Soil name: Kaiwera

Overview

Kaiwera soils occupy about 4,500 ha on rolling to steep slopes of the Hokonui Hills and the Kaiwera district, at altitudes of up to 600m. They are formed in stony colluvium from tuffaceous greywacke, and minor additions of windblown loess. Kaiwera soils are well drained, with a slightly deep root depth and moderate water-holding capacity, that is limited by gravelliness and/or presence of bedrock. Kaiwera soils are strongly leached, with P-retention of >85% an pH of <5.5 typical in the subsoil. They are used for extensive pastoral grazing with sheep and beef cattle. Climate is cool temperate with regular rain.

Soil classification

NZ Soil Classification (NZSC):	Acidic Allophanic Brown; angular stony, tuffaceous sandstone; clayey
Previous NZ Genetic Classification:	Strongly leached lowland yellow-brown earth

Classification explanation

The NZSC of Kaiwera soils is consistent with the previous classification. They are strongly leached soils with yellow-brown colours, P-retention of >85% and pH of less than 5.5 in the subsoil. Kaiwera soils have a horizon with >35% gravel within 45cm depth, and textures are typically silty clay.

Soil phases and variants

Identified units in the Kaiwera soils are:

- Kaiwera undulating shallow (KwU3): has gravel within 45cm depth; occurs on slope of 0–7°
- Kaiwera rolling shallow (KwR3): has gravel within 45cm depth; occurs on slopes of 7–15°
- Kaiwera hilly shallow (KwH3): has gravel within 45cm depth; occurs on slopes of 15–25°
- Kaiwera steep shallow (KwS3): has gravel within 45cm depth; occurs on slopes >25°

The soil properties described in this Technical Data Sheet are based on the most common phase, Kaiwera hilly shallow (KwH3). 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., Kaiwera rolling shallow (KwR3).

Associated soils

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

- Rosemarkie: formed in deep loess on rolling upland basins.
- Otaraia: moderately leached Brown soil formed in deep loess
- Craigdale: moderately leached Brown soil formed in moderately deep loess overlying tuffaceous greywacke bedrock.

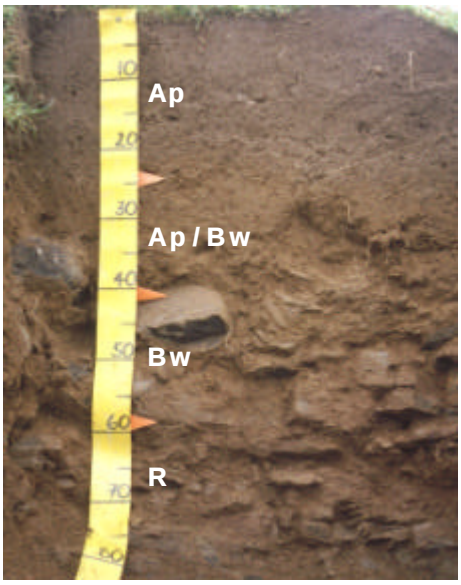
Similar soils

Some soils that have similar properties to Kaiwera soils are:

- Venlaw: strongly leached Allophanic soil; upland equivalent of the Kaiwera soil
- Pukerau: strongly leached Allophanic soil; consistently has bedrock within 45cm depth
- Kuriwao: moderately leached Brown soil equivalent of the Kaiwera series; has P-retention of 60–80% and pH of less than 5.5
- Waiarikiki: moderately deep equivalent of the Kaiwera soil; formed in gravelly colluvium, but the very gravelly horizon with >35% gravel occurs deeper, at between 45 and 90cm depth
- Tyneholm: moderately leached Brown soil with tuffaceous greywacke bedrock within 45cm depth.

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.

Kaiwera profile	Horizon	Depth (cm)	Description
	Ap	0–21	Very dark greyish brown slightly gravelly silty clay; compact particle packing; strongly developed fine polyhedral structure; gravel angular and moderately weathered; abundant roots.
	Ap/Bw	21–33	Yellowish brown slightly gravelly silty clay; many worm casts; compact particle packing; strongly developed fine blocky structure; gravel angular and moderately weathered; many roots.
	Bw	33–62	Yellowish brown very gravelly silty clay; compact particle packing; weakly developed fine blocky structure; gravel angular and moderately weathered; few roots.
	R	62–90	Tuffaceous greywacke bedrock

Key profile features

Kaiwera soils have a 20–25cm deep topsoil with strongly developed structure. Subsoil structure is moderate, grading to weakly developed in the lower subsoil. Bedrock is common in the subsoil, between 45 and 90cm depth.

