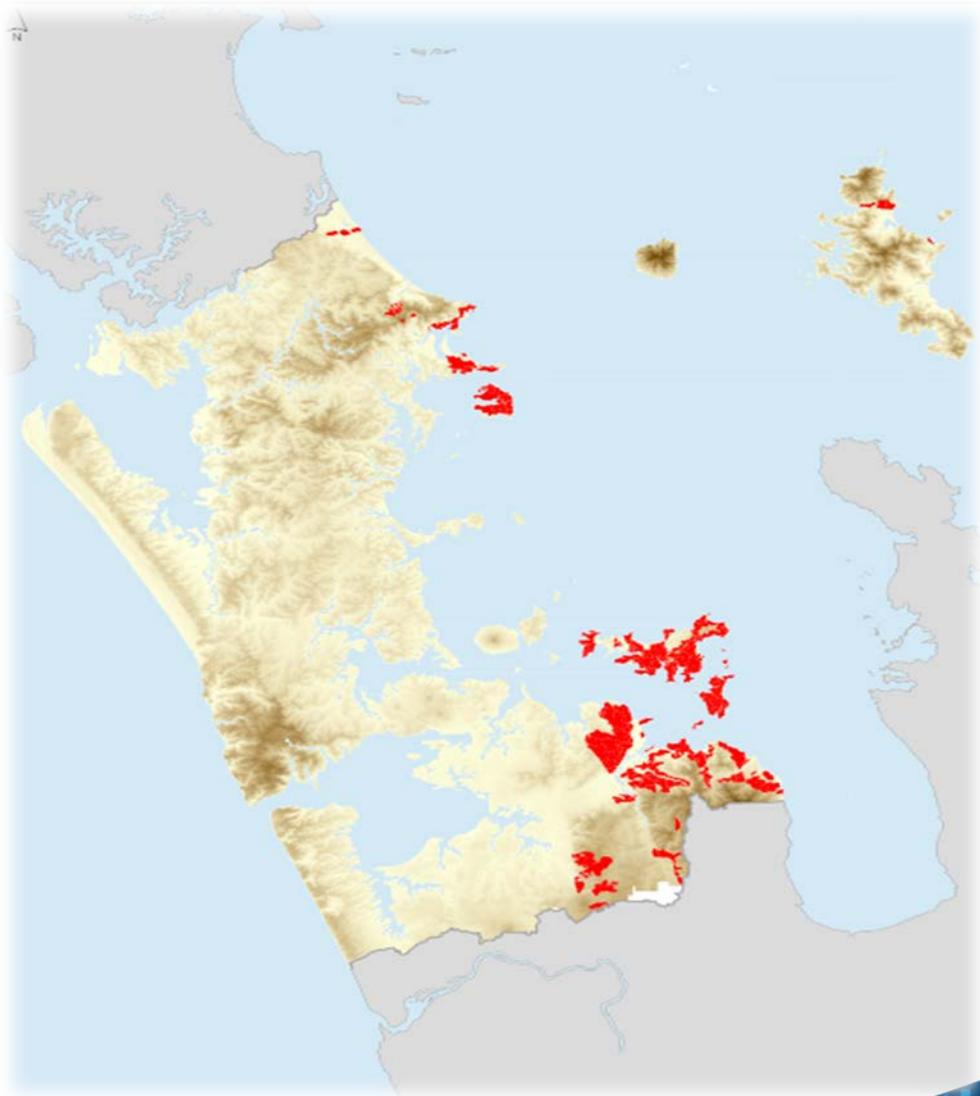


Soil Information Inventory:

Marua and related soils

October 2018

Soil Information Inventory 10





Soil Information Inventory 10: Marua and related soils

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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be understood or used without referring to background information which is dispersed across old maps, publications, or unpublished reports.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

Marua and related soils are depicted on the DSIR's published soil maps of North Auckland (1:100,000) as two series i.e. soils with distinct profiles and parent materials, separated into five soil types i.e. divided according to texture or other characteristics:

MR, MRH	Marua clay loam
MRr, MRrH	Marua light brown clay loam
MRu, MRuH	Marua brown clay loam
RA, RAH	Rangiora clay, clay loam or silty clay loam
RAI, RAIH	Rangiora silty clay loam

These labels appear on map polygons singly or combined e.g. MR + MRH, MR + MRu, MR + RA. Rarely in Auckland though commonly in Northland, they appear associated with other soils e.g. RA + HK (Hukerenui silt loam).

