

Soil Information Inventory:

Whangamaire and Whakapara soils

October 2018

Soil Information Inventory 26





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Soil Information Inventory, SII 26

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be understood or used without referring to background information which is dispersed across old maps, publications, or unpublished reports.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

South of Auckland, DSIR's oldest published maps (1: 253,840) depict soils on young stream alluvium as two series i.e. soils with distinct profiles and parent materials:

1	Manawatu series
2	Kairanga series

The same soils appear on a map of intermediate age covering part of Franklin district (1:63,360), labelled as a single series with a local name, divided into two types i.e. soils with differences in texture or other characteristics:

W	Whangamaire silt loam
Wm	Whangamaire clay loam

A recent map of Manukau city (1:20,000) separates the soils into numerous mapping units that contain spatially associated soil types, assigning alphanumeric labels:

ACA1, 2, 13	Whangamaire sand (raw)
ACA3, 14, 15	Whangamaire silt loam over Whangamaire sand
ACA4	Whangamaire sandy clay (raw)
ACA5	Whangamaire silt loam over sandy clay
ACA6	Whangamaire clay (raw)
ACA7	Whangamaire clay loam
ACA8	Whangamaire clay loam over old alluvial soil
ACA9, 10, 16	Whangamaire clay loam (gleyed)
ACA11	Whangamaire sandy clay (raw)
ACA12	Whangamaire sand (raw) complexed with silt loam and old alluvial soil

North of Auckland, DSIR's published maps (1: 100,000) depict similar soils as a single series divided into two types:

WF	Whakapara silt loam or clay loam
WFm	Whakapara clay loam (mottled)

Sourced from:

Soil maps of Maungaturoto-Kaipara area; Mangawhai-Warkworth area; Helensville-Waitakere 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)
maps 11/2, 11/3

Soil map of part Franklin county

NZ Soil Bureau map 149/1

Soil map of Manukau City

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:

1, 2	No family name or sibling number assigned
W, Wm	Hastings family, sibling 28
ACA1,2,13	Rangitikei family, sibling 45
ACA3,14,15	Oronoko family, sibling 69
ACA4	Twizel family, sibling 1
ACA5	Hinds family, sibling 9
ACA6	Baton family, sibling 35
ACA7	Baton family, sibling 16
ACA8	Riccarton family, sibling 1
ACA9,10,16	Flaxmere family, sibling 24
ACA11	Nixon family, sibling 3
ACA12	Oronoko family, sibling 18
WF	Mataikona family, sibling 25a
WFm	Whakapara family, sibling 1a

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

South of Auckland, limited field investigation of published map polygons labelled 1, W, ACA etc. has been undertaken by local mappers. When farm mapping or identifying soil for sampling, labels are attached as follows:

Wms	Whangamaire sand or silt (raw)
Wmg	Whangamaire sandy clay, silty clay, or clay (raw)
Wm	Whangamaire sandy or silt loam
Wmm	Whangamaire silty clay loam or clay loam

North of Auckland, any published map polygon labelled as WF or WFm. turns out to be a mosaic of several soil types when investigated in the field by local soil mappers, on farm-scale soil maps (1: 5,000 - 1: 10,000) they are labelled as:

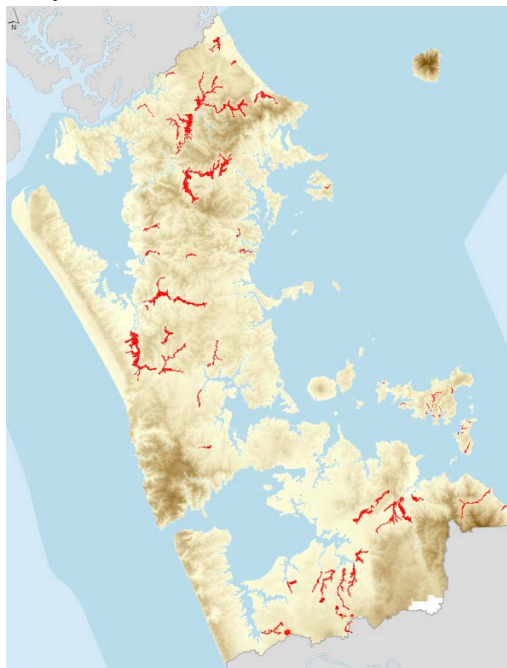
Wfs	Whakapara sand or silt (raw)
Wfg	Whakapara sandy clay, silty clay, or clay (raw)
Wf	Whakapara sandy or silt loam
Wfm	Whakapara silty clay loam or clay loam

Local series names for Whangamaire, Whakapara and related soils have been retained on Auckland Council's farm-scale maps for continuity with published nomenclature. A local mapper (DLH) considers they could be regarded as the same series, north and south of Auckland.

