

This Technical Data Sheet describes the *typical average properties* of the specified soil.

It is essentially a summary of information obtained from one or more profiles of this soil that were examined and described during the Topoclimate survey or previous surveys. It has been prepared in good faith by trained staff within time and budgetary limits. However, no responsibility or liability can be taken for the accuracy of the information and interpretations. Advise should be sought from soil and landuse experts before making landuse decisions on individual farms and paddocks. The characteristics of the soil at a specific location may differ in some details from those described here.

No warranties are expressed or implied unless stated.

Soil name: **Tiwai**

Overview

Tiwai soils occupy about 2,300 ha on alluvial and old marine terraces in the coastal area of the Southland Plain south east of Invercargill. They are formed in shallow to moderately deep loess derived from greywacke that overlies gravel. Tiwai soils are imperfectly drained soils, with shallow rooting depth, moderately high available water capacity and silty textures. The soils show strong leaching, with high P-retention and are strongly acidic. The podzol features are likely to be less evident in areas that have significant development inputs. Present use is pastoral grazing with sheep, beef cattle and some dairy. Climate is cool temperate with regular rain throughout the year.

Soil classification

NZ Soil Classification (NZSC):

Humose Pan Podzol; rounded-stony, quartzic; silty

Previous NZ Genetic Classification:

Lowland podsolised yellow-brown earth

Classification explanation

The NZSC of the Tiwai soil is consistent with the previous classification. Tiwai soils are strongly leached with low base saturation, and are strongly acidic. The profile form is characterised by humus and iron illuviation staining the matrix and coating peds, with the development of a Bh horizon. There is a subsoil horizon that is structureless, with slightly firm or greater soil strength, that may limit root penetration, and has slow permeability that may cause waterlogging during wet periods. Subsoils typically have thin iron pans. The soils typically have silt loam textures, and gravels within 45cm depth.

Soil phases and variants

Identified units in the Tiwai soils are:

- Tiwai undulating moderately deep (TiU2): has gravel between 45 and 90cm depth; occurs on slopes of 0–7°
- Tiwai undulating shallow (TiU3): has gravel within 45cm depth; occurs on slopes of 0–7°

The soil properties described in this Technical Data Sheet are based on the most common phase, Tiwai undulating moderately deep (TiU2). Values for other phases and variants can be taken as being similar. Where they differ significantly they are recorded with a separate versatility rating.

Associated soils

Some soils that commonly occur in association with Tiwai soils are:

- Otanonomo: poorly drained peat soil; formed on raised peat bogs
- Invercargill: poorly drained peat soil; formed on basin peat bogs
- Mokotua: imperfectly drained Brown soil
- Tisbury : deep poorly drained soils

Similar soils

Some soils that have similar properties to Tiwai soils are:

- Ashers: podzolised soil formed into deep loess
- Kapuka: podzolised moderately deep to shallow soil on marine terraces; tends to have dominantly iron enriched Bs horizons, whereas Tiwai tends to have dominantly organic enriched Bh horizons, is typically shallow and has thin iron pans in the subsoil

Typical profile features

The following is a 'generic' or composite profile description representing the most common combination of characteristics for this soil type. The actual profiles for which descriptions and data are available are listed at the end of this Technical Data Sheet.

Tiwai profile	Horizon	Depth (cm)	Description
	Ap	0–21	Brownish black very slightly gravelly loamy silt; slightly firm soil strength; moderately developed very fine polyhedral structure; abundant roots
	Bhi	21–29	Brownish black very slightly gravelly loamy silt; few dull yellowish brown and few light grey mottles; common fine nodules; weak soil strength; moderately developed very fine polyhedral structure; many roots
	BCx(g)	29–40	Dull yellowish brown silt loam; few greyish yellow and few reddish brown mottles; 5mm placic pan is wavy through the horizon; very firm soil strength; massive structure; no roots
	2BC(f)	40–69	Dull yellowish brown very gravelly loamy sand; few bright brown mottles; very dense particle packing; massive structure; gravels fresh and rounded; no roots
	2BCt	69–90+	Dull brown very gravelly loamy sand; profuse dull brown clay coats bridging gravels and on gravel faces; very dense particle packing; massive structure; gravels fresh and rounded; no roots

Key profile features

Tiwai topsoils are 20–28 cm deep and have a moderately developed structure. Subsoil structure is also moderately developed but changes to a very firm massive structure within 40cm depth. The slow permeability and very dense packing of the clay-bound underlying gravels is reflected in the subsoil mottling. The dark coloured upper subsoil is characterised by the accumulation of complexes of iron and organic matter that reflect the podzolised nature of this soil.