Typical physical properties

Note: values in Italics are estimates

Horizon	Depth (cm)	Bulk density	Permeability	Texture	Gravel content
Ap	0–21	—	*Moderate*	Silty clay	Very slightly gravelly
Ap/Bw	21–33	—	*Moderate*	Silty clay	Very slightly gravelly
Bw	33–62	—	*Moderate*	Silty clay	Very gravelly
R	62–90	—	—	—	—

Profile drainage: Well

Plant readily available water: *Moderate*

Potential rooting depth: Slightly deep

Rooting restriction: Subsoil gravelliness and/or presence of bedrock

Key physical properties

Kaiwera soils have moderate available water and a slightly deep rooting depth that is restricted by the gravelliness and bedrock in the subsoil. These soils are well drained, with good aeration and moderate permeability throughout the soil. Textures are typically silty clay to loamy clay, with topsoil clay content of 40%. The soils are gravelly throughout, and typically have at least 35% gravel within 45cm depth.

Typical chemical properties

Horizon	Depth (cm)	pH	P retention	CEC	BS	Ca	Mg	K	Na
Ap	0–21	Moderate	High	High	Moderate	High	Moderate	Moderate	Low
Ap/Bw	21–33	Moderate	High	Moderate	Low	Low	Moderate	Low	Low
Bw	33–62	Moderate	Very high	Moderate	Very low	Very low	Low	Very low	Low
R	62–90	—	—	—	—	—	—	—	—

Additional chemical properties (as a profile average)

Reserve potassium values are medium; sulphate sulphur low in the topsoil but moderate in the subsoil.

Key chemical properties

Topsoil organic matter levels are 8–11%; P-retention 60–70% in the topsoil, increasing to >85% in the subsoil. pH is moderate, but lower in the subsoil – commonly below 5.5. Cation exchange values are high to moderate, with base saturation low in the subsoil. Available cations are at moderate or high levels in the topsoil but low in the subsoil. Soil reserves of phosphorus are low. Micro-nutrient levels are generally adequate for pasture but may be deficient in cobalt for sheep and copper for deer and cattle over summer.

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, moderate clay and organic matter levels.
Nutrient leaching	severe	These soils have a severe vulnerability to leaching to groundwater. This rating reflects the good drainage, moderate permeability, and moderate water-holding capacity.
Topsoil erodibility by water	minimal	Due to the loamy clay texture, 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	nil	These soils have a nil vulnerability to waterlogging during wet periods. This rating reflects the good drainage, moderate permeability, and the rolling to steep slopes.

General landuse versatility ratings for Kaiwera 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.

KwU3 (Kaiwera undulating shallow)

Versatility evaluation for soil KwU3		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Limited	Restricted rooting depth
Arable	Moderate	Vulnerability to leaching; topsoil stoniness
Intensive pasture	Moderate	Vulnerability to leaching; restricted rooting depth
Forestry	Limited	Restricted rooting depth

KwR3 (Kaiwera rolling shallow)

Versatility evaluation for soil KwR3		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Limited	Restricted rooting depth
Arable	Limited	Rolling slopes
Intensive pasture	Moderate	Vulnerability to leaching; restricted rooting depth
Forestry	Limited	Restricted rooting depth

KwH3 (Kaiwera hilly shallow)

Versatility evaluation for soil KwH3		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Unsuitable	Hilly slope
Arable	Unsuitable	Hilly slope
Intensive pasture	Limited	Hilly slope
Forestry	Limited	Restricted rooting depth

KwS3 (Kaiwera steep shallow)

Versatility evaluation for soil KwS3		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Unsuitable	Steep slopes
Arable	Unsuitable	Steep slopes
Intensive pasture	Limited	Steep slopes
Forestry	Limited	Steep slopes; restricted rooting depth

Management practices that may improve soil versatility

- Management of nutrient applications so as to minimise leaching losses

Soil profiles available for Kaiwera soils

Soil symbol	Profile ID	Topoclimate map sheet	Profile description available	Physical data available	Chemical data available	Profile photo available
KwH3	GG/GW138	35	✓	✓		
KwH3	GG/GW145	35	✓	✓		
KwH3	K1273	42	✓	✓		
KwH3	M200	26	✓	✓		

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