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

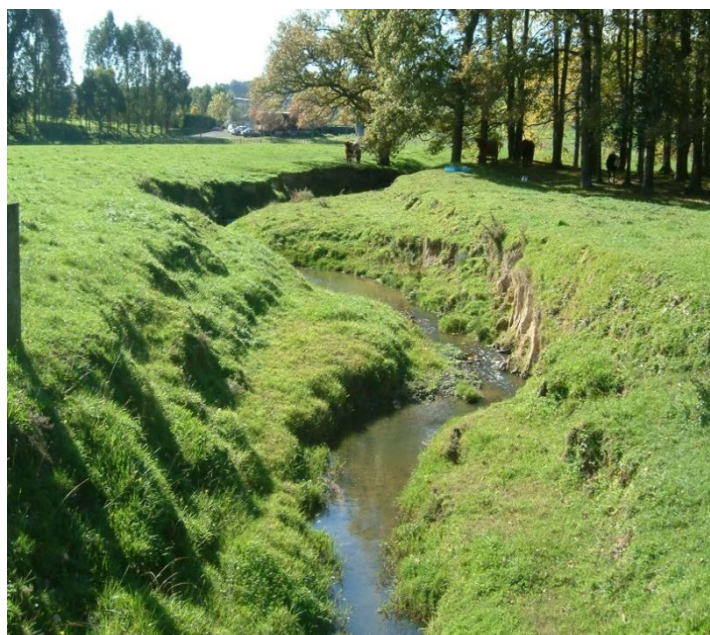
River and stream valleys throughout the Auckland region from its northern boundary at Te Hana, to the southern boundary near Pukekohe.



Location of Whakapara and related soils

Whangamaire and Whakapara soils are mapped on 12,300 hectares (2% of Auckland Region). About 7,000 hectares (60% of the area mapped) are in agricultural use (estimated from overlay of AgriBase 2010 on Fundamental Soils Layer).

<http://intermaps.arc.govt/AucklandCouncilViewer/>



Whangamaire sandy loam on flood berm next to stream bank, with clay loam on low alluvial flat in background, Drury Photo: D. Hicks

5.1 On what landform

Whangamaire and Whakapara soils occur on low stream flats (floodplains) inundated by floods occasionally (every few years) to regularly (annual). Also, lower-level floodways through the flats, adjacent to streams and frequently flooded (several times a year).

Floodplains have recent phases of soil, formed from a thin veneer of young alluvium, over buried soil in old alluvium which may be visible where drains are cut. Floodways have raw phases, on deposits of young alluvium that are still accumulating. Old alluvial soil is deeply buried here, though stream incision may expose it in channel banks or beds. Overlying young alluvium is the youngest formation within Tauranga Group sediments, varying in age from several hundred to just a few years old.

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

5.2 How they differ from other soils

Coarse-textured Whakapara and Whangamaire soils are free to slow-draining and have good structure for cultivation throughout the year. Their position in the landscape places them at risk of erosion or deposition by floodwater, so they are not continuously cropped, though crops (usually fodder maize) are rotated with pasture. The fine-textured types have imperfect or impeded drainage. Their structure is good while moist but becomes massive and sticky when wet or turns blocky and hard when dry, so the cultivation window is narrow. Fine-textured phases occur in landscape positions where the water table is high from winter through spring. Their silty clay or clay texture is water-retentive, so pasture growth is good, but they pug if heavily stocked when wet.

