

CLA Clarendon Land System

Moderately steep to steep low hills in the Upper Sturt - Mount Bold - Kangarilla - Clarendon area

Area: 102.9 km²

Annual rainfall: 625 – 1,055 mm average

Geology: The underlying geological materials are predominantly fine grained weakly metamorphosed basement rocks. These include siltstones, slates and fine sandstones, with minor quartzites and dolomites, of the Saddleworth, Balhannah and Castambul Formations. There are small areas of coarse grained quartzitic sandstones which are outliers of the Ackland Hill Land System. Much of the land surface was deeply weathered and lateritized prior to uplift and dissection. Remnants of these deep weathering profiles occur on scattered crests. In the lower rainfall areas to the west, the rocks are partially veneered by fine carbonates of aeolian origin. Unconsolidated alluvial sediments are very minor overall, and are confined to narrow drainage depressions.

Topography: The Clarendon Land System is a tract of moderately steep to steep country on the western edge of the Mount Lofty Ranges block. The north western part includes the dissected escarpment of the range. Here, water courses, the main one of which is the Sturt River, have carved deep valleys through the uplands as they flow westwards. Most of the central part of the System is an irregular mass of dissected upland created by the down cutting of the Onkaparinga River and its tributaries. In places, particularly the valley of the river itself, the depth of downcutting is up to 150 m, with very steep slopes. The Dashwood Gully catchment, to the south of the main System, is a section of dissected escarpment very similar to the landforms in the north west. Although water courses have played the dominant role in shaping the landscape, the flats through which they flow occupy less than 5% of the total area. There is a sharp demarcation between the flats and the adjacent hillslopes - lower slope outwash fans are virtually absent. The remnants of an ancient flat land surface occur as flat topped crests (summit surfaces) scattered throughout the System.

Elevation: 570 m in the north to 120 m where the Onkaparinga River exits in the south west

Relief: Up to 150 m

Soils: The majority of soils are moderately deep over basement rock. Loamy surfaced soils, usually with red or brown clayey subsoils are most common, but there are sandier soils formed on sandstones, and shallow stony profiles on steeper slopes. There are minor areas of ironstone soils and deep sandy, clay loamy and texture contrast soils on alluvium.

Main soils

Soils formed in weathering basement rock

K2a Acidic loam over red clay

L1a Shallow stony loam

C2 Shallow gradational red loam over calcareous rock

Soils formed on deeply weathered and / or lateritized rocks

K1c Acidic gradational loam over kaolinized rock



Minor soils

Soils formed in weathering basement rock

- D1** Shallow loam over red alkaline clay
- K1** Acidic gradational loam – brown (**K1a**) or red (**K1b**)
- K2b** Acidic loam over brown clay
- K3** Acidic sandy loam over red clay
- K4** Acidic sandy loam over brown clay
- K5** Acidic gradational stony sandy loam
- L1** Shallow stony soil - sandy (**L1b**), or loamy on calcified rock (**L1c**)

Soils formed on deeply weathered and / or lateritized rocks

- F1a** Loam over brown clay on highly weathered rock
- J2** Acidic ironstone soil – red loam (**J2a**) or brown sandy loam (**J2b**)
- K4/J2** Acidic sandy loam over brown clay on kaolinized rock

Soils formed in alluvial outwash sediments

- F1** Sandy loam over brown clay – sandy alluvium (**F1b**), or clayey alluvium (**F1c**)
- M1** Deep sandy loam
- M2** Deep black clay loam

Main features:

The Clarendon Land System is characterized by moderately steep to steep hillslopes with mainly loamy soils. These are shallow over basement rock on steep slopes, but generally they have a well structured clayey (or sometimes soft to semi hard lime) subsoil. These soils are inherently fertile and well drained. Only about 10% of the land is suitable for cultivation due to the sloping terrain, and a further 40% is too steep for any uses other than grazing. The remaining 50% is well suited to perennial horticulture or viticulture where water is available, provided that erosion control measures are adequate.

