SOILS OF THE PURAMAHOI DISTRICT

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Introduction

As part of the updating of basic land resource and soils information and the identification highly productive land in the Golden Bay region of Tasman District Council, soil mapping (stage 2) of the lowland area from the western side of the Takaka River near its mouth to the estuary of the Otere River just north of Onekaka was undertaken. The area covered was approximately 3000 ha and comprises predominantly dissected old coastal terrace land with smaller areas of lower valley floor and plain that are bounded by adjacent hilly and steep land.

Survey methods

The survey was undertaken between July and December 2006 with field examinations made on forty-six days. The soils were examined primarily by augering to 100 cm, where possible, on representative traverses across the various landforms. A total of six hundred and seventy four auger observations were made and sixty six detailed inspections from excavated soil profile pits, with an average observation frequency of approximately one per four hectares. Observations were however more closely spaced on the lower lying flats and terrace lands than in the associated hilly lands.

The positions of the observation sites were recorded by GPS and located on 1:8000 up to date photogrametric field sheets and the soil boundaries also plotted on these sheets. Stereoscopic examination of January 2004 colour aerial photos was used to assist with the identification of landform features and soil and drainage patterns. The soil boundaries were transferred to sheets of the same scale to complete the compilation for subsequent redrawing of the final map by TDC staff.

The soil core obtained at each observation site was recorded photographically and the soil properties were described from this material. Included in the field description were the soil horizons and thicknesses, soil colours, texture and mottle patterns as well as soil stoniness and depth to gravel, along with other features including the existence of iron pans, a water table and evidence of flooding. A more detailed assessment of the above soil properties was made from sixty-six soil pits and also included soil drainage, soil structure and soil strength assessment as well as root distribution and the nature of underlying gravels when present. Criteria used for the description of the soils are those given in the Soil Description Handbook (Milne et al. 1995) which is the official standard for New Zealand soils. The field information was recorded with the help of an assistant using a palm top and the data later downloaded and analysed to determine the characteristics and range of properties for each soil.

Previous soil surveys of the area

The low coastal country from the Takaka River to just northeast of Puramahoi was mapped by Cawthron Institute Staff in a survey of Takaka County. The survey was

carried out during the 1950's and compiled at a scale of one mile to one inch. Although this map was not published it provides a record of the work undertaken around that time and of the various soil types that were identified. This work subsequently formed the basis for the later 1:250,000 scale (4 miles to the inch) Survey of the Soils of South Island (New Zealand Soil Bureau Staff 1968). The later Land Use Capability Survey at a scale 1:63,360 (one inch to one mile) did not provide any new soil information. A brief review of the soils of the area was made by O'Byrne (1983) but again, no additional soils information was gathered.

General description of the area

The survey area encompasses three distinct physiographic or landscape entities. They are The Puramahoi Plain, a small lowland area centered around Puramahoi, older elevated dissected terrace lands to the north and south of the Puramahoi Plain and the bordering hilly and steep land predominantly to the south and west.

The Puramahoi Plain is a complex fluvial system derived from the alluvial deposits of three small rivers or streams. The surface sediments are largely fine textured but are underlain by coarse gravels which attest to extensive and high velocity water flows at the time of deposition. The deposits are described, according to the Geological Map of New Zealand (Sheet S8-Takaka, Grindley 1971; Sheets S1 and S3 Farewell-Collingwood Bishop 1971) belong to the Bainham Formation of late Last Glaciation (Otiran) age. To the south in the vicinity of Onahau River the sediments are largely of granitic origin due to the occurrence of the Onahau Granite Formation in the adjacent hills, whereas to the north sediments of the Pariwhakoho and Puramahaia Rivers are predominantly from schist and argillite from the Onekaka Schist Formation. The rivers have an associated rather poorly defined terrace system with progressively younger alluvial deposits nearer the rivers. Older river overflow channels on the Puramahoi Plain have in part been occupied by smaller streams with associated alluvial deposits. The net effect is a series of fluvial channels across the Puramahoi Plain with associated highly variable alluvium and drainage conditions.

The older elevated terrace lands extend from about 40 meters above sea level near the coast to around 120 meters above sea level further inland. Two distinct terrace sets have been identified by Grindley (1971) and Bishop (11971), the oldest and highest belonging to the Rockville Formation (third last glaciation) and the lower set belonging to the Kaituna Formation (second last glaciation). The terrace gravels incorporate a variety of rocks including quartzite, argillite marble and schist with greater amounts of schist to the north. Once again, the coarse nature of the gravels implies extensive and widespread water flows at the time of their deposition.

The uplifted terrace lands are largely underlain by Tertiary sedimentary rock (Tarakohe Mudstone Formation) which comprises sandstone, siltstone and mudstone, the latter fracturing to give a distinctive rubbly appearance. Erosion along streams and gullies, consequent upon tectonic uplift has resulted in terrace surfaces that are patchy and discontinuous.

The hilly and steep land that bounds the Puramahoi Plain and coastal terrace lands comprise schist and granite rocks to the south and schist and Tertiary sediments to the

west and north of Puramahoi. The soils and landscapes in this area are a result of intermittent and alternating periods of stability and instability resulting from past climate changes.

Reliability of the soil information

Soils are intrinsically related to the landforms on which they occur and to the sedimentary processes involved in the formation of the landscapes. Variations in the composition of the materials, drainage conditions and age of the land surfaces greatly influence the soil properties and therefore the distribution of the various soil types. There is a high degree of variability in the soil forming conditions over the surveyed area and the information presented is an interpretation from the observations made and from an understanding of the landscape and soil processes.

The assessment of the productive value of the soils is based on the properties of the soils rather than on actual land use within the district. It follows the system used for the classification of productive land in the Tasman District (Agriculture New Zealand 1994). The productive value assessment takes into account the nature of the intrinsic soil properties such as slope, soil texture, structure and depth as well as limiting soil features such as drainage impediment, restricted rooting depth, stoniness etc. The Puramahoi district has a relatively high rainfall which clearly is restrictive of the range of conventional crops that can be grown. The productive value assessment given here indicates the relative range of land uses that are feasible within the climatic limits and under which less conventional crops might be grown.

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Soils of the Puramahoi District

Legend for soil mapping units

			Land use rating	
Soils of the coastal dune and low country				
Dunes				
Okari soils	Ok		G	(light yellow)
Karoro soils	Ko		F	(light yellow)
Mahinapua soils	Ma		B	(light brown)
Coastal wet land				
Karangarua soils	Ka		E	(dark blue)
Soils of the river floodplain				
Well drained				
Takaka soils	Tk,	Tk1	B	(yellow)
Poorly drained				
Harihari soils	Hh		F	(blue)
Soils of the stream flats, plains and low terrace lands				
Well drained				
Hokitika soils	Ho		B	(yellow)
Ikamatua soils	Ik,	Ik1	A	(yellow/orange)
Puramahoi soils	Pm,	Pm1	A	(brown)
Moderately well drained to imperfectly drained				
Tukurua soils	Tu		B	(pale blue)
Paton soils	Pt		D	(pale blue)
Imperfectly to poorly drained soils				
Parapara soils	Pp		E	(blue)
Dogan soils	Dg		F	(blue)
Soils of the higher terrace lands				
Onahau & Onahau Hill soils	On	OnH	E	(purple)
Pariwhakoho soils	Pk		D	(brown)
Milnthorp Hill soils	MnH		E	(brown)
Soils of the hilly and steep lands				
From sandstone sedimentary rock				
Waitapu Hill soils	WtH		F	(light brown)
From siltstone sedimentary rock				
Tadmor Hill & Steepland soils	TmH	TmS	E	(light brown)
From mudstone sedimentary rock				
Otere Hill & Steepland soils	OtH	OtS	E	(brown)
From schist rock				
Onekaka Hill & Steepland soils	OkH	OkS	F/G	(brown)
From granite rock				
Kanieri Hill soils	KnH		F	(brown/purple)
Orikaka Hill soil	OrH		F	(purple)

Soil name and map symbol: Okari soils (Ok)

Concept and overview

Okari soils cover 21 ha and occur on young coastal sand dunes mostly within an intermittent narrow zone along the coast. The soil material is derived from recently deposited sand, most probably of Post-European age, that has been blown inland from the beaches. Okari soils occur in an intermittent narrow strip sometimes only within about 30 m from the coast. The topography is mainly low dunes.

Relationship to previously named soils

These soils were separated but un-named in the earlier unpublished soil map of the Takaka region. They were included within the lower rainfall (<1000mm) Tahunanui set (68c) in the 1:250,000 General Survey of the Soils of South Island (New Zealand Soil Bureau Staff 1968) but were not mapped in that survey within the present survey area. They have a closer affinity with Okari soils which were mapped on the young coastal dunes along the coast at Pakawau by Soil Bureau Staff (1968).

Landform origin and history

The sands are derived from the schist, granite, Tertiary sedimentary rocks, limestone and other rocks of the region. Coastal dunes are inherently unstable landforms with erosion or sedimentation fluctuating according to changes in the supply of sediment to the beaches. The dune sands of Okari soils are very recent, at most a few hundred years and have weakly developed soil profiles. The unconsolidated nature of the soil material makes Okari soils susceptible to wind and coastal erosion.

Key soil features

Okari soils have a thin weakly structured topsoil and an unweathered subsoil. They are sandy textured throughout and are loose and lack development of subsoil structure. They are excessively drained and lack significant moisture storage.

Identified variants

In places, the sand deposits are recent and lack a topsoil.

Associated and similar soils

Mahinapua soils formed on older sand dunes and with well developed soil profiles occur alongside Okari soils. Tahunanui soils are similar in having weakly developed profiles. They occur in the Tasman Bay region but under a lower rainfall.

Key physical properties

The A horizon is moderately deep and sandy textured with very weak soil strength. The B and C horizons are loose and unweathered and provide no restriction to plant rooting. The profile drainage is excessive and the plant available water is very low.

Versatility and land use ratings

Okari soils have a low versatility rating, the chief limitations being lack of structural development with susceptibility to wind erosion and excessive drainage with low soil

moisture storage. These soils are grouped within class G of the Tasman District Council land classification scheme. They are used for urban purposes in the Patons Rock area.

Horizons	Depth cm	Description
A	0-16 cm	Very dark grayish brown sand; single grain structure; very weak soil strength; very friable, many fine and medium roots
BC	16-22cm	olive brown sand; single grain structure; loose; few fine roots
C	22-90+ cm	olive sand; single grain structure; loose; very few fine roots

Soil name and map symbol Kororo soils (Ko)

Concept and overview

Kororo soils occupy 19 ha and occur on narrow strips of land alongside the coast. They occur on coastal sand deposits that are a little older and further inland than those from which Okari soils are formed and the soils are therefore somewhat more developed. As much of the land between Rangihaeta Heads and Tukurua Point rises abruptly from the sea and there are no significant estuaries, coastal sand deposits are relatively minor in extent.

Relationship to previously named soils

Kororo soils were not identified in the previous soil surveys of the area but were included within the un-named coastal sand soils of the early unpublished soil map of the district. Kororo soils were mapped by Mew (1980) in a survey of the Greymouth-Hokitika region and separated as soils from dunes that are a little older than those from which Okari soils are formed and which show more advanced profile development.

