

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: Athol

### Overview

Athol soils occupy about 1960 ha on terraces and downlands in northern Southland and west Otago. They are formed in deep loess derived from greywacke and schist rocks. They are deep, silty, poorly drained soils with a degraded fragipan that restricts water drainage. At present they are used for pastoral grazing for sheep, dairy and deer, with occasional cropping. Regular rainfall occurs but in some summers soil may be seasonally dry.

### Soil classification

**NZ Soil Classification (NZSC):** Typic Perched-gley Pallic; stoneless; silty.

**Previous NZ Genetic Classification:** Yellow-grey earth.

### Classification explanation

The NZSC of the Athol soil is consistent with the previous classification. Athol soils are poorly drained, due to perching of water on a degraded fragipan. The fragipan is described as degraded due to the medium to coarse prismatic structure, compared to the extremely coarse or greater prismatic structure that is typical of a fragipan (e.g., Waikoikoi series). The degraded fragipan also typically has high density, which limits root growth to fissures between the prisms. Athol soils also have silty textures and P-retention of <30% throughout the profile, and are typically stonefree.

### Soil phases and variants

Identified units in the Athol soils are:

- Athol undulating deep (AtU1): has no gravel within 90cm depth; occurs on slopes of 0–7°
- Athol undulating moderately deep (AtU2): has gravel between 45 and 90cm depth; occurs on slopes of 0–7°
- Athol rolling deep (AtR1): has no gravel within 90cm depth; occurs on slopes of 7–15°
- Athol hilly moderately deep (AtH2): has gravel between 45 and 90cm depth; occurs on slopes of 15–25°

The soil properties described in this Technical Data Sheet are based on the most common phase, Athol undulating deep (AtU1). 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., Athol hilly moderately deep (AtH2).

## Associated soils

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

- Jacobstown: poorly drained soil formed in alluvium; on floodplains with high groundwater
- Arthurton: imperfectly drained Brown soil that is associated with Pallic soils of northern Southland and west Otago.
- Benio: shallow soil formed in old weathered gravelly alluvium

## Similar soils

Some soils that have similar properties to Athol soils are:

- Waikoikoi: poorly drained, perch-gley soil due to a fragipan
- Glenure: poorly drained gley soil on terraces, fans and downlands; has no perch-gley features within 90cm depth
- Warepa: imperfectly drained equivalent of the Waikoikoi soil
- Hokonui: has clayey textures, and formed in mixed loess and alluvium on fans from the Hokonui Hills

## 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.

Athol profile	Horizon	Depth (cm)	Description
	Apg	0–25	Brownish grey silt loam; common brownish grey and very few brown mottles; weak soil strength; moderately developed very fine to medium polyhedral structure; abundant roots
	Apg/Bg	25–38	Light grey silt loam; common bright brown mottles; many worm casts; slightly firm soil strength; weakly developed very fine to coarse polyhedral structure; many roots
	Bg	38–57	Greyish olive silt loam; many bright brown mottles; few worm casts; slightly firm soil strength; weakly developed fine to coarse polyhedral structure; many roots
	BC(x)(g)	57–90	Bright brown silt loam; many light grey mottles; firm soil strength; moderately developed coarse prismatic breaking to medium polyhedral structure; many roots

## Key profile features

Athol soils have a 15–25cm deep topsoil that has a moderately developed structure. Subsoil structure is moderate to weakly developed. Greyish colours are dominant in the upper subsoil, indicating the poor drainage caused by water perching on the brighter coloured degraded fragipan.

## Typical physical properties

Note: values in *Italics> are estimates*

Horizon	Depth (cm)	Bulk density	Permeability	Texture	Gravel content
Apg	0–25	Moderate – High	Moderate	Silt loam	Gravel free
Apg/Bg	25–38	Moderate – High	Moderate	Silt loam	Gravel free
Bg	38–57	Moderate – High	Slow	Silt loam	Gravel free
BC(x)(g)	57–90	High	Slow	Silt loam	Gravel free

<b>Profile drainage:</b>	Poor
<b>Plant readily available water:</b>	Moderately high
<b>Potential rooting depth:</b>	Deep
<b>Rooting restriction:</b>	Limited subsoil aeration during sustained wet periods

## Key physical properties

Athol soils have a moderately deep to deep rooting depth, depending on the degree to which the fragipan has degraded. The soils are poorly drained, with slow permeability in the subsoil. Textures are loamy silt to light silt loams. Topsoil clay content is 15–25%. Moderately deep phases have gravel between 45 and 90cm depth.

