

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: **Excelsior**

Overview

Excelsior soils occupy about 5,600 ha on fans and terraces of the northwest flanks of the Takitimu Mountains in the Te Anau basin. They are formed into loess that, in part, is derived from basic volcanic rock from the Takitimu Mountains. They are well drained moderately deep to deep soils, with slightly deep rooting depth, moderately high water holding capacity, and silty textures. They are used for pastoral farming with sheep and beef cattle and are recognised as having cropping potential. Climate is cold in the winter and summers can occasionally be dry, when soils can dry out.

Soil classification

NZ Soil Classification (NZSC):

Allophanic Firm Brown; soils with stones; silty over skeletal

Previous NZ Genetic Classification:

Moderately to strongly leached lowland yellow-brown earth

Classification explanation

The NZSC of the Excelsior soils is consistent with the previous classification. Excelsior soils are well-drained soils with yellow-brown subsoils. There is a subsoil horizon that is structureless and compacted sufficiently to meet the requirements of a fragipan. This horizon forms a barrier that limits root penetration and has slow permeability that may cause waterlogging during wet periods.

Soil phases and variants

Identified units in the Excelsior soils are:

- Excelsior undulating deep (EsU1): has no gravel within 90cm depth; occurs on slopes 0–7°
- Excelsior hilly deep (EsH1): has no gravel within 90cm depth; occurs on slopes 15–25°
- Excelsior undulating moderately deep (EsU2): has gravel between 45 and 90cm depth; occurs on slopes 0–7°
- Excelsior rolling moderately deep (EsR2): has gravel between 45 and 90cm depth; occurs on slopes 7–15°
- Excelsior hilly moderately deep (EsH2): has gravel between 45 and 90cm depth; occurs on slopes 15–25°
- Excelsior steep moderately deep (EsS2): has gravel between 45 and 90cm depth; occurs on slopes >25°
- Excelsior undulating deep imperfectly drained (EsU1vi): has no gravel within 90cm; is imperfectly drained; occurs on slopes of 0–7°.
- Excelsior hilly moderately deep imperfectly drained (EsH2vi): has gravel between 45 and 90cm; is imperfectly drained; occurs on slopes of 15–25°.

The soil properties described in this Technical Data Sheet are based on the most common phase, Excelsior undulating moderately deep (EsU2). Values for other phases and variants can be taken as being similar. Where they differ significantly they are recorded with a separate versatility rating, e.g., Excelsior hilly deep (EsH1).

Associated soils

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

- Wairaki: occurs on similar landforms but is a shallow stony soil
- Te Anau: occurs on glacial moraines, and is shallow to moderately deep
- Otahu: occurs on similar landforms, but is poorly drained, with a fragipan.
- Glenelg: occurs on intermediate terraces from the Takitimu Mountains; a shallow stony soil

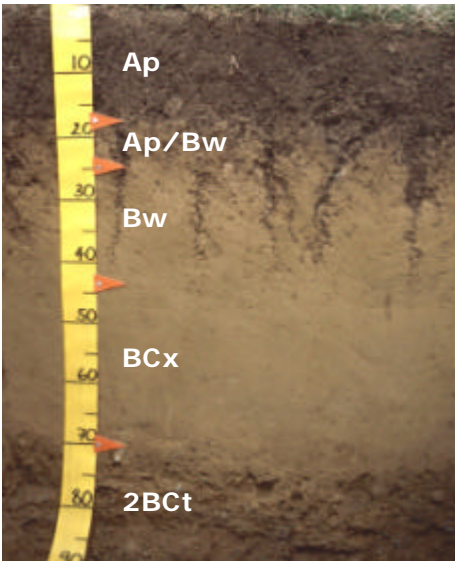
Similar soils

Some soils that have similar properties to Excelsior soils are:

- Rosemarkie: occurs in upland hill country east of Gore; has similar P-retention of >85%, but no fragipan in the subsoil
- Princhester: formed in alluvium on fans from the Takitimu Mountains, mainly in the area of the Key; has similar P-retention of >85%, but no fragipan 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.

Excelsior profile	Horizon	Depth (cm)	Description
	Ap	0–18	Greyish yellow brown silt loam; weak soil strength; moderately developed fine polyhedral structure; abundant roots
	Ap/Bw	18–25	Dull yellowish brown silt loam; many worm casts; weak soil strength; moderately developed fine polyhedral structure; abundant roots
	Bw	25–43	Dull yellowish brown silt loam; firm soil strength; moderately developed coarse prismatic structure; many roots
	BCx	43–70	Dull yellowish brown loamy silt; few dull yellow orange mottles; very firm soil strength; massive structure; no roots.
	2BCt	70–90	Bright brown very gravelly loamy silt; dense particle packing; massive structure; gravel subangular and slightly weathered; no roots

Key profile features

Excelsior soils have a topsoil 18–25cm deep that has strongly developed structure. Subsoil has moderately developed structure but below 40cm becomes structureless and sufficiently compact to meet fragipan requirements.