Landform origin and history

The coastal sands are derived from the same rock types as Okari soils and the dunes are not prominent and have a gentle relief. In a few places, the soils are gravelly, the soil materials being beach deposits rather than wind-blown sands. The weak degree of soil development indicates that at most, the soils are probably just a few hundred years old. In some places Karoro soils are very close to the shore line suggesting that there may have been some regression of the coast.

Key soil features

Kororo soils have a distinct topsoil that grades down into an incipient or weakly developed B horizon before passing into unweathered sand. Soil structure and soil strength are weakly developed to non existent and the sandy subsoil is loose. They are excessively drained, lack significant moisture storage but have no physical impediment to deep rooting.

Identified variants

Sandy gravel soils occur in some places while in some hollows between dune ridges, a water table may be present within 50 cm of the surface and the soils are imperfectly to poorly drained.

Associated and similar soils

Okari soils occur with Karoro soils on younger sand deposits nearer the coast while Mahinapua soils occur on older dunes a little further inland.

Versatility and land use rating

Kororo soils have a low versatility rating, the chief limitations being weak soil development, limited soil moisture storage due to sandy textures and susceptibility to wind erosion. They are grouped within class F of the Tasman District Council land classification scheme.

Horizon	Depth cm	Description
A	0-18 cm	Black fine sand; weakly developed fine polyhedral structure; very weak soil strength very friable; many fine roots
AB	18-23 cm	black and light olive brown fine sand; loose; single grain structure many roots
BC	23-40 cm	light olive brown fine sand; loose; single grain structure; few roots
C	40-95+ cm	olive sand; loose; single grain structure; very few fine roots.

Soil name and map symbol: Mahinapua soils (Ma)

Concept and overview

Mahinapua soils occupy a small area, some 11 ha and like Okari and Karoro soils are found in a few places along the coast. They are formed on sand dunes that are older than the dunes on which Okari and Kororo soils are formed and typically occur furtherest inland from the coast. The sands have a dominantly low relief or flattish surface due to their greater age and landscape stability. Because the soils are older, weathering is more advanced as indicated by greater oxidation and breakdown of mineral material in the subsoil.

Relationship to previously named soils

Mahinapua soils were not separated in the early Takaka survey but were loosely separated as sand dune soils in the coastal Puramahoi district. They were also not mapped in this area in the 1:250,000 General Survey of the Soils of South Island (New Zealand Soil Bureau Staff 1968). The name Mahinapua is that used for older dune soils occurring on the South Island West Coast region (70c Zealand Soil Bureau Staff 1968).

Landform origin and history

In coastal lands throughout New Zealand, there is evidence of numerous dune building periods going back several thousand years and relating to changes in climatic conditions and coastal sediment supply. Mahinapua soils in the Takaka region represent an early period of dune building, possibly 2-3000 years ago. A substantial part of the coast of the current survey area is backed by elevated land which, in the absence of coastal terraces and significant dune deposits, suggests that coastal erosion has been active in the recent past.

Key soil features

Mahinapua soils have a moderately deep sand to loamy sand topsoil (average depth 21cm) which is predominantly very dark brown. It grades into a yellowish brown to strong brown sandy textured B horizon about 30 to 40cm thick that is slightly firm. Deeper horizons are generally olive coloured passing into unweathered loose light grey sand. Mottle patterns resulting from variable oxidation conditions may be present in the B horizon

Identified variants

In some places, Mahinapua soils are moderately deep (45-90cm range) and overlie beach gravel. The lower B horizon may sometimes be weakly iron cemented.

Associated and similar soils

Mahinapua soils are associated with Kororo and Okari soils which occur on younger sand dunes nearer to the coast. They pass into Karangarua soils where the sand thins and drainage becomes poorer.

Key physical properties

Mahinapua soils are deep with sandy textures throughout. They are friable with weak soil strength but where some iron segregation is present in the subsoil it is slightly firm. They are well drained, have moderately rapid permeability and have a deep rooting depth.

Versatility and land use rating

The versatility of Mahinapua soils is restricted somewhat by their sandy textures, weakly developed soil structures and moderately rapid permeability. They are never the less capable of growing a wide range of tree or vine crops. They are grouped in class B of the Tasman District Council land classification scheme.

Horizon	Depth	Description
A	0-22 cm	Very dark brown sand; moderately developed polyhedral structure; weak soil strength; friable; many fine roots
AB	22-34 cm	very dark brown and brownish yellow sand; moderately developed polyhedral structure; weak soil strength; friable; many fine roots
B	34-52 cm	brownish yellow sand; weakly developed blocky structure; weak soil strength; brittle; common fine roots
BC	52-65 cm	yellow sand; weakly developed fine blocky structure; weak soil strength; friable; red and yellow distinct medium mottles; few fine roots
C	65-90 cm	light grey sand; loose

Soil name and map symbol: Karangarua (Ka)

Concept and overview

Karangarua soils cover 18 ha and occur on low lying land on the margins of estuaries in the vicinity of Rangihaeata Head and Onekaka. Because of their proximity to the sea, drainage is intrinsically poor and the water table may rise to the surface during periods of intensive rain when streams may overflow onto the low lying land. Originally covered with coastal wetland lowland forest communities, the vegetation is now dominated by rushes and swamp grasses.

Relationship to previously named soils

The early unpublished soil survey of the Takaka district separated these soils as unclassified swampy soils, while the later 1:250,000 General Survey of the Soils of South Island (Soil Bureau Staff 1968) grouped these soils within the Karamea set (99c). Karangarua soils are similar to soils of the same name that were mapped in low lying swampy areas in soil surveys of the West Coast in the 1980's (Mew 1980).

Landform origin and history

The low lying estuary margin wetlands are composed of alluvial sands and gravels that are commonly interspersed with organic (peaty) layers that accumulated during periods when sediments were not being deposited. Periodic stream flooding has resulted in thin accretions of alluvium while adjacent to the coast, wind blown coastal sand has in places encroached onto the surface forming low dunes.

Key soil features

Karangarua soils are poorly drained and have a very dark brown topsoil that is predominantly peaty. Mineral horizons in the subsoil vary in colour according to the degree of soil wetness and range from pale brown to grey and olive grey generally with few mottles, while textures are commonly silt loam. Underlying gravel is present in most places at depths between 30 cm and 75 cm (average 49 cm). A water table was present in 40% of the observation sites at an average depth of 45 cm.

Identified variants

Karangarua shallow soils occur where the depth to gravel is <45 cm and Karangarua moderately deep soils where gravel occurs between 45 and 90 cm. Where the water table is at a greater depth Karangarua soils may be imperfectly rather than poorly drained.

Associated and similar soils

Karangarua soils grade into Mahinapua or Kororo soils where encroachment of coastal sand has occurred in the coastal areas. Dogan soils occur on older inland surfaces and are similar to Karangarua soils and sometimes having accumulations of peaty material although commonly have clayey subsoils.

Key physical properties

Karangarua soils have a thin topsoil (average 16 cm) which is commonly peaty. Organic layers may also be present in the subsoil between mineral layers that have poor drainage. The soil rooting depth is severely restricted by the presence of a water table while underlying gravel is commonly compact and iron cemented and also restricts root penetration. The soils are poorly drained. Flooding occasionally occurs.

Versatility and land use ratings

Under the present drainage conditions, Karangarua soils have a low versatility rating, the limitations being susceptibility to flooding, poor drainage and shallow to moderately deep rooting depth. They are included in class F of the Tasman District Council land classification scheme. Their potential use is likely to be very limited under anticipated future sea level rise although as wetland areas they are important in respect of carbon storage.

Horizon	Depth	Description
AH	0-6 cm	Very dark brown (10YR 2/2) humic loam; fine polyhedral structure; very weak strength; friable; many fine roots
A	6-21 cm	black (10YR 2/1) fine sandy loam; fine polyhedral structure; very weak strength; friable; many fine roots
bH	21-30 cm	dark brown (7.5YR 3/2) humic loam; very weak strength; very friable; few roots
Cr1	30-42 cm	light grey (10YR 7/2) silt loam; massive; slightly firm; very few roots
Cr2	42-55 cm	grey to light grey (5Y 6/1) silt loam; massive; firm; very few roots
on		gravel with the water table reaching 42 cm

Soil name and map symbol Takaka soils (Tk, Tk1)

Concept and overview

Takaka soils cover 36 ha occurring only in a small part of the survey area on low lying land in Takaka Valley just north of the main highway bridge across the Takaka River. They are young soils that have formed on the Takaka River flood plain alluvium deposited during floods that have occurred in post-European settlement times. Because of their youthful age, soil development is only weakly expressed.

Relationship to previously named soils

The soils on the floodplain of the Takaka River were separated in the early unpublished survey of the Takaka district as Takaka undifferentiated sands gravels and stony loams but were included within Karamea set (99c) in the 1:250,000 General Survey of South Island (Soil Bureau Staff 1968). They are similar to Tasman soils (99) which are widely mapped throughout the South Island on the floodplain surfaces of many river valleys. Tasman soils are formed from greywacke alluvium whereas Takaka and Karamea soils are from predominantly granitic alluvium. As in the 2005 survey of the lower Takaka Valley, the original concept of Takaka soils is retained.

Landform origin and history

Takaka soils in the present survey area occur in the lowest part of the Takaka River system in a somewhat unstable deltaic environment. Flooding in the past has been frequent and related to changes in the river channel. River diversion work that alleviated the passage of floodwaters to the sea has lessened the incidence of flooding in this area. However, the frequency of flooding is likely to increase in future as sea level continues to rise consequent upon global warming.

Key soil features

Takaka soils (Tk) are weakly developed soils formed from recent flood alluvium that is mainly silty to sandy textured and moderately deep or deep overlying gravel. The soil horizons are weakly developed and have little accumulation of organic matter. The topsoil is thin (average 13 cm) and the upper olive brown subsoil is barely distinguishable from the underlying unaltered alluvium. The underlying gravels commonly comprise coarse boulders.

Identified variants

Takaka stony soils (Tk1) with gravels sometimes bouldery at the surface and Takaka shallow soils (gravel <45 cm depth) are present, more especially to the north where the soils grade into estuarine deposits. In lower lying areas, the soils have slight drainage restrictions and are weakly mottled.

Associated and similar soils

Harihari occur along with Takaka soils in lower lying flood channel reaches. Karamea soils, not mapped in the present survey area, occur on somewhat older river alluvium above flood level and have more advanced profile development with better soil structure. Hokitika soils, mapped further north in the survey area in the vicinity of

Puramahoi are also recent soils but are formed from thin accumulations of recent flood alluvium overlying older buried soils.

Key physical properties

Takaka soils (Tk) are mainly deep and well drained to moderately well drained with little restriction to deep rooting. Topsoils are thin and soil structure is weakly developed. Greyish mottles are sometimes present in the topsoil and are probably a result of anaerobic conditions (pugging) through stock trampling during wet conditions.