Sourced from:

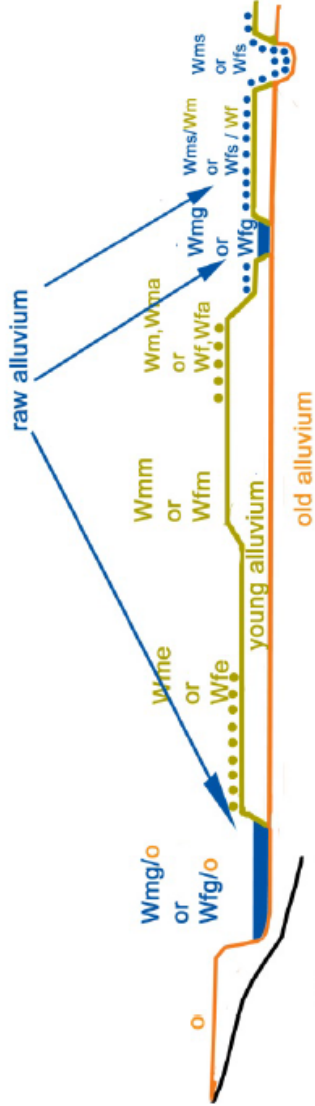
Wilson, A.D. and Cox, J.E., Soils of Rodney County, Unpublished report, Soil Bureau DSIR Orbell, G., 1977 Soils of part Franklin County, Report 33, Soil Bureau DSIR

6 Classification

NZ genetic (NZG):	Recent
NZ soil (NZSC):	Mottled fluvial recent, typic recent gley http://soils.landcareresearch.co.nz/contents/SoilNames/NZSoilClassification_SoilOrders.aspx
Soil Taxonomy (USDA):	Fluventic or fluvaquentic dystrochrept, typic or aquic dystrochrept, typic or aeric haplaquept http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051544.pdf
World Soils (FAO):	Fluvisol 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 Whangamaire, Whakapara and related soils' position in the landscape



South Auckland

On raw alluvium:

Wms Whangamaire sandy silt or sand
Wmg Whangamaire silty or sandy clay

On young alluvium:

Wm, Wma Whangamaire sandy silt loam or sandy loam
Wmm, Wme Whangamaire silty clay loam or clay loam

On old alluvium:

O Other soils

North Auckland

On raw alluvium:

Wfs Whakapara sandy silt or sand
Wfg Whakapara silty or sandy clay

On young alluvium:

Wf, Wfa Whakapara sandy silt loam or sandy loam
Wfm, Wfe Whakapara silty clay loam or clay loam

On old alluvium:

O Other soils

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

7 Soil profile descriptions

http://en.wikipedia.org/wiki/Soil_horizon



Topsoil (Ag)

Subsoil (Cg)

Whangamaire clay loam Photo: F. Curran-Cournane

DSIR's soil mappers south of Auckland just described a single type profile for Whangamaire clay loam (Wm):

Whangamaire clay loam

Horizon	Depth (cm)	Description
Ag	0-20	Greyish brown clay loam; friable; moderately developed fine subangular polyhedral structure; few faint fine yellowish and red mottles; distinct boundary.
Cg1	20-35	Grey silt loam; slightly firm; weakly developed medium subangular polyhedral structure; many distinct fine yellowish brown mottles; distinct boundary.
Cg2	on	Grey clay loam; firm; moderate fine prismatic structure; many distinct fine yellowish red mottles.

This is the modal (most common) profile on stream alluvium derived from sedimentary rocks, plus a small amount of airfall volcanic ash washed off slopes. When observed in the field it appears identical with Whakapara silty clay loam, type profile (a) on page 16.

Whangamaire soils equivalent to gleyed clay (b), silty (c), or sandy (d) loam Whakapara profiles are also mapped at farm scale south of Auckland, as are raw variants.



Whangamaire silt loam *Photo F. Curran-Cournane*

Moving into areas where stream sediment is entirely volcanic in origin (eroded from Patumahoe, Karaka or related soil series), soils mapped as Whangamaire retain similar profiles but differ in mineral composition. There could be a case for retaining the Whangamaire series name here.



Raw variant of Whangamaire soil forming on stream sediment derived from volcanic ash.