## Typical chemical properties

Horizon	Depth (cm)	pH	P retention	CEC	BS	Ca	Mg	K	Na
Apg	0–25	Moderate	Low	Low	Moderate	Moderate	Very low	Very low	Very low
Apg/Bg	25–38	Moderate	Moderate	Low	Low	Low	Very low	Very low	Very low
Bg	38–57	Moderate	Moderate	Low	Very low	Very low	Very low	Very low	Very low
BC(x)(g)	57–90	Moderate	Low	Low	Moderate	Low	Moderate	Very low	Very low

## Key chemical properties

Topsoil organic matter levels are 3–6%; P-retention values 20–30% and pH moderate (high 5s). Subsoil pH values tend to decrease down the profile. Cation exchange values are low and base saturation values moderate to low. Available calcium, magnesium and potassium levels tend to be low. Soil reserves of phosphorus and sulphur are also low. Micronutrient levels are generally adequate although boron responses in brassics and molybdenum responses in legumes can be expected.

## 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
<b>Structural compaction</b>	very severe	These soils have a very severe vulnerability to structural degradation by long-term cultivation, or compaction by heavy stocking and vehicles. This rating reflects the poor drainage, low clay and P-retention values.
<b>Nutrient leaching</b>	slight	These soils have a slight vulnerability to leaching to groundwater. This rating reflects the poor drainage, slow permeability and moderately high plant available water.
<b>Topsoil erodibility by water</b>	severe	Due to the low clay and organic matter content, topsoil erodibility in these soils is severe. Erodibility is highly dependent on management, particularly when there is no vegetation cover.
<b>Organic matter loss</b>	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).
<b>Waterlogging</b>	severe	These soils have a severe vulnerability to waterlogging during wet periods. This rating reflects the slow permeability of the subsoil and poor drainage.

## General landuse versatility ratings for Athol 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.

**AtU1 (Athol undulating deep)**

**AtU2 (Athol undulating moderately deep)**

Versatility evaluation for soil AtU1, AtU2		
Landuse	Versatility rating	Main limitation
Non-arable horticulture	Limited	Inadequate aeration during wet periods; vulnerability to topsoil structural degradation by cultivation and compaction.
Arable	Limited	Inadequate aeration during wet periods; vulnerability to topsoil structural degradation by cultivation and compaction.
Intensive pasture	Limited	Vulnerability to topsoil structural degradation by cultivation and compaction; risk of short-term waterlogging after heavy rain.
Forestry	Limited	Inadequate aeration during wet periods; vulnerability to topsoil structural degradation by cultivation and compaction.

**AtR1 (Athol rolling deep)**

Versatility evaluation for soil AtR1		
Landuse	Versatility rating	Main limitation
Non-arable horticulture	Limited	Inadequate aeration during wet periods; vulnerability to topsoil structural degradation by cultivation and compaction.
Arable	Limited	Inadequate aeration during wet periods; rolling slopes
Intensive pasture	Limited	Vulnerability to topsoil structural degradation by cultivation and compaction; risk of short-term waterlogging after heavy rain.
Forestry	Limited	Inadequate aeration during wet periods; vulnerability to topsoil structural degradation by cultivation and compaction.

**AtH2 (Athol hilly moderately deep)**

Versatility evaluation for soil AtH2		
Landuse	Versatility rating	Main limitation
Non-arable horticulture	Unsuitable	Hilly slopes
Arable	Unsuitable	Hilly slopes
Intensive pasture	Limited	Vulnerability to topsoil to erosion by water; hilly slopes.
Forestry	Limited	Inadequate aeration during wet periods; vulnerability to topsoil structural degradation by cultivation and compaction.

**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 should be minimised during these periods.
- Installation and maintenance of subsurface mole and tile drains will reduce the risk of short-term waterlogging.

**Soil profiles available for Athol soils**

Soil symbol	Profile ID	Topoclimate map sheet	Profile description available	Physical data available	Chemical data available	Profile photo available
AtU1	TT3	23	✓	✓	✓	✓
AtU1	GT4	4	✓	✓	✓	✓
AtR1	G351A	4	✓	✓		
AtU1	VT4	2	✓	✓	✓	✓

Published by Crops for Southland with financial support from Environment Southland.

**Copyright © 2002, Crops for Southland**

This Technical Data Sheet may be reproduced in whole or in part and in any form for educational or non-profit purposes without special permission from the copyright holder, provided acknowledgement of the source is made. Crops for Southland and Environment Southland would appreciate receiving a copy of any publication that uses this Technical Data Sheet as a source.

No use of this Technical Data Sheet may be made for resale or for any other commercial purpose whatsoever without prior permission in writing from Crops for Southland.

Crops for Southland  
PO Box 1306, Invercargill. New Zealand



[www.cropssouthland.co.nz](http://www.cropssouthland.co.nz)