Soil versatility and land use rating

Takaka soils are moderately versatile but low levels of organic matter (a thin topsoil with weak structure and soil strength) may lead to compaction and pugging under intensive use. They are also vulnerable to flooding, the incidence of which may increase with rising sea level. The soils are included in class B of the Tasman district Council land classification Scheme

Horizon	Depth	Description
A	0-10 cm	Olive brown (2.5Y 4/4) silt loam; moderately developed polyhedral structure; weak soil strength; friable; 15% light brownish grey (2.5Y 6/2) mottles; many fine roots
BC	10-30 cm	olive brown to light olive brown (2.5Y 4/4-5/4) silt loam; moderately developed blocky structure; very weak soil strength; brittle; many fine roots
C1	30-60 cm	olive brown (2.5Y 4/4) silt loam; weakly developed blocky structure; very weak soil strength; brittle; 15% light yellowish brown (2.5Y 6/4) faint mottles; many fine roots
C2	60-85 cm	olive brown (2.5Y 4/4) sandy loam; light 20% yellowish brown (2.5Y 6/4) and yellowish brown (10YR 5/4) medium distinct mottles; few fine roots

Soil name and map symbol Harihari soils (Hh)

Concept and overview

Harihari soils occupy a very small area (2 ha) and are separated and mapped as the poorly drained equivalent of Takaka soils. Like Takaka soils, they are formed on the youngest lower lying surface of the Takaka River flood plain but occur in small narrow strips and depressions of earlier flood channels.

Relationship to previously named soils

Harihari soils were not mapped in the previous unpublished survey of the soils of Takaka district but were included with the soils mapped as Karamea soils (99c) in the General Survey of Soils of South Island (New Zealand Soil Bureau Staff 1968). The name originates from the West Coast where they were mapped as imperfectly drained soils from recent alluvium (Mew 1980). Harihari soils were mapped in the 2005 survey of the soils of Lower Takaka Valley.

Landform origin and history

The low alluvial surfaces of Takaka valley have been subjected to repeated flooding and sinuous flood channels are commonly found on the lower terrace surfaces. These channels are generally poorly drained often with a water table close to the surface.

Key soil features

Harihari soils have imperfect drainage with the water table being present in the subsoil and rising to near the surface during heavy rainfall or at times of high river levels. The topsoil is shallow (average 12 cm) and both soil strength and structure are weakly developed. The subsoils have dominantly silt loam to heavy silt loam texture with olive to grey colours and brownish mottles indicative of variation in oxidation and reducing conditions. Buried soils are occasionally present.

Associated and similar soils

Harihari soils are found with the better drained Takaka soils on the same floodplain land system. Karangarua soils are poorly drained and occur in the swampy lower lying areas nearer the coast. Paton soils, on lower lying areas with poor drainage, are mapped further north in the Puramahoi area on older land surfaces and have greater soil development.

Identified variants

The soils vary mainly in respect of their drainage characteristics and in the depth to gravel. Buried soils are present in places.

Key physical properties

Harihari soils have weakly developed soil structure and silt loam to heavy silt loam textures, are moderately deep with imperfect drainage and have a moderate rooting depth due to the presence of a water table commonly at about 70 cm depth.

Soil versatility and land use rating

Harihari soils have low versatility rating. Their use is restricted by a groundwater presence and imperfect drainage and a susceptibility to periodic flooding. Because of their situation in floodplain drainage channels and their proximity to the coast, drainage conditions are likely to worsen with rising sea levels. The soils are grouped in class F of the Tasman District Council land classification scheme.

Horizon	Depth	Description
A	0-10 cm	Greyish brown (2.5Y 5/2) silt loam; weakly developed polyhedral structure; weak soil strength; friable; 15% reddish brown (5YR 4/3) mottles; many fine roots
BCg	10-27 cm	grayish brown (2.5Y 5/2) silt loam; moderately developed blocky structure; weak soil strength; friable; 30% yellowish red (5YR 4/6) medium mottles; many fine roots
Cg1	27-52 cm	grayish brown to dark grayish brown (2.5Y 5/2-4/2) silt loam; moderately developed blocky structure; weak soil strength; brittle; 30% yellowish red medium distinct (5YR 4/6) mottles; few roots
Cg2	52-75cm	grayish brown (2.5Y 4/2) heavy silt loam; massive; 20% yellowish red (7.5YR 4/6) medium distinct mottles; water table at 70 cm

Soil name and map symbol Hokitika soils (Ho)

Concept and overview

Hokitika soils cover 81 ha and are mapped in a number of places alongside stream and river courses between the Onahau and Pariwhakaoko rivers. They are recent soils that occur on the lowest identifiable alluvial surfaces in this area and are formed on the recent flood deposits of these fluvial systems. The alluvium is derived from quartzitic, schist and granite rocks and some Tertiary sedimentary rocks and the deposits are typically thin and commonly overlie buried soils.

Relationship to previously named soils

Hokitika soils were not mapped in the previous soil surveys of the Takaka-Golden Bay district and in the 1:250,000 General Survey of the Soils of South Island were included within the Puramahoi Set (43b). Soils on some of the lower surfaces of Pariwhakaoko River were however separated in the early unpublished Takaka-Golden Bay survey as coarse sands and gravelly soils. Hokitika soils have been mapped on the flood plains in higher rainfall areas of the West Coast as younger generally well drained soils from granite, schist and greywacke alluvium.

Landform origin and history

Streams that drain the Onahau-Puramahoi area are slightly entrenched and flow through a landscape that lacks a strongly defined terrace system. The lowermost fluvial surface is for the most part discontinuous and is often represented by short meanders within the stream course. Land clearance and farming within the Puramahoi Plain catchment area appear to have resulted in greater than normal stream flows with associated deposition of sediment on the lowest surfaces, along with burial of older soils.

Key soil features

Hokitika soils are predominantly well drained soils with variable depth and loamy textures. They frequently overlie buried soils with similar properties. Soil development varies according to the age of the alluvium but they usually have a weak expression of soil properties. However, sometimes the soil drainage is impeded by the presence of finer textured subsoil layers.

Associated and similar soils

In the survey area, Hokitika soils are associated with Ikamatua soils that occur on slightly higher land surfaces and which are sometimes buried by the alluvium that forms Hokitika soils. Hokitika soils are similar in their development to Takaka soils but have browner colours.

Identified variants

In the lower reaches of the Pariwhakaoho River where the flood plain is a little more extensive, shallow and imperfectly drained soils are present. Elsewhere, the soil depth varies from 29 cm to >100 cm over gravel with approximately 30% being shallow to moderately deep.

Key physical properties

Hokitika soils have a thin topsoil (average 13 cm) a light olive brown to yellowish brown B horizon (average 23 cm) and a light olive brown C horizon (average 27 cm) commonly overlying a buried A horizon. Soil structure is weakly developed and they are well drained and predominantly moderately deep.

Soil versatility and land use rating

Hokitika soils are moderately versatile, their principal limitation being susceptibility to flooding. In places they occur only in very small areas and this requires that they are managed in conjunction with neighboring soils. They are included in class B of the Tasman District Council land classification scheme.

Horizons	Depth cm	Description
A	0-10 cm	Dark yellowish brown (10YR 4/4) fine sandy loam; moderately developed polyhedral structure; weak soil strength; friable; many fine roots
B	10-24 cm	dark yellowish brown to dark brown (10YR 5/4) sandy loam; weakly developed blocky structure; weak soil strength; friable; many fine roots
bAB	24-40 cm	brown to dark brown (10YR 4/3) silt loam; weakly developed blocky structure; weak soil strength; brittle; 2% yellowish red (5YR 5/8) distinct mottles; some charcoal particles; few roots
bC	40-90 cm+	light yellowish brown (2.5Y 6/4) silt loam; massive; slightly firm soil strength; 30% yellowish red (5YR 5/8) distinct mottles; very few roots

Soil name and map symbol Ikamatua (Ik, Ik1)

Concept and overview

Ikamatua soils cover 228 ha on the Puramahoi Plain and valley floor surfaces between Onahau and Onekaka. They are formed on low stream and river terrace surfaces that occur immediately above the flood plain level of the fluvial systems in this area. The alluvial deposits on which Ikamatua soils have formed are younger than the main valley floor of the lowlands and the soils are youthful in their development. Mostly they are well drained (Ik) but in some places they are moderately well drained (Ik1).

Relationship to previously named soils

Ikamatua soils were not mapped or separated in the unpublished soil survey of the Takaka district. However, in the 1:250,000 General Survey of the Soils of South Island (Soil Bureau Staff 1968) Ikamatua soils (43c) were mapped on the valley floor of the Otere River although were not separated elsewhere. Ikamatua soils have been widely mapped in West Coast soil surveys as well drained soils from mixed alluvium on Holocene terraces under a rainfall range of 2000-4000 mm (Mew et al. 1975, Mew 1980, Heine & Mew 1981).

Landform origin and history

The alluvial sediments forming the Puramahoi Plain were probably deposited in the Late Last Glaciation period from extensive erosion in the Parapara Range immediately to the west. Following this period of maximum sediment deposition, the streams became incised forming weakly developed terraces. To the north, the outlet of the Pariwhakoko River has alternated between low hills near the coast owing to changes in geomorphic conditions. Here, Ikamatua soils are more extensive on the low land than elsewhere on the Puramahoi Plain surface.

Key soil features

Ikamatua soils are predominantly well drained with deep (>75 cm) profiles. Topsoils are moderately deep (average 19 cm) and the subsoils average about 43 cm before passing into unweathered material. Topsoil textures are mainly silt loam whereas subsoil textures are dominantly sandy loam, the sand content increasing with depth. The lower horizons are predominantly unweathered light olive to olive loose sand.

Identified variants

Around 15% of the soils were found to be shallow (<45 cm to gravel) and 12% moderately deep (between 45-90 cm to gravel) 15% were found to be moderately well drained and 6% imperfectly drained. Textures in the A and B horizons are dominantly silt loam (60%) and dominantly sandy or loamy (80%) in the lower horizons.

Associated and similar soils

Physiographically, Ikamatua soils occur at intermediate levels and between Hokitika soils on the lowest surfaces and Tukurua and Puramahoi soils on the upper parts of the plain allivial surfaces. They resemble Karamea soils which occur on the main

alluvial valley surface of the Takaka River but show more advanced soil development and have somewhat browner soil colours. Parapara soils, newly identified in the present survey, are formed from young granite alluvium in the Little Onahau River area and they are imperfectly drained and have pale subsoil colours.

Key physical properties

Ikamatua soils (Ik) are well drained with silt loam textures in upper horizons passing to sandy loam and sand in lower horizons. Topsoil structure is moderately developed but subsoil structure weakly developed. The potential rooting depth is for the most part in excess of 90 cm. Moderately well drained Ikamatua soils (Ik1) have mottles in the lower horizons indicating that drainage is at times somewhat impeded.

Soil versatility and land use rating

Ikamatua soils are versatile soils with few limitations for intensive use. Although the subsoil textures are predominantly sandy and the water holding capacity accordingly restricted, the higher rainfall of the Puramahoi district ensures that they do not become excessively dry over the summer months. Ikamatua soils are included in Class A of the Tasman District Council land Classification scheme.