South of Auckland DSIR's older maps (1:253,840) distinguish two series labelled as:

35, 35H	Marua clay loam
41, 41H	Rangiora clay and silty clay loam

In a few areas re-mapped at larger scale, notably the Manukau City Soil Survey (1:20,000), the Marua and Rangiora series have received greater subdivision into mapping units with alphabetic and numeric labels that indicate each series singly, in combination, or as a complex with other soils:

CG1, 3	Marua clay loam
CG2	Rangiora clay loam
CX3	Marua complex
DG1	Hukerenui sandy loam + Marua brown clay loam
DG2	Opaheke clay loam
DG3, 7	Marua clay loam
DG4, 5, 8	Marua stony clay loam
DG6	Marua stony clay loam + Marua brown clay loam
DX16	Ararimu-Marua complex
DX17	Marua-Brookby complex
DXG10, 11	Marua clay loam complexed with other soils
DXG12, 13	Marua stony clay loam complexed with other soils

Sourced from:

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

Soil information inventory 10: Marua and related soils

Helensville-Waitakere area; Whangaparaoa-Auckland area,

NZ Soil Bureau maps 189, 190, 220, and 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.

Soil map of Manukau City.

NZ Soil Bureau map 149/1

NZ Soil Bureau map, unpublished

3 Online maps

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

MR, MRH	No family or sibling assigned
MRr, MRrH	No family or sibling assigned
MRu, MRuH	Whangaripo family, sibling 21
RA, RAH	No family or sibling assigned
RAI, RAIH	No family or sibling assigned
35, 35H	No family or sibling assigned
41, 41H	No family or sibling assigned
CG1	Bushc family, sibling 20, Whangaripo family, siblings 4 and 1.
CG2	Whangaripo family, sibling 4, and Whangaripo family, sibling 1
CG3	Whangaripo family, sibling 1, and Kell family, sibling 1
CX3	Pearson family, sibling 8, and Ormiston family, sibling 1
DG1	Pearson family, sibling 8, and Whangaripo family, sibling 11
DG2	Whangaripo family, sibling 11, and Pearson family, sibling 8
DG3, 4, 5	Whangaripo family, sibling 1 and 4
DG8	Whangaripo family, sibling 1, and Brown family, sibling 2
DG6	Whangaripo family, siblings 1, 2, and 8
DG7	Whangaripo family, sibling 1, and Guys family, sibling 2
DX16	Guys family, sibling 2 + Whangaripo family, sibling 1
DX17	Whangaripo family, sibling 1 + Whangaripo family, sibling 2
DXG10, 11	Whangaripo family, siblings 1 and 4, complexed with Oronoko family, sibling 68
DXG12	Whangaripo family, sibling 1, complexed with Oronoko family, sibling 68
DXG13	Whangaripo family, siblings 1, and 2

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

When investigated in the field by local soil mappers, any published map polygon labelled as Marua series (MR etc.) or Rangiora series (RA etc.) contains just four soil types i.e. series divided according to texture. On farm-scale maps (1:5,000 - 1:10,000) they are labelled as:

Mru	Marua brown (sandy) clay loam
Mr	Marua clay loam
Ra	Rangiora clay loam
Rac	Rangiora clay

Map polygons labelled as hill soils (MRH etc) contain small areas of Marua or Rangiora soil on stable ground. These are differentiated and labelled accordingly. Most of any such polygon is occupied by shallow soil on slopes disturbed by gullies or mass movement (slips, and slumps). For the time being these are labelled as:

Mru'	Marua brown stony clay loam (shallow)
Mr'	Marua stony clay loam (shallow)
Ra'	Rangiora stony clay loam (shallow)
Rac'	Rangiora stony clay (shallow)