Soil Landscape Unit summary: 13 Soil Landscape Units (SLUs) mapped in the Clarendon Land System:

SLU	% of area	Main features #
AJC	2.4	Moderately steep dissected west facing escarpment slopes formed on weakly calcified siltstones, slates and fine sandstones, and minor quartzites and dolomites. Slopes are 15-30% and relief is up to 50 m. Watercourses are well defined in regularly spaced narrow parallel valleys. Rock outcrop is sporadic, but extensive in places. There is variable surface stone. Most soils are shallow to moderately deep over siltstone which may be non-calcified or contain soft carbonate in rock fissures. Main soils: <u>Acidic loam over red clay</u> - K2a (E) <u>Shallow stony loam</u> - L1a and L1c (C) <u>Shallow loam over red alkaline clay</u> - D1 (L) <u>Shallow gradational red loam</u> - C2 (L) Variation in soil depth is considerable, but otherwise the soils are inherently fertile and well drained. The slopes preclude any cultivated agriculture, but gentler slopes where water is available are suitable for perennial horticulture or viticulture.
AaC AaD	36.4 32.9	Moderate to steep hills formed on siltstones, fine sandstones and minor quartzites and dolomites of the Saddleworth, Balhannah and Castambul Formations. Slopes range from 20% to 50% generally, but are up to 150% in the gorges of the Onkaparinga River and Sturt Creek. On some upper slopes and broader crests, slopes are less than 10%. Relief is typically between 100 and 200 m. Drainage depressions are narrow with well defined watercourses. Usually an abrupt break between creek flats and adjacent hillslopes. AaC Moderately steep low hills up to 100 m high. Slopes are 15-30%. Rounded upper slopes and crests with slopes of less than 5% are included. There is occasional rock outcrop and minor surface stone. AaD Steep to very steep hillslopes with relief to 150 m, slopes of 30-75% (sometimes 150%), occasional rock outcrop and moderate surface stone. The soils are predominantly loamy with red to yellowish brown clay subsoils forming in weathering rock. On steeper slopes, loamy surface soils are formed directly in rock. Red loamy soils overlying abundant soft to semi-hard carbonate occur on calcareous rocks. Main soils: <u>Acidic loam over red clay</u> - K2a (E-L)