Horizons	Depth cm	Description
A	0-27 cm	Brown to dark brown (10YR 4/3) silt loam; moderately developed polyhedral structure; weak soil strength; friable; many fine and some medium roots
AB	27-37 cm	brown to dark brown (10YR 4/3) plus yellowish brown (10YR 5/8) fine sandy loam; moderately developed polyhedral and blocky structure; weak soil strength; friable; many fine roots
Bw	37-50 cm	yellowish brown (10YR 5/8) loamy sand; moderately developed blocky structure; weak soil strength; brittle; few fine roots
BC	50-64 cm	yellow (10YR 7/8) loamy sand; weakly developed blocky structure; very weak soil strength; brittle; few fine roots
C	64-90 cm	light brownish grey (2.5Y 6/2) sand; massive breaking to single grain; very few fine roots.

Soil name and map symbol Parapara (Pp)

Concept and overview

Parapara soils cover 12 ha and are mapped on the fluvial valley floor deposits of Little Onahau river. They are young soils formed on granitic alluvium derived from erosion of granite rocks in the upper catchment of Little Onahau River and are imperfectly drained. The upper portion of the valley floor is in places poorly drained and peaty layers are sometimes interspersed with the alluvial sediments. The land surface is commonly uneven as a result of stream meander patterns.

Relationship to previously named soils

Parapara soils were not identified or mapped in the previous unpublished survey of the Takaka district but were included with soils mapped as "pakahi soils." In the 1:250,000 General Survey of the Soils of South Island (Soil Bureau Staff 1968) they were mapped with Onahau soils. Soils from granite colluvium and alluvium were mapped in the Grey Valley by Mew (1980) as Absolum soils although they occur under appreciably higher rainfall (4000-4450 mm) than Parapara soils.

Landform origin and history

The valley floor sediments consist of young alluvium that was mapped by Grindley (1971) as Post Glacial Aranuian Group swamp deposits. The sedimentation in the valley has been via small meandering stream flow consequently there is considerable variation in both the sediment and soil textures. The poor natural drainage conditions supported swamp forest vegetation hence buried organic materials and tree remains are commonly found. The granite alluvium is mainly pale coloured and has been derived from erosion of the Onahau Granite Formation which covers most of the catchment area. Post European vegetation disturbance within the catchment has resulted in deposition of recent alluvium mostly adjacent to the present river channel area.

Key soil features

Parapara soils are predominantly deep and imperfectly drained. Topsoils are moderately deep (average 20 cm). Textures in upper horizons are silt loam with lower horizons sandy to clayey. The imperfect drainage conditions are indicated by pale subsoil colours and mottle patterns, with mottles sometimes also present in the topsoil. A water table is commonly present and organic material including woody material may be present in the lower subsoil.

Identified variants

Well drained, rather than imperfectly drained soils are found, more especially in the lower portion of the Little Onahau River valley. In places, the soils are also moderately deep (45-90 cm over gravel).

Associated and similar soils

In low lying wet areas where peaty or organic material may be present, Dogan soils are present.

Key physical properties

Parapara soils have topsoils that are moderately deep to deep, they have silty to clayey textures and they are imperfectly drained. Subsoils are often massive and restrict root penetration. The water table may be near the surface during rainy periods.

Soil versatility and land use rating

Parapara soils have a low versatility rating. Their potential use is restricted by the soil drainage conditions which commonly results in excessive wetness in the wet winter and spring months. Surface pugging is common under high stock concentrations. They are included in class E of the Tasman District Council land classification scheme.

Horizons	Depth cm	Description
A	0-19 cm	Very dark grayish brown (10YR 3/2) silt loam; moderately developed polyhedral structure; weak soil strength; friable; many fine and few medium roots
A(g)	19-30 cm	dark grayish brown (10YR 4/2) silt loam; moderately developed polyhedral and blocky structure; weak soil strength; 10% distinct reddish brown (2.5YR 4/4) mottles along root channels; friable; many fine roots
B(g)	30-45 cm	pale yellow (2.5Y 7/4) silt loam; moderately developed blocky structure; weak soil strength; 20% reddish yellow (7.5YR 6/8) distinct mottles; friable; few fine roots
C	45-85cm	yellow (10YR 8/6) sandy loam; massive; weak soil strength; 10% brownish yellow (10YR 6/8) 10% fine distinct mottles; very few roots

Soil name and map symbol Puramahoi (Pm, Pm1)

Concept and overview

Puramahoi soils cover 409 ha, and are the most widespread of the soil types on the Puramahoi plains area, occurring from near the coast to the inland borders of the adjacent hilly and steep lands. They are associated with the older alluvial deposits of the Pariwhakaoko, Puremahaia, Onahau and Otere Rivers that are derived from predominantly quartzitic, marble and schistic rocks from the Parapara Ridge area. They are the oldest soils of the better drained and slightly more elevated Puramahoi plain surface and have the greatest degree of soil development, with weathering extending to include some alteration of underlying gravels.

Relationship to previously named soils

Puramahoi soils (Puramahoi fine sandy loam) were mapped over almost the entire Puramahoi plain in the early unpublished survey of the Takaka district. This area was also mapped as Puramahoi soils (43b) in the 1:250,000 General Survey of the Soils of South Island (Soil Bureau Staff 1968). This latter survey also mapped Puramahoi soils in the Clifton and Pohara area of the lower Takaka Valley where the soils are formed from mainly marble, quartz diorite and granite rocks. However, in the 2005 survey of the Lower Takaka Valley these soils were separated as Motupipi and Pohara soils.

Landform origin and history

The main alluvial deposits of the Puramahoi Plain are derived from the Pariwhakaoko, Puremahaia and Onahau Rivers in some respects resemble a coalescence of low angle fans. The overall slope of the surface is about 3-4º and between the river courses there are lower lying areas. The alluvial deposits are mapped as Bainham Formation Late Last Glaciation gravels by Grindley (1971) and are mostly coarse bouldery gravels. The area lacks a distinctive set of younger degradational surfaces which for the most part are limited to minor terracing a few meters below the main outwash surface. Between the rivers, a secondary drainage pattern is formed largely through accumulated water flows in older overflow channels. The net result of the Late Last Glaciation alluvial aggradation and the subsequent river and stream entrenchment and periodic river overflows is a somewhat complicated fluvial pattern, combined with marked differences in drainage conditions between areas of higher and lower ground.

Key soil features

Puramahoi soils are well drained soils that range in depth from shallow (<45 cm over gravel) to deep (>90 cm over gravel). Topsoils are moderately deep (average 21 cm) and overlie yellowish brown to olive brown B horizons of around 50 cm thickness. The lower less weathered subsoil has olive to light olive colours and where subsoil gravel is present, stones are commonly partly weathered. Soil texture is silt loam in the A horizon, trending towards clay loam in the B horizons but often becoming sandy in the lower subsoil.

Identified variants

Shallow and moderately deep soils (<45 cm and <45-90 cm over gravel) occur widely and have been mapped separately where possible.

Associated and similar soils

On less well drained and lower lying land, as well as on land surfaces that may be a little younger, Puramahoi soils occur with or grade into Tukurua soils, which are moderately well drained. Puramahoi soils are also associated with Paton soils which occur in the lowest lying areas in the Puramahoi district and which have imperfectly soil drainage. Motupipi soils, mapped in the 2005 survey of the Lower Takaka Valley, are somewhat similar to Puramahoi soils in their degree of development but occur under somewhat lower rainfall (around 1550 mm) and from differing rock materials.

Key physical properties

Puramahoi soils are moderately deep to deep well drained soils with good structure and silty to loamy textures. Reddish mottles are sometimes present in the subsoil and may indicate somewhat slow transmission of water during heavy rainfall periods.

Soil versatility and land use rating

Puramahoi soils are versatile soils with few limitations to intensive use. High rainfall inhibits use for some conventional crops but this coupled with relatively high sunshine may be beneficial for crops with more specific climatic requirements. Puramahoi soils are included in class A of the Tasman District Council land classification scheme

Horizons	Depth cm	Description Puramahoi deep silt loam
A	0-21 cm	Brown to dark brown (10YR 4/3) silt loam; moderately to strongly developed polyhedral structure; weak soil strength; friable; many fine roots
AB	21-29 cm	brown to dark brown (10YR 4/3) and yellowish brown to light olive brown (10YR 5/6-2.5Y 5/6) silt loam; moderately developed polyhedral structure weak soil strength; friable; many fine roots
Bw1	29-50cm	yellowish brown to light olive brown (10YR 5/6-2.5Y 5/6) silt loam to clay loam; moderately developed blocky structure; weak soil strength; brittle; few fine roots
Bw2	50-67 cm	light olive brown (2.5Y 5/6) silt loam; weakly developed blocky structure; weak soil strength; brittle; 5% yellowish red (5YR 5/6) mottles; few fine roots
Bw3	67-90 cm	dark yellowish brown (10YR 4/4) fine sandy loam; weakly developed blocky structure; weak soil strength; brittle; 2% pale olive (5Y 6/6) mottles; very few fine roots

Horizons	Depth cm	Description Puramahoi shallow silt loam
A	0-23 cm	Brown to dark brown (10YR 4/3) silt loam; moderately developed polyhedral structure; weak soil strength; friable; 2% medium to coarse stones; many fine roots
AB	23-29 cm	brown to dark brown (10YR 4/3) and light olive brown (2.5Y 5/6) silt loam; moderately developed polyhedral structure; weak soil strength; 2% medium to coarse stones; many fine roots
Bw1	29-40 cm	light olive brown to olive brown (2.5Y 5/6-4/4) sandy loam to silt loam; weakly developed blocky structure; weak soil strength; brittle; 5% yellowish brown (10YR 5/8) distinct mottles; 4% medium and coarse stones; few fine roots
Bw2	40-65 cm	light olive brown (2.5Y 5/6) sandy silt loam; loose; 5% dark brown (7.5YR 3/4 distinct mottles; 25% medium and coarse partly weathered stones; few fine roots
BC	65-75cm +	light olive brown (2.5Y 5/4) sandy silt loam; loose; 35% medium to very coarse partly weathered stones; very few fine roots

Soil name and map symbol Tukurua (Tu)

General concept and overview

Tukurua soils cover 201 ha and like Puramahoi soils, they occur on the Puramahoi Plain and are formed on alluvial deposits of the Pariwhakaoko, Puremahaia and Onahau Rivers that are derived from quartzitic, marble and schistic rocks from the Parapara Ridge. They are moderately well drained to imperfectly drained soils and occur mainly on the lower parts of the plains surface and on the interfluve areas between the major drainage channels.

Relationship to previously named soils

Tukurua soils are associated with the well drained Puramahoi soil as a somewhat less well drained (moderately well drained to imperfectly drained) soil. They were not identified or separated in the early unpublished survey of the soils of Takaka district or the 1:250,000 General Survey of the Soils of South Island (Soil Bureau Staff 1968). They resemble Pohara soils, which were mapped in the 2005 survey of the soils of the lower Takaka Valley but Pohara soils are derived from different rock materials.

Landform origin and history

Tukurua soils occur on the alluvial deposits mapped by Grindley (1971) as Bainham formation sediments of Late last Glaciation age. Tukurua soils may be a little younger than Puramahoi soils as they are found on the slightly lower weakly expressed degradational surfaces of the lower Puramahoi Plain area. Overall land drainage plays an important part in the soil distribution pattern with Puramahoi soils quickly merging into Tukurua soils where the land surface is depressed.