Photo: A Thompson



Topsoil (Ag)

Subsoil (Cg)

Whakapara silty clay loam *Photo: D Hicks*

DSIR mappers north of Auckland described Whakapara clay loam (WFm) as occurring on sedimentary alluvium “mainly from soils of the Puhoi Suite, formed from the Waitemata sandstones”. Their unpublished type description contains two modal profiles, the first described as “moderately gleyed ... floods generally for shorter periods”; the second as “strongly gleyed ... lower areas ... generally some distance from river or stream, where the turbid flood waters remain for longer period and with a water table closer to the surface”:

Whakapara clay loam (a) moderately gleyed = Whakapara silty clay loam

Horizon	Depth (cm)	Description
Ag	0-5	Dark brown (10YR 4/3) clay loam, common faint reddish brown mottles mainly along the root channels; friable (when dry); fine subangular polyhedral, very fine and extremely fine subangular polyhedral structure and some extremely fine subrounded polyhedral structure; irregular boundary.
A/C(g)	5-23	Pale brown (10YR 6/3) clay loam; abundant faint grey and reddish yellow mottles mainly along the root channels; friable when dry; fine subangular polyhedral structure; diffuse boundary.
Cg	on	Brownish grey (10YR 6/2) clay; many prominent reddish yellow mottles; slightly sticky when wet, very firm when dry; coarse subangular polyhedral to prismatic structure.

Type profile (a) corresponds to the soil mapped as Whakapara silty clay loam at farm scale.

Whakapara clay loam (b) strongly gleyed

Horizon	Depth (cm)	Description
A	0-8	Dark brown (10YR 4/3) clay loam; friable when dry; fine subangular polyhedral structure; irregular boundary.
A/Cr	8-28	Light brownish grey (2.5Y 6/2) clay, few faint reddish yellow mottles; slightly sticky when wet; firm when dry; medium to coarse subangular polyhedral structure, breaking to fine subangular polyhedral; diffuse boundary.
Cr	28-68	Light grey (2.5Y 7/2) clay; many prominent red-yellow mottles; slightly sticky when wet, very firm when dry; coarse subangular polyhedral structure breaking to fine blocky.
2Cg	on	Olive-grey (5Y 6/2) sandy clay; abundant distinct reddish brown mottles; sticky; saturated with water; massive structure.

Type profile (b) is mapped as Whakapara clay loam at farm scale.

The DSIR mappers give a separate type profile description for Whakapara silt loam (WF), described as occurring on “sedimentary alluvium”, with “some accumulation because of flooding” where floods are “frequent and irregular”:



Topsoil (A and A/B)

Subsoil (Bw and Bf)

Whakapara silt loam Photo: F. Curran-Cournane

Whakapara silt loam (c)

Horizon	Depth (cm)	Description
A	0-8	Dark greyish brown (10YR 4/2) silt loam; very friable when dry; very fine and extremely fine subangular and subrounded polyhedral structure; diffuse boundary.
A/B	8-16	Dark brown (10YR 4/3) silt loam; very friable when dry; medium subangular polyhedral structure, breaking to extremely fine subangular polyhedral on gentle pressure; diffuse boundary.
Bw	16-34	Dark yellowish brown (10YR 4/4) silt loam; very friable when dry; medium subangular polyhedral structure, breaking to extremely fine subangular polyhedral; diffuse boundary.
B(f)	34-52	Light yellowish brown (2.5Y 6/4) clay loam; many distinct yellowish red mottles; firm when dry; subangular polyhedral and fine blocky structure breaking to extremely fine subangular polyhedral; diffuse boundary.
Cg	on	Light grey (2.5Y 7/2) clay; many prominent dark red and yellowish red mottles; slightly sticky when wet, firm when dry; coarse subangular polyhedral structure breaking to fine blocky structure.

Type profile (c) is a good description of the soil mapped at farm scale, except that its B horizon (flood deposit) is often deeper than 35 centimetres and has silty or sandy silt texture throughout.