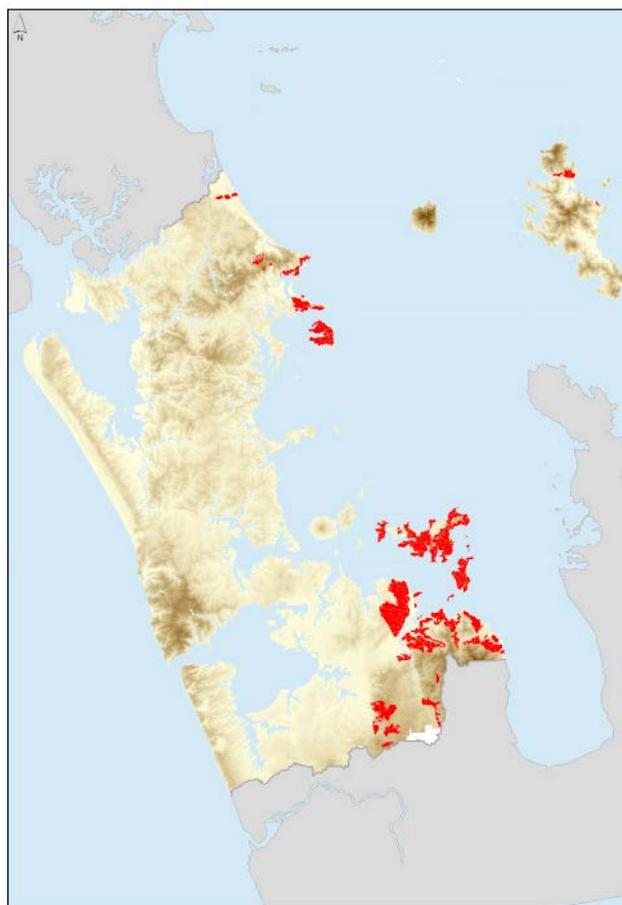
A local soil mapper (DLH) considers these hill soils are similar to the ones on published map polygons labelled Opaheke clay (41b, 41bH), Te Ranga steepland soil (122) or Rimutaka steepland soil (122S). For their descriptions, refer to the soil information inventory for Te Ranga and related soils.

Local series names 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

Throughout eastern parts of the Auckland region, initially as pockets within hill country from Te Arai to Leigh, then as extensive tracts from hills between Maraetai and Clevedon south through the Hunua hills and ranges. As hilly parts of the Hauraki Gulf islands, immediately offshore (Kawau, Tiritirimatangi, Motutapu, Waiheke, Ponui) and outer (Great Barrier, Mokohinau)



Location of Marua and related soils

25,400 hectares of Marua and related soils are mapped (5% of Auckland region). About 16,000 hectares (63% of the area mapped) are in productive use, mainly 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

Rolling downlands and moderate hillslopes with clay regolith weathered from Waipapa Group metasedimentary rocks. Commonly referred to as greywacke (the most common rock is hard grey sandstone), these formations are inter-bedded siltstone, sandstone and tuffaceous sandstone, plus basalt or andesite volcanics, conglomerate, chert, and limestone. They differ from Waitemata Group sedimentary

Soil information inventory 10: Marua and related soils

rocks in age (older, Permian to Jurassic), structure (deformed beds, dipping steeply, folded or contorted), strength (indurated to weakly metamorphosed), and composition (more diverse). They are the Auckland region's "basement rocks", present at depth throughout, but outcropping only where uplifted and stripped of younger sediments.

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



Deep Marua and Rangiora soils occur on stable greywacke slopes (middle distance) above weathered clay soil on wet footslopes (foreground).

Photo: D. Hicks



Shallow Marua and Rangiora soils occur on unstable slopes above young alluvial soil in valley bottoms (foreground). *Photo: D. Hicks*

5.2 How they differ from other soils

Marua clay loam and Rangiora clay loam were first described in Northland where greywacke rocks are deeply weathered to “rotten rock” i.e. clay in which traces of the original rock strata remain visible. Profiles differ depending on mineralogy of the parent material. Their common characteristic is clay subsoil of variable structure and permeability over short distances. This variability contrasts with the profiles of Whangaripo or Aponga and related soils, which have weathered from younger marine sedimentary rocks.

On steep ground in ranges or along the coast, the parent material of Marua and Rangiora soils (as depicted on published maps) is slightly weathered greywacke. Here the profiles contain less clay, weathered stones are usually visible in subsoil, and unweathered rock may be exposed in outcrops. For a description of these shallow hill phases, refer to the Soil Information Inventory for Te Ranga and related soils.

Sourced from:

*Wilson, A.D. and Cox, J.E., Soils of Rodney County, Unpublished report, Soil Bureau DSIR
Purdie, B. et al 1982, Manukau Soil Survey. District Office Report Hv5 Soil Bureau, DSIR*