Key soil features

Tukurua soils are deep silty to clayey soils (>90 cm over gravel) with a very dark grayish brown moderately deep topsoil that averages 22 cm in thickness. The subsoils are dominantly light olive brown to light yellowish brown coloured, usually with few mottles but mottles increase in abundance and intensity with increasing depth. The lowest horizon is sometimes dominated by grey colours. Soil drainage is moderate to imperfect.

Identified variants

Shallow soils are occasionally present and moderately deep soils (45-90 cm over gravel) were found in 12% of the observations.

Associated and similar soils

Tukurua soils are associated with Puramahoi soils which occur on better drained and slightly more elevated parts of the land system. They are also associated with imperfectly drained Paton soils which are found on lower lying land in depressions and drainage channels.

Key physical properties

Tukurua soils are deep, moderately well drained to imperfectly drained soils as indicated by the mottle patterns in the subsoil. Silt loam texture in the upper horizons passes into silt loam to clay loam or clay loam in the lower horizons with associated lower permeability and somewhat impeded drainage. The potential rooting depth is in excess of 90 cm. A water table is occasionally present in the lower subsoil.

Soil versatility and land use rating

The versatility of Tukurua is restricted by the less than perfect drainage conditions. Excessive soil wetness in spring months gives rise to soil pugging with associated topsoil mottling under heavy stock concentrations. Tukurua soils are included in class B of the Tasman District Council land classification scheme.

Horizon	Depth	Description
A	0-18 cm	Brown to dark brown (10YR 4/3) silt loam; moderately developed polyhedral structure; weak soil strength; friable; many fine roots
AB	19-29 cm	brown to dark brown (10YR 4/3) and light olive brown (2.5Y 5/6) silt loam to clay loam; moderately developed polyhedral structure; friable; many fine roots
Bw1	29-54 cm	light olive brown to light yellowish brown (2.5Y 6/4-5/4) clay loam; weakly developed blocky structure; weak soil strength; brittle; 30% medium distinct strong brown (7.5YR 5/8) mottles; few fine roots
Bw2	54-90 cm	yellowish brown (10YR 5/8) sandy clay loam; weakly developed prismatic and blocky structure slightly firm soil strength; 15% light yellowish brown to light brownish grey (2.5Y 6/4-6/2) and yellowish red (5YR 5/8) medium distinct mottles; 2% fine gravel; few fine roots and some old coarse tree roots

Soil name and map symbol Paton (Pt)

General concept and overview

Paton soils occupy 87 ha and occur in the somewhat wetter areas associated with low lying depressions and overflow drainage channels. They are formed from alluvial deposits similar to those of Puramahoi and Tukurua soils mainly in the Puramahoi Plain area. The subsoils are dominated by a predominance of grayish colours that are indicative of restricted soil drainage conditions and a water table is commonly found at intermediate depths within the soil. Rushes are a common component of the vegetation.

Relationship to previously named soils

Of the older fluvial deposits on the Puramahoi plain, Paton soils are imperfectly drained, whereas Puramahoi soils are well drained and Tukurua soils moderately well drained. Soils with a significant drainage impediment were not identified or separated in the Puramahoi area in either the early survey of the soils of Takaka district or the 1:250,000 General Survey of the Soils of South Island (Soil Bureau Staff 1968). In the 2005 survey of the soils of Lower Takaka Valley, imperfectly drained Clifton soils were mapped in lower lying areas and resemble Paton soils. However they are formed from differing rock types.

Land form origin and history

The accumulation of alluvium from the three rivers crossing the Puramahoi plain occurred as a consequence of extensive outflows of water and sediment. Sediment accumulation largely followed the river courses and between the river courses, particularly towards the coast, the ground is somewhat lower lying. During major flood periods, overland flows created drainage channels which presently collect and discharge surface waters and subsurface seepages. These lower lying areas and drainage channels have impeded drainage and are the sites where Paton soils are found.

Key soil features

Patons soils are mostly deep but some shallow (<45 cm to gravel) and moderately deep 45-90 cm to gravel) occur. Topsoils are dominantly very dark brown averaging 19 cm thick with silt loam texture. The subsoil has pale colours which become predominantly grayish with increasing depth while texture, clay loam or silt loam becomes sandier at greater depths. A water table was found in 20% of the observations at depths between 30-90 cm.

Identified variants

The main variation identified was in respect of soil depth with 24% of the observations being grouped as shallow and moderately deep soils.

Associated and similar soils

Paton soils are associated with Puramahoi soils which are well drained and with Tukurua soils which are moderately well drained to imperfectly drained, these soils being found within the same landform system. Parapara soils are also imperfectly

drained soils but are formed from younger aged granite alluvium. Dogan soils have similarities with Paton soils in that they are formed in low lying areas but they are poorly drained and commonly have organic accumulations.

Key physical properties

Paton soils are imperfectly drained and are wet for a considerable part of the year. Water commonly lies at the surface during and after rainfalls. Textures are silty to clayey and deeper subsoils sometimes massive.

Soil limitations and land use rating

The use of Paton soils is limited by the imperfect drainage which because of their low lying situation and clayey subsoil, would be difficult to correct. They are included in class D of the Tasman District Council land classification scheme.

Horizon	Depth	Description
A	0-12 cm	Dark brown (10YR 3/3) silt loam; moderately developed polyhedral structure; weak soil strength very friable; many fine and medium roots
Ag	12-17 cm	dark grayish brown (10YR 4/2) silt loam; moderately developed polyhedral structure; weak soil strength; friable; 50% dark reddish brown (2.5YR 3/4) mottles; many fine and few medium roots
Bw(g)	17-40 cm	grayish brown to light yellowish brown (2.5Y 5/2-5/4) silt loam; moderately developed blocky structure; weak soil strength; brittle; 20% strong brown (7.5YR 5/6) medium distinct mottles; few fine and medium roots
Bw(g)2	40-62 cm	light brownish grey to light yellowish brown (2.5Y 6/2-5/4) silt loam to clay loam; moderately developed blocky structure; slightly firm soil strength; brittle; 20% yellowish brown (10YR 5/8) medium distinct mottles; very few roots
BC(g)	62-75+ cm	olive grey to light olive grey (5Y 5/2-6/3) silt loam; weakly developed blocky structure; weak soil soil strength; semi deformable; 15% strong brown (7.5YR 4/6) medium distinct mottles; very few roots; water table at 65 cm

Soil name and map symbol Dogan soils (Dg)

Concept and general overview

Dogan soils cover 107 ha and are mapped on low lying often swampy areas of the Puramahoi Plain as well as on the floors of some poorly drained gullies on various land surfaces between Onahau and Onekaka. The soils are poorly drained and the land often boggy. Organic layers, including old tree roots are commonly present in the soil. These areas were swampy prior to clearance of original vegetation and accompanying land drainage changes.

Relationship to previously named soils

Dogan soils were not separated in the early unpublished survey of the soils of Takaka district or in the 1:250,000 General Survey of the Soils of South Island (Soil Bureau Staff 1968) but were included with Puramahoi and Onahau soils. No similar soils were identified in the 2005 survey of the lower Takaka valley area. Karangarua soils, mapped in this area and the lower Takaka Valley, are also poorly drained soils containing peaty material, but they occur on young low lying surfaces adjacent to the coast.

Landform origin and history

The low lying poorly drained areas mostly occur in gullies or drainage channels where colluvial sediments, derived from erosion wash from adjacent sloping land has accumulated They are also found in some low swampy areas. These deposits were in places mapped by Grindley (1971) as Aranuian, or Post Glacial swamp deposits. The inherently wet environment under which these soils have formed is indicated by accumulations of peaty or woody organic materials that are often present within the soils.

Key soil features

Dogan soils are deep and poorly drained with a water table being found at an average depth of 47 cm at 40% of the observation sites. Organic horizons, below the existing A horizon and sometimes in the subsoil were observed at 40% of the observation sites. Subsoil mineral horizons are variable in texture but often clay loam with grey and sometimes bluish colours and few mottles, indicating more or less permanent wetness.

Identified variants

Considerable variation exists in the subsoil horizon colours and textures due to variable sedimentation and drainage conditions. In some older gullies, a pale grey horizon underlies the surface horizon with an iron pan at lower depth.

Associated and similar soils

Dogan soils are mainly associated with Onahau soils, the former occurring on gully floors and the latter on adjacent terrace surfaces.

Key physical properties

Dogan soils are poorly drained and deep with silt loam topsoils and dominantly clay loam subsoils. Transmission of water through the soil is slow and severe surface poaching may occur through stock grazing in winter and spring months.

Soil versatility and land use rating

Dogan soils have a low versatility rating due to the poor soil drainage conditions with wetness precluding the use of machinery until late spring. With drainage, cultivation for fodder crops such as maize is possible. The soils are included in class E of the Tasman District Council land classification scheme.

Horizon	Depth	Description
A	0-15 cm	Very dark grayish brown (10YR 3/2) sandy loam; weakly developed polyhedral structure; weak soil strength; friable; 1% medium stones; many fine and few medium roots
bAH	15-25cm	dark grey (10YR 4/2) humic loam; weakly developed polyhedral structure; very weak soil strength; very friable; 20% dark reddish brown (5YR 3/2) medium diffuse mottles; abundant fine roots
bAB	25-40 cm	dark grey (10YR 4/1) and very pale brown (10YR 7/3) silt loam; weakly developed blocky structure; weak soil strength; brittle; few fine roots
bBg	40-90 cm	very pale brown to light grey (110YR 7/3-7/2) sandy loam; weakly developed medium prismatic structure; weak soil strength; brittle; 40% dark brown (10YR 3/3) medium diffuse mottles; very few fine roots but some old tree roots

Soil name and map symbol Pariwhakaoho (Pk)

General concept and overview

Pariwhakaoho soils occupy 24 ha and occur in the northwest of the survey area on elevated and distinctly dissected old terrace lands just to the north of the Pariwhakaoho River. They are well developed soils with deep profiles that have formed on thick schistose deposits of alluvial or colluvial origin. Although these soils occur at a similar or higher elevation as Onahau soils from old terrace gravels, they lack the distinctive features of grey ashy layers or iron pans present in the Onahau soils.

Relationship to previously named soils

Pariwhakaoho soils were not separated in either the early unpublished survey of the soils of Takaka district but were included with Waitapu soils which were derived from schists and sandstones. Similarly, they were not separated in the 1:250,000 General Survey of the Soils of South Island (Soil Bureau Staff 1968) and were included with Onahau soils (59).

Landform origin and history

Pariwhakaoho soils occur on undulating land between about 100-140 m above sea level on gravel deposits that were mapped as Rockville Formation (third last glaciation deposits) by Grindley (1971). Although the gravels are underlain by and lie adjacent to Tarakohe Mudstone, they are derived from the Onekaka Schist and Arthur Marble Formations which occur on Parapara Ridge to the west. The Rockville Formation sediments here comprise schistose sandy gravel, with a finer texture than the gravels on the same terrace formation nearer the coast and may be an older sedimentary unit. The land surface is dissected by several shallow gullies.