:



Topsoil (A and A/C)

Subsoil (Cu and Cf)

Whakapara sandy loam Photo: D. Hicks

A fourth profile is encountered where alluvium is sandy. Its provisional description (prepared by D. Hicks) is

Whakapara sandy loam (d)

Horizon	Depth (cm)	Description
A	0-12	Dark grey sandy loam; friable when dry; subrounded polyhedral to earthy structure; diffuse boundary.
A/C	12-24	Dark grey sandy loam; friable when dry; subrounded polyhedral to earthy structure; diffuse boundary.
Cu	24-42	Yellowish brown sandy loam; friable when dry; loose, almost massive; diffuse boundary.
2C(f)	42-60	Yellowish brown sandy clay loam; few distinct yellowish red mottles; firm when moist, friable when dry; subangular to subrounded polyhedral structure; diffuse boundary.
3C(f)	on	Brownish grey clay (or in some location light grey sandy clay); many prominent reddish yellow mottles; sticky when wet, firm when dry; blocky to subangular polyhedral structure break to subangular or subrounded polyhedral.

Raw variants of all four soils are mapped at farm scale as Whakapara sandy clay or silty clay (Wfg) on floodways, and Whakapara sandy silt or sand (Wfs) on flood berms and channel banks.

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

Orbell G.E., 1977, *Soils of part Franklin County*, Report 33, DSIR Soil Bureau

8 Properties of typical profile

These are best indicated by analysis results for the type profiles i.e. sites where Waikare, Hukerenui or Wharekohe series were defined and described. Data for other sites will vary somewhat, particularly where different types within the series are found.

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

No chemical analysis for Whakapara or Whangamaire soil appears in the online version of National Soils Database (NSD). No analyses were published in Soil Bureau Bulletin 5 (General Survey of the Soils of North Island). At its publication date (1954), Whakapara and Whangamaire soils were correlated either with Manawatu (free to slow-draining) or Kairanga (imperfectly draining to impeded) soils.

Whakapara sandy or silt loam; Whangamaire sandy or silt loam

Property	Topsoil	Subsoil	Units
Acidity	-	-	pH
Total carbon	-	-	%
Total nitrogen	-	-	%
Available phosphorus	-	-	%
P retention	-	-	%
Available sulphur	-	-	Ug/g
Cation exchange capacity	-	-	me %
Base saturation	-	-	%
Calcium	-	-	me %
Magnesium	-	-	me %
Potassium	-	-	me %
Sodium	-	-	me %

Sourced from laboratory analysis SB????, DSIR Soil Bureau

Whakapara silty clay or clay loam: Whangamaire silty clay or clay loam

Property	Topsoil	Subsoil	Units
Acidity	-	-	pH
Total carbon	-	-	%
Total nitrogen	-	-	%
Available phosphorus	-	-	%
P retention	-	-	%
Available sulphur	-	-	µg/g
Cation exchange capacity	-	-	me %

Base saturation	-	-	%
Calcium	-	-	me %
Magnesium	-	-	me %
Potassium	-	-	me %
Sodium	-	-	me %

Sourced from laboratory analysis SB? DSIR Soil Bureau

8.2 Physical

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

Physical analyses for Whakapara or Whangamaire soil do not appear in the online version of NSD, nor are there any analyses in Soil Bureau Bulletin 5 or old Soil Bureau survey reports. The following estimates are sourced from Fundamental Soils Layer (FSL) plus relevant S-map factsheets.

Whakapara sandy or silt loam; Whangamaire sandy or silt loam

Property	Topsoil	Subsoil	Units
Stones	0	0	%
Sand	10-14	10-14	%
Silt	67-69	67-69	%
Clay	19-21	19-21	%
Dry bulk density	0.94	1.22	g/cm ³
Total porosity	-	-	%
Macroporosity	5-14.9	-	%

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

Whakapara silty clay or clay loam; Whangamaire silty clay or clay loam

Property	Topsoil	Subsoil	Units
Stones	0-4	-	%
Sand	2-10	2-10	%
Silt	53-54	53-54	%
Clay	36-45	36-45	%
Dry bulk density	1.08	1.26	g/cm ³
Total porosity	-	-	%
Macroporosity	7.5-9.9	-	

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

8.3 Irrigation and drainage

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

Soil moisture analyses for Whakapara or Whangamairi soil do not appear in the online version of NSD, nor are there any analyses in Soil Bureau Bulletin 5 or old Soil Bureau survey reports. The following estimates are sourced from Fundamental Soils Layer (FSL) plus relevant S-map factsheets.

