slowly permeable layer	<4		mm/hr

Sourced from FSL table, Landcare Research

Huia steepland soil

Property	Topsoil	Subsoil	Units
Field capacity			% w/w
Wilting point			% w/w
Plant-available water			% w/w
Plant-available water	25-99		mm
Depth to slowly permeable layer	1.20-1.49		m
Perm. at slowly permeable layer	<4		mm/hr

Sourced from FSL table, Landcare Research

8.4 Topsoil properties under different uses

Local management practices affect the properties of soil, so the history of land use needs to be considered. For many Auckland soils, an indication is provided by soil test results collected by Auckland Council from sites known to have been under the same use long-term. These sites are being re-sampled at five to ten-year intervals to detect any trends. Waitākere, Huia and related soils have been sampled at four sites in the Auckland region, all under natural cover.

Land Use		Natural Cover		Pasture	
Type:		Bush	Scrub	Brush	Scrub
Sample number-		12/102	12/103	12/104	12/105
Acidity	pH	5.1	4.7	5.6	6.3
Total carbon	%	9.4	14.9	7.8	3.0
Total nitrogen	%	0.51	0.72	0.42	0.24
Available nitrogen	µg/ cm ³	183	271	175	123
Available phosphorus	µg/ cm ³	1	1	2	4
Cation exchange capacity	cmol/cm ³	-	-	-	-
Base saturation	%	-	-	-	-
Calcium	cmol/ cm ³	-	-	-	-
Magnesium	cmol/ cm ³	-	-	-	-
Potassium	cmol/ cm ³	-	-	-	-
Sodium	cmol/ cm ³	-	-	-	-
Bulk density	t/ m ³	0.56	0.47	0.82	1.14
Particle density	t/ m ³	2.50	2.40	2.60	2.80
Aggregate stability	mm mwd	-	-	-	-
Total porosity	%	78	80	69	59
Macroporosity	%	9	18	9	15
Total available water	%	-	-	-	-
Readily available water	%	-	-	-	-

Sourced from Sparling, G. et al, various dates, 500 Soils Project, Landcare Research Reports to Auckland Council and Soil quality of indigenous sites in the Auckland region 2012

9 Land use capability

Land use capability is a classification of land according to properties that determine its capacity for sustained primary production. Classes 1 to 4 are arable, classes 5 to 8 non-arable. Class 1 is versatile i.e. capable of many uses, with negligible limitations to any use. Class 8 is land with extreme limitations that preclude productive use.

<http://www.landcareresearch.co.nz/publications/books/luc>

Three factors - geology, soil and slope - are considered when assigning land use capability classes. Another two - erosion and vegetation - may be recorded but rarely affect the decision. On regional-scale maps, notably the 1: 50,000 New Zealand Land Resource Inventory (NZLRI), limitations to use are indicated by four subclasses, c (climate), w (wetness), s (soil) or e (erosion). Unit numbers (1, 1b etc.) are used as labels for areas of land (map polygons) with the same geology, soil and slope, which are considered to have similar productive potential and management needs. General descriptions of productive potential and management needs are attached to NZLRI unit numbers.

NZLRI sub-classes and unit numbers were used for farm-scale land use capability maps (1:5,000 - 1: 10,000) prepared by Auckland Regional Authority or Auckland Regional Council between 1979 and 2010. On farm-scale soil maps prepared for Auckland Council since 2011, the four sub-classes are now replaced by twenty specific limitations. NZLRI unit numbers and their attached general descriptions are replaced by farm-specific tables.

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Landform	NZLRI	Farm	Main limitation	Sustainable uses
Plateaux	5c2,6c1	5c, 6c	Wind exposure and/or high rainfall	Improved pasture
Stable slopes	-	5g	Slight risk of gullies	Improved pasture
Unstable slopes	6e2	6l	Moderate risk of gullies, slips, earthslips	Semi-improved pasture, forest plantations
Slopes with shallow or stony soil	6e16	6r	Coastal exposure plus moderate slip and gully risk	Semi-improved pasture, forest plantations
Coastal slopes	6e2c	6r+c	Above + coastal exposure	Semi-improved pasture
Steep faces	7e1	7l	Severe risk of slips, debris avalanches	Forest plantations, conservation
Steep faces with shallow or stony soil	7e1b,8e2	7r	Severe slip, earthslip and gully risk	Conservation
Rock outcrops and bluffs	8s1	8k	Debris avalanches, rockfalls	Conservation
Coastal faces	7e1c, 8e3	7r+c,8k+c	Above + coastal exposure	Conservation

Sourced from: Harmsworth, G.R. 1996, Land use capability classification of the Northland region, Publication 9, Landcare Research; Anonymous 1979, NZLRI Waikato region land use capability extended legend, Water and Soil Division, MWD; Jessen, M.R. 1984, Additions to NZLRI Waikato Region land use capability extended legend, Water and Soil Division, MWD; Hicks, D. and Vujcich, V. 2017, Farm-scale land use capability classification for Auckland. Auckland Council technical report TR2017/016.