Key soil features

Pariwhakaoho soils are deep soils that have a moderately deep topsoil (average 18 cm thick) with a brownish yellow upper B horizon that grades into a paler subsoil that is often olive coloured. Where drainage is impeded, the deeper subsoil may have grayish colours. Subsoil mottles are generally present indicating slightly impeded drainage conditions. Weathered gravels are commonly present in the profile.

Identified variants

Soil textures vary and range from sandy loam to clay loam. Drainage varies from well drained to imperfect.

Associated and similar soils

Onahau soils, with their distinctive pale grey ashy subsurface horizon and iron pan are present within the same land system as Pariwhakaoho soils.

Key physical properties

Pariwhakaoho soils are deep soils with clayey textures. They are moderately well drained and have no significant limitation to deep rooting. Surface pugging occurs when concentrated stock grazing occurs during winter and spring months.

Soil versatility and land use rating

Pariwhakaoho soils are moderately versatile soils with the chief limitations being impeded drainage and land slope which ranges from 5-10º. They are included in class C of the Tasman District Council land classification scheme.

sh brown (10YR 3/2) silt loam to clay
ly to strongly developed polyhedral
soil strength; friable; many fine roots

sh brown and dark yellowish brown
) clay loam; moderately developed
e; weak soil strength; brittle; 10%
7.5YR 5/8) distinct mottles (rock
ny fine roots
n to light olive brown (10YR 5/6-
to clay loam; moderately developed
re; slightly firm soil strength; brittle;
wn (7.5YR 5/6) fine distinct mottles;

n (10YR 5/8) clay to clay loam;
veloped blocky structure; weak soil
e to semi deformable; 5% yellowish
fine distinct mottles; few fine roots

silt loam to clay loam; very weakly
cky structure; very weak soil
deformable; 10% yellowish brown
dium mottles; few fine roots

sandy silt loam; 5% medium gravels;

95 cm; some old large tree roots

Soil name and map symbol Onahau (On, OnH)

General concept and overview

Onahau soils cover 776 ha and occur on the elevated and dissected older terrace lands to the southeast and northwest of the Puramahoi Plain. They are the soils (known as Podzols) on land that has previously been identified as "pakahi" land, the characteristic feature being inherently poor surface and soil drainage. These soils are characterized by the presence of a dense grey coloured or "ashy" layer with an iron pan at some depth below, characteristics that account for the low soil permeability and poor soil drainage. These soil features are a consequence of weathering over an extended period, with most of the readily soluble components of the gravel materials having been leached away, leaving a concentration of the less soluble siliceous. Iron and organic matter are translocated to lower depths to form iron pans and humic layers.

Relationship to previously named soils

Onahau soils were recognized in the early survey of the soils of Takaka district although were named only as Pakahi. In the 1:250,000 General Survey of the Soils of South Island (Soil Bureau Staff 1968), they were mapped as Onahau soils (59). In the Kotinga district of Takaka Valley and on a lower terrace system, Kotinga soils (59a) with similar properties were separated in the South Island General Survey while Kongahu soils (59b), again with somewhat similar properties, were mapped in the Buller district. These separations appear to represent efforts to distinguish soils showing differing degrees of podzolization.

Landform origin and history

The surfaces on which Onahau soils have been mapped are old sloping terraces that are capped with aggradational gravels deposited in earlier glacial periods. To the south east around the Onahau River area, the terrace elevation is around ±30 m and is mapped by Grindley (1971) as Kaituna Formation (second last glaciation). To the northwest, two terraces are ranging from about 30-100 m asl and are mapped by Grindley (1971) and Bishop (1971) as Kaituna Formation and Rockville Formation (Third last glaciation). Both terraces are dissected by well formed gullies and at their inland margins The terrace surfaces generally increase in elevation towards the west and merge with the adjacent hilly land where Onahau Hill soils or Otere soils are mapped.

Key soil features

Onahau soils have a thin surface horizon which largely consists of the organic accumulation and surface modification built up under grassland farming. Beneath is a darker coloured horizon (AE) that is flecked with and merges with a white or light grey sandy or silty (E) horizon. Underlying this is a brown to dark brown coloured organic rich layer (Bh) that sits on a firm iron pan (Bfm). Yellowish brown partly weathered gravelly horizons (Bs, Bw) are generally present below the iron pan.

Identified variants

There is considerable variation in respect of the development of the soil horizons in Onahau soils. In the southwest, the E horizons are generally sandy textured while to the northwest they are predominantly silty. The depth at which the iron pan is found (when present) also varies although it is generally deeper on the older terrace surface. Some separation of the soils mapped as Onahau in this survey would probably be possible but would require more extensive soil investigations.

Associated and similar soils

Milnthorp soils are associated with Onahau soils. They are formed from gravels that are exposed on the upper slopes of the gullies around the margins of the terraces. However, they lack the distinctive E or Bfm horizons of Onahau soils are well drained. In places however, Onahau soils grade into Milnthorp soils with a thin E horizon present but no Bfm horizon. On hilly and steep slopes where granite rocks occur, soils with similar horizon sequences as Onahau soils are present (Orekaka soils). These usually occur on sites that are stable and more weathered but the soil differs from Onahau in that the subsoil passes into partly weathered granite rock.

Key physical properties

Onahau soils are shallow to moderately deep and poorly drained. The topsoil is thin and has organic material that has accumulated under farming management. The E horizon is dense and firm and the Bfm horizon (iron pan) usually very hard.

Soil versatility and land use rating

Onahau soils have severe limitations for intensive use. Very low nutrient status, weak topsoil structure, the dense poorly structured subsoil together with the poor drainage and restricted rooting depth are difficult limitations to overcome. Extensive pugging by stock can occur in the wetter months. Never the less, some drainage improvement is possible with deep ripping of the iron pan and after the soils dry out in late spring, fodder crops are occasionally grown. The soils are grouped in class E of the Tasman District Council land classification scheme.

Horizon	Depth	Description
AH	0-10 cm	Very dark brown (10YR 2/2) humic loam; weakly developed polyhedral structure; very weak soil strength; friable; abundant fine roots
AE	10-21 cm	very dark grey and white (10YR 3/1+8/1) silt loam; weakly developed polyhedral and blocky structure; weak soil strength; brittle; many fine roots
Eh	21-43 cm	white and light grey to pale brown (10YR 8/2 + 7/2-6/3) sandy silt; very weakly developed prismatic to blocky structure; firm soil strength; brittle; 5% fine to medium quartz gravels; few fine roots
Bh	43-50 cm	dark yellowish brown (10YR 3/4) silt loam; weakly developed polyhedral structure; firm soil strength; brittle; 5% fine and medium angular quartz gravels;
Bfm	50-51 cm	dark brown (7.5YR 3/4) iron pan; hard
Bs	51-80 cm	brownish yellow (10YR 6/8) sandy clay loam; massive; firm soil strength; brittle; 30% coarse to to very coarse gravels; occasional thin red (5YR 5/8) iron pans

Soil name and map symbol Milnthorp (MnH)

General concept and overview

Milnthorp Hill soils cover 168 ha and occur on landscapes associated with the higher terrace country to the southeast and northwest of the Puramahoi Plain. They are the soils of the upper slopes of gullies that have been cut into the older terrace deposits and are formed principally from the terrace gravel deposits found around the margins of the terraces. The land surfaces are moderately sloping except in some deeply cut gullies where slopes are steep. Sedimentary rock of the Tarakohe Mudstone Formation underlies the terrace gravels and in many places is also present on the gully sides at lower elevations. The terrace gravel material is commonly mixed with the sedimentary rock material lower down the slopes through erosion processes.

Relationship to previously named soils

Milnthorp Hill soils were not separated in either the early unpublished survey of the soils of the Takaka district or the 1:250,000 General Survey of the Soils of South Island (Soil Bureau Staff 1968) but were included with the soils of the terraces (Pakaki soils and Onahau soils).

Landform origin and history

The terrace gravel deposits were mapped by Grindley (1971) and Bishop (1971) as Kaituna and Rockville Formations of Late Quaternary age (second and third last glaciations). Down cutting by small streams and the larger rivers has given rise to the dissection patterns that presently exist on the terrace surfaces. This down cutting, probably assisted by regional uplift, may have been more or less continuous, although interrupted at times during climatic cycles and changes in sea levels. The age of the land surfaces in the gullies and the soils formed on them appear to be relatively recent, as deeply or strongly weathered slope deposits are scarce.

Key soil features

Milnthorp Hill soils are deep well drained soils with a moderately deep topsoil and a yellowish brown to olive brown moderately structured subsoil that passes into olive to olive brown coloured gravelly slope detritus. Stones are typically present throughout the profile.

Identified variants

The main variation identified is in respect of soil stoniness and drainage with moderately well drained and imperfectly drained soils occurring in secondary channels. Grey coloured E horizons may be present at times.

Associated and similar soils

Milnthorp Hill soils are associated with Onahau soils which occur on adjacent terrace surfaces. They are also associated with Tadmor and Otere soils which may occur on the lower slopes of the gullies where Tarakohe Formation sediments outcrop.

Key physical properties

Milnthorp Hill soils are deep and well drained, have silt loam texture that grades to sandy loam in the lower subsoil and has variable quantities of stones throughout the soil. There is little restriction in plant rooting depth.

Soil versatility and land use rating

Use of Milnthorp Hill soils is restricted by slope which is commonly within the range of 16-25º. The soils are included in class F of the Tasman District Council land classification scheme.

Horizon	Depth	Description
A	0-22 cm	Dark brown (10YR 3/3) silt loam; moderately developed polyhedral structure; weak soil strength; friable; 2% coarse gravels partly oxidized; many fine and medium roots
AB	22-37 cm	dark brown and light olive brown (10YR 3/3 + 2.5Y 5/4) silt loam; moderately developed polyhedral structure; weak soil strength; friable; 7% coarse to very coarse partly oxidized gravels; many fine roots
Bw	37-60 cm	yellowish brown to light olive brown (10YR 5/6 – 2.5Y 5/4) silt loam to clay loam; moderately developed blocky structure; weak soil strength; brittle; 10% medium and coarse partly weathered gravels; few fine roots
BC	60-95 cm	olive yellow to light olive brown (2.5Y 6/6-5/6) sandy silt loam; weakly developed blocky structure; firm soil strength; brittle; 10% medium to coarse partly weathered gravels; few roots

Soil name and map symbol Waitapu (WpH)

General concept and overview

Waitapu soils are the soils on hilly land that are formed from sandstone sedimentary rocks of the Motupipi Coal Measures Formation. They occupy 80 ha and are mapped in the southeast part of the survey area in the vicinity of Little Onahau River and Rangihaeta. They include some areas of steepland soils found in the coastal cliffs and steeper slopes around Rangihaeata Head. Waitapu soils have not been examined in any detail.

Key soil features

Waitapu soils are deep soils with a moderately deep (average 22 cm) dark brown topsoil overlying a brownish yellow subsoil that passes into yellow sandy loam and then into compact partly weathered sedimentary rock. The soil is well drained but drainage varies considerably with soils on lower slopes being imperfectly drained at times.