		<p><u>Shallow stony loam - L1a (C)</u> <u>Acidic gradational loam over kaolinized rock - K1c (L)</u> on upper slopes <u>Shallow gradational red loam - C2 (L-C)</u> on calcareous rocks</p> <p>Although most soils are shallow, there is a significant proportion that are moderately deep, well drained and inherently fertile. The easily accessible slopes of AaC have high potential for viticulture and other perennial horticulture where water is available. However, the steep terrain of AaD limits land use options to grazing.</p>
AbC AbD	6.8 6.2	<p>Moderately steep to very steep hills formed on shales, siltstones, fine sandstones and minor quartzites and dolomites. Slopes range from 18% to 90%, but are usually less than 75%. Relief varies from about 30 metres on some low hills to 200 metres. Crests and drainage depressions are narrow in the steeper country, but are broader where the slopes and relief are more subdued.</p> <p>AbC Rolling low hills and moderate hillslopes with relief to 80 m and slopes of 18-30%. AbD Steep to very steep moderately rocky hillslopes with relief to 200 m and slopes of 30-90%.</p> <p>The soils are predominantly loamy with brown to yellow subsoil clays forming in weathering rock. On steeper slopes, soils are shallow on rock, while on lower slopes, clay subsoils are thick with rock deeper than a metre.</p> <p>Main soils: <u>Acidic gradational brown loam - K1a (E-C)</u> <u>Acidic loam over red clay - K2a (L)</u> <u>Shallow stony loam - L1a (L-C)</u> on steeper slopes <u>Acidic gradational brown loam on kaolinized rock - K1c (L)</u> on upper slopes <u>Loam over brown clay - F1a (L)</u> on highly weathered rock on lower slopes</p> <p>This land is all non arable, but the less steep slopes of AbC, with moderately deep, well drained and reasonably fertile soils, are ideal for perennial horticulture. The main limitations are potential for erosion during establishment and soil acidity. The steep slopes of AbD are largely undeveloped or are used for grazing, with some horticulture in more accessible areas.</p>
AuC AuD	2.8 0.3	<p>Moderately steep to steep hillslopes developed on medium to coarse grained sandstones and quartzites. Slopes range from 12% to 50% and relief is up to 50 metres. The slopes are rough and very rocky.</p> <p>AuC Moderate slopes of 12-30%, up to 50 m high. There is up to 10% rocky outcrop. AuD Steep slopes up to 50 m high with slopes of 30-50%. There is up to 20% rocky outcrop. The main soil features are shallow profiles over bedrock and grey, sandy surfaces which are gritty and stony. Subsoils are often absent.</p> <p>Main soils: <u>Acidic gradational sandy loam on rock - K5 (E)</u> <u>Shallow sandy loam on rock - L1b (L-C)</u> <u>Acidic sandy loam over brown clay on rock - K4 (C)</u> <u>Acidic sandy loam over red clay - K3 (L)</u> <u>Acidic gradational brown loam - K1a (M)</u> on fine grained rocks</p> <p>This land has very limited productive potential due to steep terrain, rocky land surface and shallow infertile soils. The land is only partially cleared and used for light grazing.</p>
AwC	2.2	<p>Moderately steep slopes and rounded crests formed on medium to coarse grained sandstones with limited interbedded fine sandstones, siltstones and quartzites. Relief up to 50 m. Slopes: 18-25%, down to 10% on crests. Rocky outcrops are minor. Most soils are moderately deep to shallow over bedrock. Profiles vary according to the nature of the parent rock. Sandy to sandy loam soils over brown, yellow or red clay subsoils occur on the coarser grained rocks. Loamy soils over orange clays typical on finer grained rocks. Limited occurrences of coarse grained rocks are characterized by shallow, stony gritty soils.</p> <p>Main soils: <u>Acidic sandy loam over brown clay on rock - K4 (E)</u> } sandstones <u>Shallow stony sandy loam - L1b (C)</u> } <u>Acidic gradational brown loam - K1a (L)</u> } finer grained rocks <u>Acidic loam over red clay - K2a (L)</u> } <u>Acidic gradational loam on kaolinized rock - K1c (M)</u> on upper slopes <u>Acidic gradational sandy loam on rock - K5 (M)</u> on coarse sandstone strata</p> <p>Soil depth is highly variable, depending on the type of underlying rock. The soils are moderately well to well drained, but most have low natural fertility and are prone to acidification. However, the land is suitable for perennial crops (where water is available) and improved pastures, provided adequate erosion control measures are taken.</p>
BED	1.9	<p>Gently rolling rises and low hills with relief to 40 m and slopes of 10-18%, formed on siltstones, fine sandstones and minor quartzites and dolomites. Drainage depressions are narrow with well defined water courses. There is usually an abrupt break between creek</p>