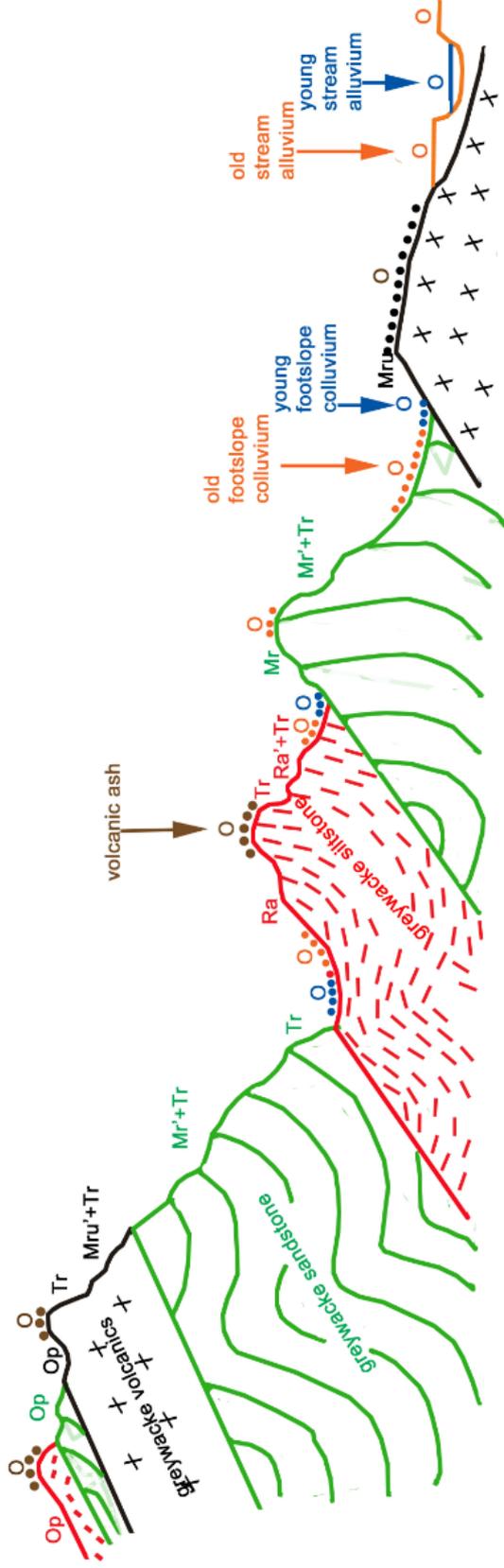
6 Classifications

NZ genetic (NZG):	Northern or central yellow-brown earth
NZ soil (NZSC):	Mottled or acid orthic brown or mottled yellow ultic http://soils.landcareresearch.co.nz/contents/SoilNames_NZSoilClassification_SoilOrders.aspx
Soil Taxonomy (USDA):	Typic or aquic haplohumult; typic or lithic dystrochrept http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051544.pdf
World Soils (FAO):	Nitisol or cambisol 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 the 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.

Soil information inventory 10: Marua and related soils

Cross section showing Marua and related soils' position in the landscape



On elevated plateaux:
Op, Op, Op Opaheke clay loam (undifferentiated)
Tr Te Ranga stony loam (undifferentiated)

On moderate hillslopes (parts unstable):
RA'+TR Rangiora stony clay loam + patches Te Ranga
Mr'+Tr Marua stony clay loam + patches Te Ranga
Mru'+Tr Marua stony brown clay loam + patches Te Ranga

On steep faces (unstable):
Tr, Tr, Tr Te Ranga stony loam (undifferentiated)

On rolling lower slopes, upper slopes & ridges (stable):
Ra Rangiora clay loam
Mr Marua clay loam
Mru Marua brown clay loam

o, o, o Other soils (refer to relevant soil information inventory)

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

7 Soil profile descriptions



Topsoil (Ap)

Upper subsoil (Bw and Bwf)

Lower subsoil (BC)

Marua clay loam Photo: D Hicks

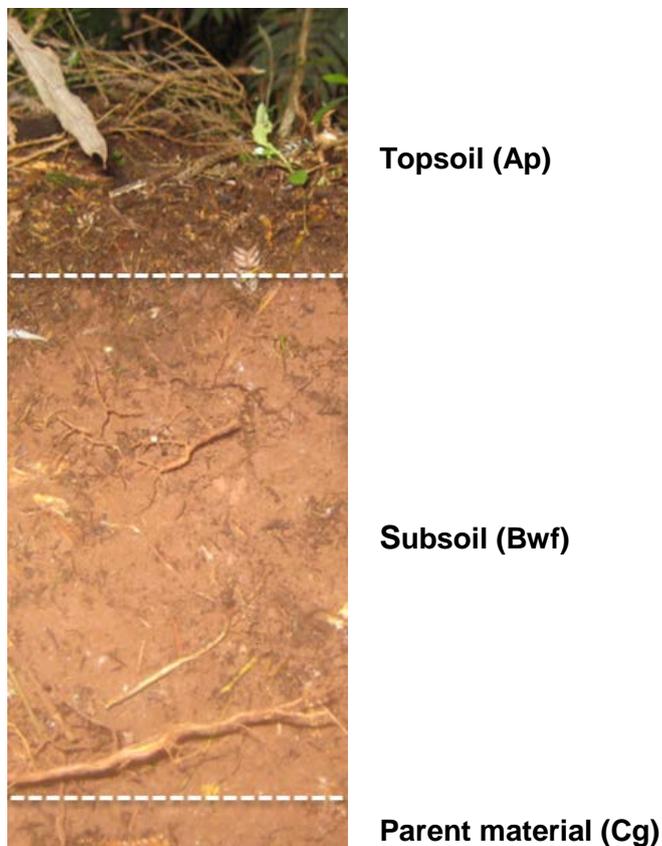
The DSIR's type profile description for Marua clay loam is:

Marua clay loam

Horizon	Depth (cm)	Description
Ap	0-9	Very dark greyish brown (10YR3/2) clay loam; friable; moderately developed very fine and fine angular polyhedral structure, fine subrounded polyhedral structure and fine cast structures; common pores; many earthworms and grass roots; sharp wavy boundary.
Bw	9-20	Dark yellowish brown (10YR4/4 - 5/4) clay; slightly sticky when wet; friable; moderately developed fine and some medium polyhedral and very fine polyhedral structure; aggregates fret to a single grain structure; common pores; slight dark brown staining on the faces of some of the aggregates; many grass roots; indistinct diffuse boundary.
Bw(f)	20-38	Brownish yellow (10YR6/6) clay; slightly sticky when wet; few fine faint yellowish red mottles; medium packing; moderately developed medium and fine polyhedral structure, breaks to very fine polyhedral structure; many grass roots; indistinct diffuse boundary.
BC	38-87	Yellow (10YR7/6) clay; slightly sticky when wet; firm packing; moderately developed medium and fine polyhedral structure which breaks to very fine polyhedral structure; few grass roots; diffuse irregular boundary.
CR	on	Red (10R5/8) pre-red-weathered greywacke and yellow clay: soft and brittle: no grass roots.

Soil information inventory 10: Marua and related soils

Marua brown clay loam is widely recorded on the DSIR's published maps of Northland and Auckland, but no type profile is labelled as such. A profile described near Te Arai (but labelled Marua clay loam) resembles the brown clay loam in consistence and structure, though does not indicate its darker colour or its sandy clay texture:



Marua brown clay loam Photo: F Curran-Cournane

Marua brown clay loam

Horizon	Depth (cm)	Description
Ap	0-8	Dark grey brown (10YR4/2) clay loam; friable; moderately developed fine blocky structure; abundant grass roots; abrupt boundary.
Bw(f)1	8-26	Light yellowish brown (10YR6/4) clay; few fine faint rusty brown mottles; friable and peds firm; moderately strongly developed medium subangular blocky structure; abundant grass roots; diffuse boundary.
Bw(f)2	26-57	Brownish yellow (10YR6/6) clay; few fine distinct, rusty brown mottles; high packing; strongly developed medium subangular blocky structure; few fine roots; diffuse boundary
C(g)	on	Brownish yellow (10YR6/8) clay; few fine faint rusty brown and grey mottles; friable; very high packing; strongly developed medium subangular blocky structure; few fine grass roots.

Soil information inventory 10: Marua and related soils



Topsoil (Ap)

Upper subsoil (Bwg and Btf)

Lower subsoil (Cf)

Rangiora clay loam Photo: D. Hicks

DSIR's type profile for Rangiora series is:

Rangiora clay loam

Horizon	Depth (cm)	Description
Ap	0-15	Dark grey (10YR4/1) silty clay (in places silt loam); high packing in place and friable in the hand; weakly developed very fine and fine polyhedral structure; contains abundant scrub roots; indistinct boundary.
Bw(g)	15-25	Pale brown (10YR 6/3) clay; faint fine brownish yellow (10YR 6/6) and light brownish grey (10YR 6/2) mottles; high packing in place and somewhat friable in the hand; common pores; weakly developed very fine and fine polyhedral structure; contains abundant scrub roots; diffuse boundary.
Bt(f)	25-66	Light yellowish brown to brownish yellow (10YR6/4 - 6/6) clay; very high packing in place and hard to dig; very few pores; moderately developed coarse polyhedral structure and strongly developed prismatic structure with a very dark grey (humic) and grey staining on the faces of the prisms; contains many scrub roots; diffuse boundary.
C(f)	on	Yellow to very pale brown (10YR7/8 - 7/4) clay; few faint fine yellowish-red mottles with a slight greying on the faces of some of the aggregates; high packing in place but reducing to low with increasing depth; moderately developed medium polyhedral structure breaking to fine polyhedral structure.