10 Past and present land uses

There does not appear to have been any concentrated Maori settlement on Waitākere, Huia and related soils, for the most part back from shorelines, sloping and in heavy bush. Such areas may even have been avoided when foraging for edible plants and hunting birds, due to the steep terrain. During European settlement timber-cutting was undertaken west of Auckland - also on Great Barrier - where contour permitted; particularly on ridges and plateaux (Waitākere soils). On steep slopes (Huia soils) some timber-cutting was practised either by dragging logs back to tram-lines on ridges, or by felling them into watercourses, then tripping temporary dams in the headwaters to drive the logs downstream to mills. A few settlers attempted to clear and farm cut-over bush on easier slopes though experienced poor pasture growth followed by scrub reversion on the wet, leached Waitākere and Tangatara soils. On steeper ground, most areas of Huia and Te Kie soil were simply left to revert.

On isolated farms in the Waitākere Ranges and on Great Barrier, a little livestock grazing persists on these soils to the present day, but only where they are interspersed with better soils on easier terrain.

Few timber plantations have been established on Huia or related soils. Poor access - there are few roads, and plantable terrain is cut off by deep gorges- deters commercial forestry.

The greater part of steep ground in Waitākere Ranges has been converted to waterworks reserve, starting with upper catchment of the Waitākere Stream in 1911, followed by the Nihotupu (1937-1956) and Huia (1960s). These catchments were formally reserved in 1940. Although the public was excluded from waterworks reserves for many years, the peripheral areas remained accessible and have been long valued by Aucklanders for recreation. Little Barrier was reserved as a wildlife sanctuary as early as 1895. Cut-over forests on Great Barrier Island became Lands and Survey reserves or State Forests, before transfer into the Hauraki Gulf Maritime Park in 1973.

Sourced from: Scott, D., 1979, Fire on the clay: the pakeha comes to west Auckland, Southern Cross Books

10.1 Typical pasture and tree plantation yields

Pasture	Yield	Units
Improved pasture (drystock)	11.8	t dm/ha/yr
Semi-improved pasture	7.9	t dm/ha/yr
Un-improved pasture	4.9	t dm/ha/yr

Source: MAF and Dexcel trials cited in Lincoln Farm Technical Manual 2008; various papers in NZ Journal of Agricultural Research

Timber	Yield	Units
Radiata pine (clearwood regime)	?	t/ha
Radiata pine (unpruned pulpwood)	?	t/ha
Macrocarpa cypress (woodlot)	?	t/ha
Eucalypt (woodlot)	?	t/ha
Acacia (woodlot)	?	t/ha

Source: FRI trials cited on SCION website; various papers in NZ Journal of Forestry and NZ Farm Forestry

11 Information about soil management

Waitākere and Huia soils are not versatile. Their productive uses - just extensive grazing and timber plantations - are restricted by shallowness associated with steep contour, leaching associated with wetness at elevation, and poor access. Their alternative uses - as waterworks reserve, or for recreation - raise different management issues:

- Conserving vegetation cover
- Minimising erosion and sediment yield
- Maintaining water quality in reservoirs
- Constructing tracks

Tips for conserving vegetation, also for controlling runoff and sediment loss along tracks or on exposed soil, are contained in:

- *Soils on ranges* *Soil Information Sheet 15, Auckland Council*
- *Code of Practice for Nutrient Management* *Fertiliser Association*
[Code of Practice for Nutrient Management](#)
- *Forest harvest guidelines* *TP223, Auckland Regional Council*
- *Streamside planting guide* *Auckland Council*
- *Native forest restoration guide* *Auckland Council*

Soil information inventory 25: Waitākere, Huia, and related soils

Find out more: phone 09 301 0101, email rimu@aucklandcouncil.govt.nz or visit aucklandcouncil.govt.nz and knowledgeauckland.org.nz