Landform origin and history

Sediments of the Motupipi Coal Measure Formation vary greatly in their textural characteristics. In this area, the sandstone is firmly consolidated and the soils pass abruptly into the underlying consolidated rock.

Relationship to previously named soils

Waitapu soils were mapped in the earlier unpublished survey of the soils of Takaka district. They were not separated in this area in the 1:250,000 General Survey of the Soils of South Island (Soil Bureau Staff 1968) but an area in the vicinity of Rangihaeata was mapped as Otere Hill soils. They are similar to the soils mapped in the 2005 survey of the soils of Lower Takaka Valley. Pakawau soils are similar to Waitapu soils but occur on the older pebbly and arkosic Pakawau Group rocks.

Identified variants

The depth to sandstone rock varies from shallow (<50 cm) to greater than 2 m. On lower slopes, the soil drainage is commonly impeded and mottles are present in the subsoil. Iron accumulation with weak subsoil cementing may occasionally occur. Where sandy conglomerate is present, the soils have very coarse texture.

Associated and similar soils

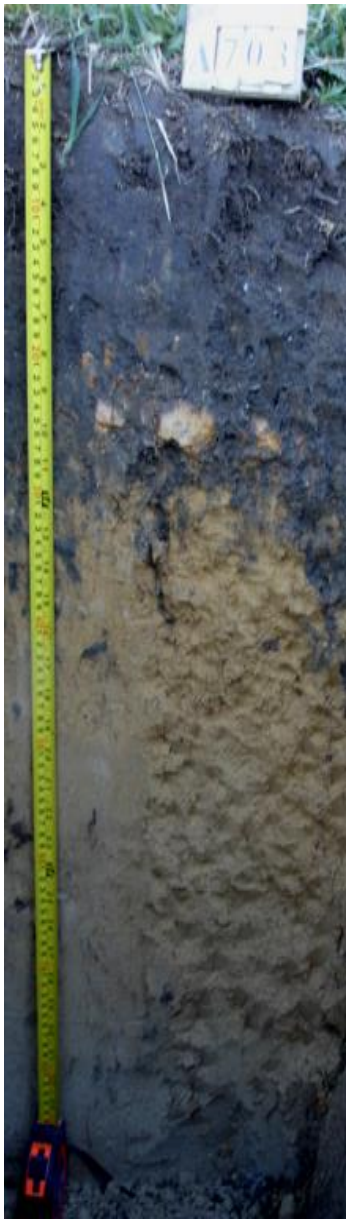
On some lower stable slopes, Waitapu soils grade into Onahau soils with distinctive pale coloured E horizons. At Rangihaeata Head, Takaka Limestone outcrops in patches and shallow Tarakohe Hill soils are present. Tadmor and Otere soils occur on younger Tertiary sedimentary rocks from sandy siltstone and sandy mudstone and they have clayey rather than sandy textures.

Key soil properties

Waitapu soils are deep with altered sandstone bedrock commonly occurring at depths >90 cm. Oxidised sandstone may occur at the base of the soil profile. Textures are mainly sandy and soil structure is weakly developed. Rainfall is higher than in the lower Takaka Valley and the soils are likely to have a very low nutrient status. Slopes are predominantly within the range of 16-25º for Waitapu Hill soils and >26º for Waitapu steepland soils.

Soil limitations and land use rating

Hilly and steep slopes are a major limitation to the use of Waitapu soils. Their weak soil structure and sandy textures mean that they are vulnerable to sheet erosion. They are included in class F of the Tasman District Council land classification system.



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Soil name and map symbol Tadmor (TmH, TmS)

General concept and overview

Tadmor soils occupy 250 ha predominantly in the hilly and steeply sloping land just to the north of Puramahoi. They are the soils that are formed on fine textured rocks of the Tarakohe Mudstone Formation (Grindley 1971, Bishop 1971) which are described as mudstone and siltstone. These sedimentary rocks underlie the terrace gravels and to the north and northwest of Puramahoi and are exposed on the lower slopes of most gullies where Tadmor soils are mapped. Tadmor soils are mapped where the Tarakohe Mudstone rocks are siltstone or sandy siltstone, the rocks having a more massive habit than the mudstones, which commonly are fragmented with a rubbly appearance.

Relationship to previously named soils

In the early unpublished survey of the soils of Takaka District, Tadmor soils were mapped in the Pohara-Takaka East area but were not mapped in the Puramahoi district. In the 1:250,000 General Survey of the Soils of South Island (Soil Bureau Staff 1968) Tadmor soils were also not mapped within the survey area. Tadmor soils were however more widely mapped by Chittenden (1966) elsewhere in the Tasman district, as soils from siltstone or sandstone.

Landform origin and history

The comparatively soft rocks of the Tarakohe Formation were widespread in the coastal area between Rangihaeata and Collingwood. In the early glacial periods, extensive erosion in the Parapara Ridge resulted in the construction of gravelly terraces on top of the Tertiary sedimentary rocks. In the Puramahoi area, erosion by the local rivers removed the sedimentary rocks and older terrace gravels but further north, erosion was restricted to dissection of the landscape by small local streams. The upper slopes of the gullies have terrace gravels around the gully margins (Milnthorp soils) whereas on the lower slopes where the Tarakohe Formation rocks are present, Tadmor soils are formed.

Key soil features

Tadmor soils are deep (>90 cm to underlying bedrock) and well drained with silt loam to clay loam textures. Soil structure is moderately developed. On some older and more stable slopes, the deeper subsoil has a distinctly reddish hue usually associated with older strongly weathered soils. Elsewhere, the transition from soil to sedimentary rock may be abrupt, with shallow soil profiles indicating slope instability.

Identified variants

Stones may be present in Tadmor soils as a result of down-slope erosion and mixing of the terrace gravels from the upper surface of the gullies.

Associated and similar soils

Tadmor soils are associated with Milnthorp soils, which occur on the upper gully slopes where terrace gravels outcrop. Otere soils are similar to Tadmor soils but they

are predominantly clayey textured. Otere soils have a more gradual transition into the underlying sedimentary rock, which has a rubbly fragmented appearance.

Key physical properties

Tadmor soils are deep, and well drained with silt loam to clay loam textures and well developed structure.

Soil limitations and land use rating

Slope is the principal limitation to use of Tadmor soils with slopes predominantly within 16-26º for Tadmor Hill soils and >26º for Tadmor steepland soils. Shallow slipping and earth flows may occur under heavy rainfall events. Tadmor soils are grouped in class E of the Tasman District Council land classification scheme.

Horizon	Depth	Description
A	0-16 cm	Dark brown (10YR 3/3) silt loam; moderately developed polyhedral structure; weak soil strength; friable; many fine and few medium roots
AB	16-30 cm	brownish yellow and dark brown (10YR 6/8+3/3) silt loam; moderately developed blocky and polyhedral structure; weak to slightly firm soil strength; friable; many fine roots
Bw1	30-47 cm	brownish yellow (10YR 6/8) clay loam; moderately developed blocky structure; weak to slightly firm soil strength; brittle; many fine roots
Bw2	47-62 cm	yellowish brown (10YR 5/6) clay to clay loam; moderately developed blocky structure; firm soil strength; brittle to semi deformable; common clay coatings; many fine roots
Bw3	62-80 cm	yellowish brown (10YR 5/6) clay; moderately developed blocky structure; firm soil strength; semi deformable; abundant clay coatings; few fine roots
Bw4	80-100 cm	strong brown (7.5YR 5/8) clay; moderately developed coarse blocky structure; firm soil strength; brittle to semi deformable; few clay coatings; few fine roots

Soil name and map symbol Otere (OtH, OtS)

General concept and overview

Otere soils cover 382 ha and are the soils that are formed on hilly and steep land to the northwest of the survey area on the lower hill country that borders the Parapara Ridge. They are formed on the upper beds of the sedimentary rocks of the Tarakohe Formation which are described as mudstone and which commonly has a bluish grey appearance. Otere Steepland soils are extensive to the west where landscape dissection has been intense while Otere Hill soils are more common at lower elevations in the gullies dissected into the older terraces.

Relationship to previously named soils

Otere soils were not mapped or identified in the early unpublished survey of the soils of Takaka district. They were however mapped in the Puramahoi-Onekaka district and the Aorere Valley in the 1:250,000 General Survey of the Soils of South Island (Soil Bureau Staff 1968) as soils on calcareous sandstone and mudstone.

Landform origin and history

The Tarakohe Mudstone Formation rises to about 200 m asl to the west where it is in fault contact with the more steeply sloping Onakaka Schist. Landscape dissection here has formed steep sided gullies (Otere steepland soils) often separated by hilly ridges (Otere Hill soils). At lower elevations, dissection has been less and on the gully sides below the older terraces that reacapped with Kaituna and Rockville Formation gravels, Otere Hill soils are more common. The mudstone has a greater clay content than siltstone or sandstone rocks and shrinkage and swelling during weathering typically gives rise to the rubbly or intensively fretted habit of the parent rock material underlying the soil profiles. These properties however make the material and the soils susceptible to earthflow and landslide erosion.

Key soil features

Otere soils are deep and well drained and generally have a gradual transition from the soil material into the underlying parent rock. Topsoils are moderately deep (average 21 cm) dark brown to dark grayish brown heavy silt loam to clay loam while subsoils are yellowish brown and have clay or clay loam texture and average 65 cm before passing into partly weathered sedimentary rock (BC horizon). Fragments of sedimentary rock may be present within the soil as firm oxidized clasts.

Identified variants

Moderately deep soils may occur on some younger aged land surfaces where deeply weathered soil has been removed by erosion. On older and more stable parts of the landscape, subsurface horizons may have redder hues. On the gully sides below the terrace surfaces, gravels are commonly present within the profiles.

Associated and similar soils

Otere soils are associated with Milnthorp soils, which occur on the upper margins of gullies that are cut into the terraces and the overlying terrace gravels. Milnthorp soils merge into Otere soils as the gravel component diminishes down slope due to mixing

of the soil materials. Tadmor soils are similar to Otere soils but soil structure is not as well developed and the transition into parent rock is usually more abrupt.

Key physical properties

Otere soils are well drained with clayey texture, well developed structure and a deep rooting depth.

Soil limitations and land use rating

The main limitations for use of Otere soils are slope (16-25º) for Otere Hill soils and >26º for Otere steepland soils and potential soil instability (earth flow or land slip). They are included in class E of the Tasman District Council land classification system.

Horizon	Depth	Description
A	0-20 cm	Dark brown to brown (10YR 4/3) silt loam to clay loam; strongly developed polyhedral structure; weak soil strength; friable; many fine and medium roots
AB	20-40cm	dark brown to brown (10YR 4/3) and yellowish brown 10YR 5/6) clay loam; strongly developed polyhedral structure; weak soil strength; friable; 5% medium firm mudstone clasts; many fine and medium roots
Bw1	40-80 cm	brownish yellow (10YR 6/8) clay to clay loam; strongly developed polyhedral structure; weak soil strength; friable; 10% medium and coarse firm mudstone clasts; common distinct clay coatings; many fine roots
BC	80-100+cm	yellowish brown (10YR 5/8) clay; moderately developed blocky structure; slightly firm soil strength; friable; 40% coarse grayish mudstone clasts; few clay/oxide coatings; few fine roots

Soil name and map symbol Onekaka (OkH, OkS)

General concept and overview

Onekaka soils cover 90 ha and are the soils formed on schist rocks of the Onekaka Schist Formation. This formation occurs extensively in the hills of Parapara Ridge to the west of the survey area and in a smaller area to the west of Waitapu where only a brief examination of Onekaka soils was made. Onekaka soils are on hilly and steep slopes and comprise deep or moderately profiles over partly weathered or weathered schist rock.