Soil information inventory 10: Marua and related soils

Other DSIR type profile descriptions for Marua light brown clay loam and Rangiora silty clay loam appear to describe perch-gley ultic soils on seasonally wet sites. Refer to the relevant soil information inventory for a description.

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

8 Properties of typical profile

The properties of typical profiles are best indicated by analysis results for the type profile sites i.e. where Marua and Rangiora soils were defined and described. Data for other sites will vary somewhat, particularly where sandy clay loam and silty clay loam types are found.

8.1 Chemical

<http://soils.tfrec.wsu.edu/mq/chemical.htm>

No chemical analysis for either soil appears in the online version of National Soils Database (NSD). The following analyses appear in Soil Bureau Bulletin 5.

Marua clay loam

Property	Topsoil	Subsoil	Units
Acidity	5.2	4.9	pH
Total carbon	8.4	-	%
Total nitrogen	0.5	-	%
Available phosphorus	0.004	-	%
P retention	-	-	%
Available sulphur	-	-	%
Cation exchange capacity	25.9	21.8	me %
Base saturation	36	29	%
Calcium	4.9	3.4	me %
Magnesium	5.9	3.1	me %
Potassium	-	-	me %
Sodium	-	-	me %

Sourced from laboratory analysis SB02651, DSIR Soil Bureau

Rangiora clay loam

Property	Topsoil	Subsoil	Units
Acidity	4.8	-	pH
Total carbon	5.7	-	%
Total nitrogen	0.3	-	%
Available phosphorus	0.002	-	%
P retention	-	-	%
Available sulphur	-	-	%
Cation exchange capacity	28.5	-	me %

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Property	Topsoil	Subsoil	Units
Base saturation	30	-	%
Calcium	3.4	-	me %
Magnesium	4.7	-	me %
Potassium	-	-	me %
Sodium	-	-	me %

Sourced from laboratory analysis SB03243, DSIR Soil Bureau

8.2 Physical

http://www.nrcs.usda.gov/wps/portal/nrcs/detail/nj/home/?cid=nrcs141p2_018993

No physical analysis for either soil appears in the online version of NSD. Soil physical data are not tabulated in Soil Bureau Bulletin 5, but the following estimates are sourced from Fundamental Soils Layer (FSL) and relevant S-map factsheets.

Marua clay loam

Property	Topsoil	Subsoil	Units
Stones	0	0	%
Sand	1-5	1-5	%
Silt	54-59	44-50	%
Clay	36-45	45-50	%
Dry bulk density	1.08	1.54	g/cm ³
Total porosity	-	-	%
Macroporosity	5.0- 7.9	-	%

Sourced from FSL table and S-map factsheet, Landcare Research

Rangiora clay loam

Property	Topsoil	Subsoil	Units
Stones	0	0	%
Sand	1-10	1-10	%
Silt	54-54	29-40	%
Clay	36-45	50-70	%
Dry bulk density	1.08	1.54	g/cm ³
Total porosity	-	-	%
Macroporosity	5.0- 14.9	-	%

Sourced from FSL table and S-map factsheet, Landcare Research

8.3 Irrigation and drainage

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

No soil moisture analysis for either soil appears in the online version of NSD. Soil irrigation and drainage properties are not tabulated in Soil Bureau Bulletin 5, but the following estimates are sourced from FSL and relevant Smap factsheets.

Marua clay loam

Property	Topsoil	Subsoil	Units
Field capacity	-	-	% w/w
Wilting point	-	-	% w/w
Plant-available water	-	-	% v/v
Plant-available water	46	31	mm
Depth to slowly permeable layer	-	0.6-0.8	m
Perm. at slowly permeable layer	-	<4	mm/hr

Sourced from FSL table and S-map factsheet, Landcare Research

Rangiora clay loam

Property	Topsoil	Subsoil	Units
Field capacity	-	-	% w/w
Wilting point	-	-	% w/w
Plant-available water	-	-	% v/v
Plant-available water	47	32	mm
Depth to slowly permeable layer	-	0.45-0.55	m
Perm. at slowly permeable layer	-	<4	mm/hr

Sourced from FSL table and S-map factsheet, 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. On Marua and related soils, just three sites were initially sampled, representing the main land uses. Another site was sampled on a minor land use (vineyards) during the second round.