Typical physical properties

Note: values in *Italics* are estimates

Horizon	Depth (cm)	Bulk density	Permeability	Texture	Gravel content
Ap	0–18	Low – Moderate	<i>Moderate</i>	Silt loam	Gravel free
Ap/Bw	18–25	Moderate	<i>Moderate</i>	Silt loam	Gravel free
Bw	25–43	Moderate – High	<i>Moderate</i>	Silt loam	Gravel free
BCx	43–70	High	<i>Slow</i>	Loamy silt	Gravel free
2BCt	70–90	–	<i>Moderate</i>	Loamy silt	Very gravelly

Profile drainage: Well drained
Plant readily available water: *Moderately high*
Potential rooting depth: Slightly deep
Rooting restriction: Dense fragipan

Key physical properties

Excelsior soils have a slightly deep rooting depth with moderate to high plant available water, that is limited by fragipan. The soils are well drained but the compact subsoil is slowly permeable, and may cause short-term waterlogging after heavy rainfall, particularly in the imperfectly drained variant. Textures are silt loams with loamy silts occurring in the lower subsoil. Topsoil clay content is 25–35%. The soils typically have gravel between 45–90cm depth. Although the deep phase is stonefree the presence of the fragipan means the physical properties are unchanged.

Typical chemical properties

Horizon	Depth (cm)	pH	P retention	CEC	BS	Ca	Mg	K	Na
Ap	0–18	Moderate	High	High	Low	Moderate	Very low	Very low	Very low
Ap/Bw	18–25	Moderate	Very high	Moderate	Very low	Very low	Very low	Very low	Low
Bw	25–43	Moderate	Very high	Moderate	Very low	Very low	Very low	Very low	Very low
BCx	43–70	Moderate	High	Low	Very low	Very low	Very low	Very low	Very low
2BCt	70–90	Moderate	High	Low	Very low	Very low	Very low	Very low	Very low

Additional chemical properties (as a profile average)

Reserve potassium values are low and sulphate sulphur levels in the subsoil are high.

Key chemical properties

Topsoil organic matter levels are 7–16%; P-retention values 75–95%; pH values are moderate and consistent down the profile (>5.6). Cation exchange values are moderate above the fragipan, but the base saturation and available magnesium and potassium are very low. Reserves of phosphorus are low and sulphate sulphur levels high in the subsoil. Micro-nutrient 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	minimal	These soils have a minimal vulnerability to structural degradation by long-term cultivation, or compaction by heavy stocking and vehicles. This rating reflects the good drainage and high P-retention.
Nutrient leaching	moderate	These soils have a moderate vulnerability to leaching to groundwater. This rating reflects the moderately high water-holding capacity and slow subsoil permeability, but is offset by the good profile drainage.
Topsoil erodibility by water	slight	Due to the strongly developed structure and high organic matter content, the topsoil erodibility of these soils is slight. 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	slight	These soils have a slight vulnerability to waterlogging during wet periods. This rating reflects the good drainage. The imperfectly drained variant will have moderate vulnerability.

General landuse versatility ratings for Excelsior soils

Note: The versatility ratings in the table below are indicative of the major limitations for semi-intensive to intensive land use. 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.

EsU1 (Excelsior undulating deep)

EsU2 (Excelsior undulating moderately deep)

Versatility evaluation for soil EsU1, EsU2		
Landuse	Versatility rating	Main limitation
Non-arable horticulture	Limited	Restricted rooting depth
Arable	Moderate	Risk of short-term waterlogging after heavy rainfall.
Intensive pasture	Moderate	Vulnerability to nutrient leaching to ground water; restricted rooting depth.
Forestry	Limited	Restricted rooting depth

EsU1vi (Excelsior undulating deep imperfectly drained variant)

Versatility evaluation for soil EsU1vi.		
Landuse	Versatility rating	Main limitation
Non-arable horticulture	Limited	Restricted rooting depth
Arable	Moderate	Inadequate aeration during wet periods; restricted rooting depth
Intensive pasture	Moderate	Inadequate aeration during wet periods; restricted rooting depth
Forestry	Limited	Restricted rooting depth

EsH1 (Excelsior hilly deep)

EsH2 (Excelsior hilly moderately deep)

EsH2vi (Excelsior hilly moderately deep imperfectly drained variant)

Versatility evaluation for soil EsH1, EsH2, EsH2vi.		
Landuse	Versatility rating	Main limitation
Non-arable horticulture	Unsuitable	Hilly slopes
Arable	Unsuitable	Hilly slopes
Intensive pasture	Limited	Hilly slopes
Forestry	Limited	Restricted rooting depth

EsS2 (Excelsior steep moderately deep)

Versatility evaluation for soil EsS2.		
Landuse	Versatility rating	Main limitation
Non-arable horticulture	Unsuitable	Hilly slopes
Arable	Unsuitable	Hilly slopes
Intensive pasture	Limited	Hilly slopes
Forestry	Limited	Steep slopes; restricted rooting depth

Management practices that may improve soil versatility

- Careful management after heavy rain and wet periods will reduce the impact of waterlogging. Intensive stocking, cultivation and heavy vehicular traffic should be minimised during these periods.
- Installation and maintenance of sub-surface mole and tile drains will reduce the risk of short-term waterlogging.

Soil profiles available for Excelsior soils

Soil symbol	Profile ID	Topoclimate map sheet	Profile description available	Physical data available	Chemical data available	Profile photo available
EsU1	SB10138	38	✓		✓	
EsU2	PT8	38	✓	✓	✓	✓
EsU2	PT10	38	✓	✓	✓	✓
EsU1vi	KT8	5	✓	✓	✓	✓
EsH2vi	KT4	5	✓	✓	✓	✓
EsH1	PT11a	38	✓	✓		
EsH2	PT11b	38	✓	✓		
EsU1	149/73/11	38	✓	✓		
EsS2	150/75/11	38	✓	✓		

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