Relationship to previously named soils

Onekaka soils were not named in the early unpublished survey of the soils of the Takaka district although were mapped but included with Waitapu soils as undifferentiated loams and coarse sandy loams from schist, quartzites and sandstone. Onekaka soils (47d 47dH) were mapped in Golden Bay and Tasman Districts and named in the 1:250,000 General Survey of the Soils of South Island (Soil Bureau Staff 1968) as the soils from schist under around 1500-2000 mm of rainfall.

Landform origin and history

The Onakaka Schist is an old Paleozoic formation that was later intruded by Mezozoic aged granite of the Separation Point Batholith (Grindley 1971, Bishop 1971). This intrusion probably resulted in the separation and occurrence of the schist that is found in the hilly land to the west of Waitapu. The area where Onekaka soils are mapped may have been once part of an old (Cretaceous age) peneplane surface that stretched across parts of Golden Bay, the present land surface resulting from subsequent uplift and erosional processes.

Key soil features

Onekaka Hill and Onekaka Steepland soils are predominantly deep, well weathered and well drained soils. Dark brown topsoils average 22 cm in thickness and subsoils >70cm of yellowish brown clay to clay loam often with reddish colours deeper in the subsoil. Quartz gravel weathered from the schist rock is commonly present through the soil.

Identified variants

In both Onekaka Hill soils and Onekaka Steepland soils, the soil depth to underlying altered rock varies with moderately deep soils (45-90 cm over rock material) occurring on some ridges. On the lower slopes of gully sides, where there are deep deposits of slope detritus, the soils may be deep, moderately well drained or imperfectly drained and stony.

Associated and similar soils

Onamalutu soils (47c), which occur in the Marlborough Sounds region, are similar soils that are formed on schist rocks. However, they are formed under somewhat lower rainfall (1250-2000 mm) and the soils are less weathered.

Key physical properties

Onekaka soils are predominantly deep (>90 cm to partly weathered rock), well drained, have weakly to moderately developed structure and clayey and gravelly subsoil texture.

Soil limitations and land use rating

The main limitations for use of these soils are slope (16-25º) for Onekaka Hill soils and >26º for Onekaka steepland soils and potential soil instability including some sheet erosion. Onekaka soils are likely to have a lower nutrient status than Tadmor or Otere soils. Onakaka soils are grouped in class F of the Tasman District Council land classification scheme.

Horizon	Depth	Description
A	0-22 cm	Very dark grayish brown (10YR 3/2) silt loam; weakly developed polyhedral structure; very weak soil strength; friable; 1% fine and medium quartz gravels; many fine and few roots
AB	22-32 cm	yellowish brown (10YR 6/8-5/8) and very dark grayish brown (10YR 3/2) silt loam to clay loam; weakly developed polyhedral and blocky structure; weak soil strength; friable; 3% fine and medium quartz gravels; many fine roots
Bw1	32-49 cm	yellowish brown (10YR 6/8-5/8) clay loam; moderately developed blocky structure; slightly soil strength; friable; 5% medium quartz gravels; many fine roots
Bw2	49-68 cm	yellowish brown (10YR 6/8) clay loam; moderately developed blocky structure; slightly firm soil strength; brittle; 5% medium to coarse quartz gravels; few fine roots
BC	68-80+ cm	yellowish brown (10YR 5/8) silt loam; massive; firm; 70% weathered schist

Soil name and map symbol Kanieri (KnH)

General concept and overview

Kanieri soils cover 80 ha and occur in some small hilly areas near Puramahoi and also on hilly and land further to the west bordering the Puramahoi Plain. They are soils that are formed from weathered granite rocks of the Onahau Granite Formation. The soils are moderately deep and lack the formation of a distinctive E horizon that is characteristic of Orikika soils with which they are associated.

Relationship to previously named soils

In the earlier unpublished survey of the soils of Takaka district, soils on the granite rocks in the hill country to the south of Puramahoi were mapped as Kaiteriteri undifferentiated loams from granite and quartzite, along with the more extensively occurring soils on granites in the Totaranui area. In the 1:250,000 General Survey of the Soils of South Island (Soil Bureau Staff 1968) the soils on granite south of Puramahoi were mapped as Kanieri soils (66) and differentiated from Kaiteriteri soils (37cH) because of higher rainfall and stronger leaching and the presence of some E horizons. Kanieri soils have also been widely mapped primarily as steepland soils in soil surveys on the West Coast (Mew 1980, Heine and Mew 1981).

Land form origin and history

The Onahau Granite on which Kanieri soils are formed is a distinctive occurrance of younger aged (early Cretaceous Grindley 1971) basement rock that forms a discrete physiographic unit. Dissection and erosion have left a few outliers of granite as small hills on the Puramahoi Plain. Slopes are for the most part hilly rather than steep but judged by the accumulated granitic alluvium in Little Onahau River erosion is more or less ongoing. On less stable slopes that have undergone some erosion, Kanieri soils are formed whereas on slopes that have greater stability where weathering is greater Orikaka soils are formed.

Key soil features

Kanieri soils are moderately deep with variable, although often clayey textures generally passing into underlying granite which is only weakly or moderately altered. Residual quartz gravels may be present throughout the soil. Topsoils are shallow (average 16 cm). Quartz gravels or boulders are commonly present at the soil surface, having accumulated as residual material following normal weathering and erosion processes.

Identified variants

Kanieri soils include shallow soils, where granite is present at <45 cm depth and bouldery soils where there are concentrations of quartz boulders at the soil surface.

Associated and similar soils

Kanieri soils are associated with Orikaka soils which are also formed on granite. Orikaka soils occur on more stable parts of the hill country landscape and have an E horizon, with an iron pan generally present.

Key physical properties

Kanieri soils are moderately deep (<90 cm) over weakly altered granite bedrock. Topsoils are shallow (average 16 cm) brown to dark brown silt loam to sandy loam and overlie brownish yellow sandy to clayey subsoils. Quartz gravels are usually present through the soil.

Soil limitations and land use rating

Slope (range 16-25º) is a significant limitation for intensive use of Kanieri soils along with potential land instability. Kanieri soils are grouped in class F of the Tasman District Council land classification scheme.

Horizon	Depth	Description
A	0-17 cm	Brown to dark brown (10YR 4/3) coarse sandy loam; weakly developed polyhedral structure; weak soil strength; friable; many fine roots
AB	17-27 cm	brown to dark brown and yellowish brown (10YR 4/3 + 6/8) gravelly sandy loam; weakly developed polyhedral structure; weak soil strength; very friable; 10% medium distinct yellowish red mottles; 15% medium and coarse quartz gravels; few fine roots
Bw1	27-40 cm	brownish yellow (10YR 6/8) sandy clay loam; weakly developed blocky and polyhedral structure; weak soil strength; brittle; 10% medium distinct yellowish red (5YR 5/8) mottles (rock particles); 5% medium and coarse gravels; few fine roots
Bw2	40-54 cm	brownish yellow to yellow (10YR 6/8-7/8) sandy clay loam; weakly developed blocky structure; very weak soil strength; friable; very few roots
BC	54-85+ cm	very pale brown (10YR 8/3) coarse sandy loam; massive weathering granite; very weak soils strength; brittle; 3% distinct strong brown (7.5YR 5/6) mottles

Soil name and map symbol Orikaka (OrH, OrS)

General concept and overview

Orekaka soils covering 30 ha have been mapped on the hilly land on the southern margin of the Puramahoi Plain. However, they occur over a larger area on the rocks identified as Onahau Granite Formation but as this area has not been examined in any detail, their exact extent is not known. Orekaka soils occur together with Kaniere soils but differ in having well developed podzolic features.

Relationship to previously named soils

Orikaka soils were not identified in the earlier unpublished survey of the soils of Takaka district and were included as undifferentiated Kaiteriteri soils from granite and quartzite. Orekaka soils were also not separated in the 1:250,000 General Survey of the Soils of South Island (Soil Bureau Staff 1968) and were included with Kanieri soils. Orikaka soils are similar to those described by Heine and Mew (1981) in the Mokihinui-Orekaka region of the West Coast, being derived from granitic rocks and having podzolic features.

Landform origin and history

Orekaka soils are formed on the Onahau Granite, a younger aged (early Cretaceous Grindley 1971) basement rock that forms a discrete physiographic unit. This hill country area has been moderately dissected and slopes around the margin of the Puramahoi Plain are strongly rolling to moderately steep but become steep in the gullies. Soil weathering may be more advanced on the easier and more stable slopes where Orekaka soils are formed while the steeper and less weathered slopes have Kanieri soils. The two soils may however be found in close proximity to each other owing to variable nature of the land surface topography.

Key soil features

Orikaka soils are moderately deep (45-90 cm) with a thin topsoil (average 14 cm) overlying a pale grey E horizon and a Bfm (iron pan) which varies from weakly developed to very hard and cemented. The underlying B horizon is strong brown coloured and passes into moderately weathered or little weathered granite. The iron pan inhibits soil drainage, which is imperfect, and also rooting depth.

Identified variants

Soil depth varies from shallow (<45 cm over rock) to deep (>90 cm) and in places the soils are bouldery where quartz clasts have accumulated through weathering and erosion.

Associated and similar soils

Orikaka soils are associated with Kanieri soils and may be found within a few meters of each other according to slope variability. Orikaka soils are similar to Onahau soils in having well developed podzolic E horizons but deeper horizons with distinct accumulations of organic matter are generally absent.

Key physical properties

Orikaka soils are shallow to moderately deep with sandy textures and weakly developed structure in the upper horizons. Drainage and soil rooting depth are restricted by the presence of an iron pan. Concentrations of residual quartz gravels may be present.

Soil versatility and land use rating

Use of Orikaka soils is restricted by slope which range from 16-25º for the hill soils and >26º for the steepland soils. Weakly developed soil structure increases the risk of sheet soil erosion. The natural soil fertility levels would be expected to be low. Orikaka soils are included in class F of the Tasman District Council land classification scheme.

Horizon	Depth	Description
A	0-12 cm	Very dark grayish brown (10YR 3/2) sandy loam; weakly developed polyhedral structure; very weak soil strength; friable; many fine roots
E	12-30 cm	light brownish grey (10YR 6/3) sandy fine gravel; weakly developed polyhedral structure; weak soil strength; 40% fine quartzitic gravels; many fine roots
Bfm	30-31 cm	yellowish red (5YR 5/8) iron cemented horizon; massive; hard
Bs	31-36 cm	reddish yellow (7.5RY 6/8) sandy silt loam; very weakly developed blocky structure; firm soil strength; brittle;
C	36-80+ cm	white (2.5Y 8/2) coarse sand; massive; very firm