Whakapara sandy or silt loam, Whangamairi sandy or silt loam

Property	Topsoil	Subsoil	Units
Field capacity	-	-	% w/w
Wilting point	-	-	% w/w
Plant-available water	-	-	% w/w
Plant-available water	84	75	mm
Depth to slowly permeable layer	-	>1	m
Perm. at slowly permeable layer	-	4-72	mm/hr

Sourced from FSL table and S-map factsheet, Landcare

Whakapara silty clay or clay loam, Whangamairi silty clay or clay loam

Property	Topsoil	Subsoil	Units
Field capacity	-	-	% w/w
Wilting point	-	-	% w/w
Plant-available water	-	-	% w/w
Plant-available water	38	36	mm
Depth to slowly permeable layer	-	>1	m
Perm. at slowly permeable layer	-	4-72	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 Whakapara and Whangamairi 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. Soil quality has been sampled on Whakapara soil at just three sites in the Auckland region, because uses other than grazed pasture is uncommon.

Land Use		Natural Cover	Pasture			
Type:		Bush	Lifestyle	Organic	Drystock	Dairy
Sample number-		1998/17	-	-	1998/18	1998/19
Acidity	pH	5.7	-	-	5.7	5.9
Total carbon	%	5.9	-	-	6.6	5.4
Total nitrogen	%	0.4	-	-	0.6	0.5
Available nitrogen	µg/ cm ³	106	-	-	138	140
Available phosphorus	µg/ cm ³	9	-	-	33	21
Cation exchange capacity	cmol/cm ³	26.8	-	-	31.3	28.4
Base saturation	%	71	-	-	75	78
Calcium	cmol/ cm ³	13.5	-	-	19.7	19.7
Magnesium	cmol/ cm ³	4.7	-	-	2.8	1.7
Potassium	cmol/ cm ³	0.5	-	-	0.6	0.4
Sodium	cmol/ cm ³	0.3	-	-	0.3	0.2
Bulk density	t/ m ³	0.94	-	-	0.92	0.91
Particle density	t/ m ³	2.46	-	-	2.45	2.49
Aggregate stability	mm mwd	1.19	-	-	2.53	2.30
Total porosity	%	62	-	-	62	64
Macroporosity	%	5	-	-	12	12
Total available water	%	26	-	-	21	24
Readily available water	%	10	-	-	6	8

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

See also:

Soil Quality for Indigenous Cover Sites in the Auckland Region 2012, Soil Quality of Dairy Sites in the Auckland Region in 2009), Soil Quality of Drystock Sites in the Auckland Region in 2010

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
Free-draining flats	2w1,2w3	2w+e	Infrequent subsoil wetness	Regular grain and fodder crops, intensive grazing
Slow-draining flats	3w1,3w2	3w+e	Frequent winter-spring wetness	Rotational grain and fodder crops, intensive grazing
Imperfect or impeded flats	4w1,4w3	4w+e	Persistent winter-spring wetness	Occasional fodder crops, intensive grazing
Semi-drained floodways	-	5f	Water table in subsoil, occasional flooding	Summer-autumn grazing, wetlands as nutrient filters/sediment traps
Swampy floodways	6w1	6f	Water table close to surface, regular flooding	Drought grazing, wetlands as nutrient filters/sediment traps
Swampy floodways	7w1	7f	Water table at surface, frequent flooding	Wetlands as nutrient filters/sediment traps
Stable streambanks	-	5b	Occasional bank erosion or deposition	Summer-autumn grazing, riparian vegetation to stabilise banks
Unstable streambanks	-	6b	Regular bank erosion or deposition	Drought grazing, riparian vegetation to stabilise banks
Unstable streambanks	-	7b	Frequent bank erosion or deposition	Riparian vegetation to stabilise banks

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

Orchards and vineyards are absent from Whangamaire and Whakapara soils, apart from small home orchards or grape blocks near farmhouses. Early settlers recognised that these soils are too wet for fruit trees or vines to thrive.