Soil information inventory 10: Marua and related soils

Land use:		Natural cover	Pasture	Forest	Horticulture
Type:		Bush	Drystock	Pine	Vineyard
Sample Number:		1999/12	1999/11	2000/10	2013/9
Acidity	pH	6.1	6.3	5.1	6.4
Total carbon	%	4.3	5.9	5.7	3.9
Total nitrogen	%	0.3	0.4	0.2	0.3
Available nitrogen	µg/ cm ³	80	116	59	81
Available phosphorus	µg/cm ³	18	12	5	18
Cation exchange capacity	cmol/cm ³	11.3	23.6	18.8	-
Base saturation	%	74	78	43	-
Calcium	cmol/ cm ³	6.7	12.3	3.9	-
Magnesium	cmol/ cm ³	1.3	5.5	3.7	-
Potassium	cmol/ cm ³	0.3	0.5	0.5	-
Sodium	cmol/ cm ³	0.1	0.3	0.4	-
Bulk density	t/ m ³	1.06	1.06	1.05	1.10
Particle density	t/ m ³	2.49	2.47	2.56	-
Aggregate stability	mm mwd	1.76	2.62	2.27	-
Total porosity	%	57	57	59	-
Macroporosity	%	12	6	18	9
Total available water	%	20	28	12	-
Readily available water	%	6	7	6	-

Sourced from Sparling, G. et al, various dates, 500 Soils Project, Landcare Research Reports to Auckland Council

Soil Quality for Horticultural Sites in the Auckland Region 2013

Soil Quality of Dairy Sites in the Auckland Region in 2009)

Soil Quality of Drystock Sites in the Auckland Region in 2010

Soil Quality of Plantation Forestry Sites in the Auckland Region in 2011

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.

Landform	NZLRI	Farm	Main limitation	Sustainable uses
Colluvial footslopes	-, -	3e	Moderate sheetwash risk if cultivated	Tree and vine crops, rotational fodder crops
Regolithic footslopes	4e7, 4e3	4t	Severe sheetwash risk if cultivated	Tree and vine crops, occasional fodder crops, improved pasture
Spurs and ridges	-, -	5s	Slope, narrow irregular shape	Tree and vine crops, improved pasture
Moderate slopes, stable	5e9, 5e3 and 14	5g	Slope, slight risk of gullies	Improved pasture, woodlots

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

Historically the Marua and Rangiora soils have not been used for commercial horticulture, though old farm orchards or vegetable gardens can be productive on slow-draining easy-contour sites, if given sufficient time to build up topsoil depth and fertility. The practical limitation is that such sites are rarely extensive enough to support large-scale growing. In the 1980s, several landowners planted grape vines and olive groves around footslopes of the Hunua Range, also on Waiheke Island. Thirty years on, most remain in small-scale commercial production, proving that Marua clay loam is suited to vine and tree crops that produce high-value yield from a small land area. Rangiora clay loam in contrast has imperfectly draining subsoil. Here fruit trees and vines may establish but will not thrive.

Original soil fertility was low when cleared from scrub or bush by early settlers, so after initial experiments they did not persist with grain crops. Although contour permits machines to move across footslopes or easy upper slopes, the Marua and Rangiora soils' clay content and associated structure (massive and sticky when wet, nutty to blocky when dry) restrict cultivation to a few weeks in spring and autumn when soil moisture is optimal. Root or green fodder crops (turnips, kale and similar) are sown on cultivable slopes, but farmers usually harvest just one crop before renewing pasture.

The few farmers with easy-contour Marua and Rangiora soil (usually associated with better soils such as Ararimu silt loam) were able to establish dairy pasture. Most farms had a larger area of moderate to steep-contour hillslope, difficult to graze, and interspersed with poorer soils such as Opaheke clay loam or Te Ranga stony loam, which did not grow enough grass to support milking cows. Such farms remained drystock sheep, struggling to remain economic until advent of aerial topdressing in the late 1940s. That, combined with ground or aerial spraying of scrub regrowth, boosted pasture yield to a level that could sustain drystock farming. Poor returns for lamb and wool through the 1980s-1990s resulted in a shift towards mixed sheep and beef, or entirely beef cattle operations.