Typical physical properties

Note: values in *Italics* are estimates

Horizon	Depth (cm)	Bulk density	Permeability	Texture	Gravel content
Ap	0–21	Moderate – High	<i>Moderate</i>	Loamy silt	Very slightly gravelly
Bhi	21–29	Moderate – High	<i>Moderate</i>	Loamy silt	Very slightly gravelly
BCx(g)	29–40	High	<i>Slow</i>	Silt loam	Gravel free
2BC(f)	40–69	—	<i>Slow</i>	Loamy sand	Very gravelly
2BCt	69–90+	—	<i>Slow</i>	Loamy sand	Very gravelly

Profile drainage: Imperfect
Plant readily available water: *Moderately high*
Potential rooting depth: Shallow
Rooting restriction: Very firm structureless subsoil, and subsoil gravelliness

Key physical properties

Tiwai soils have moderately high plant available water and a shallow rooting depth limited by the dense and gravelly subsoil. The subsoil acidity and aluminium toxicity may also be limiting (particularly on less developed sites). Soils are imperfectly drained, with slowly permeable subsoils that may cause short-term waterlogging after heavy rain. Textures are silt loams to loamy silts throughout the profile, with topsoil clay content of 10–22%. Tiwai soils typically have gravels within 45cm, although the shallow phase has gravels between 45–90cm depth.

Typical chemical properties

Horizon	Depth (cm)	pH	P retention	CEC	BS	Ca	Mg	K	Na
Ap	0–21	Moderate	Moderate	High	High	High	Moderate	Very low	Moderate
Bhi	21–29	Low	High	High	Low	Moderate	Moderate	Very low	Low
BCx(g)	29–40	Low	High	Moderate	Very low	Very low	Very low	Very low	Low
2BC(f)	40–69	Low	High	Moderate	Very low	Very low	Very low	Very low	Mod
2BCt	69–90+	—	—	—	—	—	—	—	—

Key chemical properties

Topsoil organic matter levels are variable (16–25%); P-retention 49–64% and pH moderate in topsoils but low in the subsoil. Cation exchange is high and base saturation depends on lime application but is often low. Available calcium and magnesium levels are moderate to high and potassium low. Soil reserve phosphorus is low. Micronutrient levels are generally adequate.

Vulnerability to environmental degradation

Note: the vulnerability ratings given in the table below are generalised and should not be taken as absolutes for this soil type in all situations. The actual risk depends on the environmental and management conditions prevailing at a particular place and time. Specialist advice should be sought before making management decisions that may have environmental impacts. Where vulnerability ratings of Moderate to Very severe are indicated, advice may be sought from Environment Southland or a farm management consultant.

Vulnerability factor	Rating	Vulnerability compared to other Southland soils
Structural compaction	slight	These soils have slight vulnerability to structural degradation by long-term cultivation, or compaction by heavy stocking and vehicles. This rating reflects the imperfect drainage and low clay content, offset by the high organic matter and P-retention.
Nutrient leaching	moderate	These soils have a moderate vulnerability to leaching to groundwater. This rating reflects the imperfect drainage, moderately high water-holding capacity and slow subsoil permeability.
Topsoil erodibility by water	minimal	Due to the high organic matter content, topsoil erodibility in these soils is minimal. Erodibility is highly dependent on management, particularly when there is no vegetation cover.
Organic matter loss	minimal	Vulnerability to long-term decline in soil organic matter levels is partly dependent on soil properties and highly dependent on management practices (e.g., crop residue management and cultivation practices).
Waterlogging	moderate	These soils have a moderate vulnerability to waterlogging during wet periods. This rating reflects the imperfect drainage and slow permeability.

General landuse versatility ratings for Tiwai soils

Note: The versatility ratings in the table below are indicative of the major limitations for semi-intensive to intensive landuse. These ratings differ from those used in the past in that sustainability factors are incorporated in the classification.

Refer to the Topoclimate district soil map or property soil map to determine which of the soil symbols listed below are applicable, then check the versatility ratings for that symbol in the appropriate table.

TiU2 (Tiwai undulating moderately deep)

TiU3 (Tiwai undulating shallow)

Versatility evaluation for soil TiU2, TiU3		
Landuse	Versatility rating	Main limitation
Non-arable horticulture	Limited	Restrictrd rooting depth
Arable	Limited	Restrictrd rooting depth
Intensive pasture	Limited	Restrictrd rooting depth
Forestry	Limited	Restrictrd rooting depth

Management practices that may improve soil versatility

- Careful management after heavy rain and wet periods will reduce the impact of short-term waterlogging. Intensive stocking, cultivation and heavy vehicular traffic use should be minimised during these periods.

Soil profiles available for Tiwai soils

Soil symbol	Profile ID	Topoclimate map sheet	Profile description available	Physical data available	Chemical data available	Profile photo available
TiU3	LT25	41	✓	✓	✓	✓
TiU2	LT27	41	✓	✓	✓	✓

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