Vegetable cropping is rare. There are instances south of Auckland where growers cultivate a large field that contains patches of Whangamaire soil enclosed by another soil type, but crop emergence and growth are visibly poorer. Just one variant of Whakapara/Whangamaire soil - the sandy loam - has good structural and drainage properties for vegetable growing.

Commercial grain or fodder cropping is uncommon, though some river-flat farms with a large area of Whakapara or Whangamaire soil have been observed to grow contract maize three or four years in succession. Typically, a single maize or kale (chou) crop is sown when farmers renew a paddock's pasture.

When settlers cleared bush and scrub from the Whakapara and Whangamaire soils 1850s onwards, it quickly became evident that they were either flood-prone or seasonally wet. Recognised as soils more suited to permanent pasture than rotational pasture and cropping, they have stayed dairy or drystock farms ever since. The balance between dairy and drystock has changed several times in response to market conditions. Presently Whakapara and Whangamaire soils support more dairy farms than drystock, but the number of both is decreasing. Many former farms close to Auckland have been subdivided into lifestyle blocks since the 1970s.

Woodlots and tree plantations are not a feature of the Whakapara/Whangamaire soil landscape, partly because its high-water table limits root development, rendering trees prone to windthrow. This is often evident where commercial timber species such as pine or cypress have been planted for farm shelter. Another factor in forestry's absence is doubtless the better returns obtainable from dairying or fattening drystock.

As Auckland's suburbs expanded beyond the Tamaki Isthmus after 1945, some of the subdivisions included Whakapara or Whangamaire soils that house-owners soon discovered to be flood-prone, necessitating remedial stormwater drainage and flood protection. By the 1970s, city and district plans precluded building on floodways, since when these areas have usually been reserved as parks or sports fields. Now there is renewed pressure for urban development in "growth areas" beyond city limits, flood risk on these soils needs to be considered when re-zoning land.

Sources: D Hicks pers. obs.

10.1 Typical crop and pasture yields

Crop	Yield	Units
Maize	Up to 12	t/ha
Forage brassica	Up to 4	t/ha

Source: grower advice

Pasture	Yield	Units
Improved pasture (dairy)	14.0-16.9	t dm/ha/yr
Improved pasture (drystock)	10.4-13.9	t dm/ha/yr
Semi-improved pasture	6.3-11.5	t dm/ha/yr
Un-improved pasture	4.6-9.1	t dm/ha/yr

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

11 Information about soil management

Whakapara and Whangamaire soils are not as versatile as better-structured soils derived from volcanic ash (such as Patumahoe or Karaka series). Nonetheless their extent, easy access and contour, and reasonably good structure enable farmers to grow grain or fodder crops where the flats are flood-free. The same features make them the most productive parts of many dairy and drystock fattening farms.

Key management issues that may arise are:

- Adequate fertilizer to replace crop and grass uptake
- Maintaining soil structure under cultivation
- Pasture loss through pugging on the silty clay and clay loams
- Draining the fine-textured soils where seasonally wet
- Disposing dairy effluent onto land safely
- Reducing nutrient loss and faecal contaminants in surface runoff from the wet raw soil on floodways
- Controlling raw silt or sand that moves downstream along the flood berms and streambanks.

So how the soils are managed impacts on water quality and sediment entry, as well as on farm production. Tips for managing soil structure and nutrients, for controlling erosion, and for applying irrigation water or effluent, are contained in:

- *Low flats with young alluvial soil* *Soil Information Sheet 3, Auckland Council*
- *Code of Practice for Nutrient Management* *Fertiliser Association*
[*\(Code of Practice for Nutrient Management\)*](#)
- *Drainage construction and maintenance:* *TP10, Auckland Regional Council*
- *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*](http://www.dairynz.co.nz/media/880785/auckland_guide_to_managing_farm_dairy_effluent.pdf)

- *Poplars* *Soil Conservation Leaflet, Auckland Regional Council*
- *Willows* *Soil Conservation Leaflet, Auckland Regional Council*
- *Streamside planting guide* *Auckland Council*
- *Riparian zone management: strategy guideline and planting guide*
TP148, Auckland Regional Council

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aucklandcouncil.govt.nz and knowledgeauckland.org.nz