Another trend which started in the 1960s on Marua and Rangiora soils was farm conversion to tree plantations. Conversion peaked in the 1990s; there has been little new planting since. Parts of the hills between Whitford and Clevedon, valley sides leading into the Hunua Range, and rolling ridges around the Hunua water supply catchments are all in commercial pine plantation. Most have been harvested and re-planted with a second rotation of pines. The remaining drystock farms usually have small pine woodlots planted on steep faces or in gullies.

Bush and scrub on easy-contour Marua and Rangiora soils were quickly cleared by settlers. By the early 1900s loggers moved onto steeper country. Any bush remnants, scrub reversion, and regenerating forest patches that remain on farms are generally small.

Soil information inventory 10: Marua and related soils

Several towns and villages around Auckland's coast, also on offshore islands, contain holiday or residential houses built on Marua or Rangiora soil. The largest such area is on Waiheke Island; others are Leigh, Maraetai, Port Fitzroy, Tryphena and Claris. Easy-contour areas being stable, there are no foundation issues here; but moderate to steep-contour areas are at risk from shallow landslides (on Marua) or deeper earthslips (on Rangiora). Marua brown (sandy) clay loam or clay loam are sufficiently permeable for stormwater drainage and effluent soakage; Rangiora clay loam or clay marginally so. Both usually lead downslope into less permeable soil (Hukerenui silt loam, Kara silt loam or clay) where water resurgence may become an environmental issue.

Sources: D Hicks pers. obs.

10.1 Typical fruit, crop, pasture, and timber plantation yields

Fruit	Yield	Units
Grapes	?	t/ha
Olives	?	t/ha

Source: grower advice

Crop	Yield	Units
Forage turnips	?	t/ha
Forage brassica	?	t/ha

Source: grower advice

Pasture	Yield	Units
Improved pasture (dairy)	8.3-11.6	t dm/ha/yr
Improved pasture (drystock)	7.8-8.6	t dm/ha/yr
Semi-improved pasture	5.4-6.7	t dm/ha/yr
Un-improved pasture	3.6-4.5	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)	?	m ³ /ha
Radiata pine (unpruned pulpwood)	?	m ³ /ha
Macrocarpa cypress (woodlot)	?	m ³ /ha
Eucalypt (woodlot)	?	m ³ /ha

Source: FRI trials cited by SCION; various papers in NZ Journal of Forestry or NZ Farm Forestry

11 Information about soil management

Marua and Rangiora soils are not versatile because variable subsoil texture and structure restrict horticulture to small areas where vines or fruit trees can thrive. In this regard, Marua brown (sandy) clay loam has better root penetration and water availability than Marua clay loam or the various Rangiora soil types. Any of the soils can grow grain or fodder crops on easy-contour stable slopes, but their high clay content (affecting soil structure and moisture) limits the times of year when they are cultivable. All have proven to be good soils for pasture and timber tree growth.

Key management issues that may arise are:

- Adequate fertilisation to replace nutrient uptake by pasture
- Avoidance of structural deterioration through pugging by stock in winter and spring
- Maintenance of dense sward through dry summers to minimise risk of topsoil loss in runoff when the autumn rains come
- Runoff and sediment loss from farm or forest tracks

Marua and Rangiora soils, despite their different parent material, have similar management needs to other ultic (clay) soils that have weathered from marine sedimentary rock in the landscape that extends from Northland through Auckland to the northern Waikato. Tips for managing soil structure and nutrients, for controlling erosion, and for applying irrigation water or effluent, are contained in:

- *Light clay soils* *Soil Information Sheet 11, Auckland Council*
- *Heavy clay soils* *Soil Information Sheet 12, Auckland Council*
- *Code of practice for nutrient management* *Fertiliser Association*
http://www.fertiliser.org.nz/site/code_of_practice/default.aspx
- *A guide to managing farm dairy effluent (Auckland)* *Dairy NZ*
http://www.dairynz.co.nz/media/880785/auckland_guide_to_managing_farm_dairy_effluent.pdf
- *Control of soil erosion in farmland* *Technical Paper 95/4, MAF Policy*
<http://maxa.maf.govt.nz/mafnet/rural-nz/sustainable-resource-use/land-management/soil-erosion.htm>
- *Poplars* *Soil Conservation Leaflet, Auckland Regional Council*
- *Willows* *Soil Conservation Leaflet, Auckland Regional Council*
- *Streamside planting guide* *Auckland Council*

Soil information inventory 10: Marua and related soils

- *Riparian zone management: strategy guideline and planting guide*
TP148, Auckland Regional Council
- *Forest harvest guidelines* *TP223, Auckland Regional Council*
- *Native forest restoration guide* *Auckland Council*

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