		<p>flats and adjacent hillslopes. The soils are predominantly loamy with red to yellow clay subsoils forming in weathering rock. On steeper slopes, loamy surface soils are formed directly in rock. Red loamy soils overlying abundant soft to semi-hard carbonate occur on calcareous rocks.</p> <p>Main soils: <u>Acidic loam over red clay</u> - K2a (E) <u>Shallow gradational red loam</u> - C2 (L) <u>Acidic loam over brown clay</u> - K2b (C) <u>Shallow stony loam</u> - L1a (L)</p> <p>These soils are mostly fertile, moderately deep and adequately drained, with high production potential for perennial crops, but erosion risk is too great for cultivated crops.</p>
BFD	1.2	<p>Gently rolling footslopes with relief to 30 m and slopes of 8-18% formed on shales, siltstones, fine sandstones and minor quartzites. The soils are predominantly loamy with brown to yellow subsoil clays forming in weathering rock. On lower slopes, clay subsoils are thick with rock deeper than a metre.</p> <p>Main soils: <u>Acidic gradational brown loam</u> - K1a (V) <u>Acidic loam over red clay</u> - K2a (L) <u>Loam over brown clay</u> - F1a (L) on highly weathered rock on lower slopes</p> <p>This land is semi arable due to the moderately high potential for erosion, so annual cropping is risky. However the moderately deep well drained and reasonably fertile soils are ideal for perennial horticulture. Main limitations are potential for erosion during establishment and soil acidity.</p>
FaZ	0.9	<p>Very gently undulating plateaux (summit surfaces) up to 30 m above surrounding land, with side slopes of up to 7%. They are remnant deeply weathered land surfaces. Underlying materials are kaolinized and lateritized basement rocks.</p> <p>Main soils: <u>Ironstone soils</u> - J2b and J2a (V) <u>Acidic sandy loam over brown clay on kaolinized rock</u> - K4/J2 (L)</p> <p>These soils are deep but imperfectly drained due to thick subsoil clays, and infertile due to strong leaching and high concentrations of phosphate fixing ironstone gravel. Susceptibility to waterlogging is a significant limitation to horticultural development. Pasture productivity is potentially high, provided that fertility and acidity are managed. Deeply weathered substrate materials often contain high amounts of salt which is dissolved and mobilized if watertables rise.</p>
FgZ	1.5	<p>Undulating upper slopes and crests of rolling low hills, occurring as strips running along ridges. Slopes range from 2% on crests to 10% on the margins grading to the steeper slopes below. The underlying rocks are deeply weathered kaolinized siltstones and sandstones. The soils are deep. Surfaces are sandy to loamy with variable ironstone gravel. Subsoils are clayey and red or yellow brown. Variations in soils are due to the depth of weathering and the nature of the underlying materials.</p> <p>Main soils: <u>Acidic loamy ironstone soil</u> - J2a (E) <u>Acidic gradational loam over kaolinized rock</u> - K1c (C) <u>Acidic sandy loam ironstone soil</u> - J2b (C) <u>Acidic gradational red loam</u> - K1b (L)</p> <p>These soils are deep and moderately well drained but low in natural fertility. The land is suitable for most uses, although low fertility and exposure limit productivity.</p>
LtE	4.5	<p>Narrow drainage depressions formed on variable locally derived alluvium. Soils have thick sandy to loamy surfaces overlying mottled clayey subsoils, or are deep sandy loams or clay loams.</p> <p>Main soils: <u>Sandy loam over brown clay</u> - F1b and F1c (V) <u>Deep sandy loam</u> - M1 (L) <u>Deep black clay loam</u> - M2 (L)</p> <p>These soils are deep and moderately fertile, but prone to waterlogging. Water courses are susceptible to erosion if banks are exposed. Although potentially productive, small contiguous areas, and the predominance of water courses, effectively limit production.</p>

PROPORTION codes assigned to soils within Soil Landscape Units (SLU):

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| (D) Dominant in extent (>90% of SLU) | (C) Common in extent (20–30% of SLU) |
| (V) Very extensive in extent (60–90% of SLU) | (L) Limited in extent (10–20% of SLU) |
| (E) Extensive in extent (30–60% of SLU) | (M) Minor in extent (<10% of SLU) |



Detailed soil profile descriptions:

Soils formed in weathering basement rock

- C2** Shallow gradational red loam over calcareous rock (Eutrophic, Red Dermosol)
Medium thickness dark reddish brown loam, overlying a reddish well structured loam to clay loam, grading to soft highly calcareous siltstone, or soft carbonate with siltstone fragments throughout at about 50 cm.
- D1** Shallow loam over red alkaline clay (Calcic, Red Chromosol)
Medium thickness reddish sandy loam with a pink gravelly A2 horizon, overlying a red well structured clay with occasional soft calcareous segregations at depth, grading to weathering fine sandstone.
- K1a** Acidic gradational brown loam (Eutrophic, Brown Dermosol)
Medium thickness loamy surface soil, becoming clay loamy and gravelly with depth, overlying an orange friable clay subsoil, grading to soft shale or siltstone.
- K1b** Acidic gradational red loam (Eutrophic, Red Dermosol)
Medium thickness dark brown loam with a paler coloured clay loamy A2 horizon containing abundant ferruginous rock fragments, overlying a red clay with polyhedral structure and increasing rock fragments with depth, grading to soft weathering siltstone at about 100 cm.
- K2a** Acidic loam over red clay on rock (Eutrophic, Red Kurosol)
Medium thickness loamy surface soil, with a paler coloured and gravelly A2 horizon, overlying a reddish brown to red well structured clay subsoil with rock fragments, grading to weathering siltstone or slate by 100 cm.
- K2b** Acidic loam over brown clay on rock (Mottled, Eutrophic, Brown Kurosol)
Thick loam with a paler coloured and gravelly A2 horizon, overlying a yellowish brown or brown well structured clay grading to weathering siltstone by 100 cm.
- K3** Acidic sandy loam over red clay (Mesotrophic, Red Chromosol)
Medium thickness loamy sand to sandy loam, with a paler coloured and very gravelly A2 horizon, overlying a red sandy clay subsoil with abundant rock fragments, grading to weathering coarse grained sandstone before 100 cm.
- K4** Acidic sandy loam over brown clay on rock (Bleached, Mesotrophic, Brown Kurosol)
Medium to thick, gravelly loamy sand to sandy loam, with a bleached and very gravelly A2 horizon, overlying a yellowish brown, red and brown sandy clay to clay grading to weathering medium to fine sandstone by 100 cm.
- K5** Acidic gradational stony sandy loam on rock (Bleached-Acidic, Mesonatric, Brown Kandosol)
Thick gravelly loamy coarse sand to coarse sandy loam with a bleached and very gritty and gravelly A2 horizon, overlying a brown or yellow sandy clay loam to sandy clay with abundant rock fragments, grading to coarse grained sandstone.
- L1a** Shallow stony loam (Palic, Paralithic, Leptic Tenosol)
Thick gravelly and stony brown loam, sometimes grading to a pinkish very stony clay loam overlying hard siltstone or slate.
- L1b** Shallow stony sandy loam (Acidic, Paralithic, Bleached-Leptic Tenosol)
Thick greyish very gravelly loamy sand to sandy loam with a bleached A2 horizon, grading to hard sandstone or quartzite by 50 cm.



L1c Shallow stony loam (Calcareous, Paralithic, Leptic Tenosol)

Thick stony reddish brown loam, grading to highly calcified weathering siltstone or fine sandstone before 50 cm.

Soils formed on deeply weathered and / or lateritized rocks

F1a Loam over brown clay (Eutrophic, Brown Kurosol)

Thick dark brown loam to clay loam with a bleached A2 horizon, overlying a brown, yellowish brown and red coarsely blocky clay grading to grey and brown coarsely prismatic clay forming in weathering siltstone deeper than 200 cm.

J2a Acidic loamy ironstone soil (Ferric, Eutrophic, Red Chromosol)

Medium thickness dark brown fine sandy loam to fine sandy clay loam with a pink A2 horizon containing abundant fragments of ferruginized siltstone and ironstone nodules, overlying a yellowish red and brown clay with blocky to polyhedral structure, grading to grey mottled kaolinitic silty clay. Hard siltstone is deeper than 200 cm.

J2b Acidic sandy loam ironstone soil (Ferric, Mesotrophic, Brown Kandosol)

Medium thickness loamy sand to sandy loam with abundant ironstone gravel, grading to a brownish yellow and red clay with ironstone fragments, over light grey and red kaolinitic clay at about 100 cm.

K1c Acidic gradational loam over kaolinized rock (Mesotrophic, Red Dermosol)

Thick fine sandy loam with minor ironstone grading to a brownish to reddish coarsely blocky clay loamy to clayey subsoil, siltier with depth, grading to kaolinized phyllite or siltstone, continuing to depths of 200 cm or more.

K4/J2 Acidic sandy loam over brown clay on kaolinized rock (Bleached, Mesotrophic, Brown Kurosol)

Medium to thick gravelly loamy sand to sandy loam, with a bleached and very gravelly A2 horizon, overlying a yellowish brown, red and brown sandy clay to clay grading to soft kaolinized sandstone by 100 cm, continuing below 200 cm.

Soils formed in alluvial outwash sediments

F1b Sandy loam over brown clay (Bleached-Mottled, Eutrophic, Brown Chromosol)

Thick dark brown loamy sand to light sandy clay loam with a bleached A2 horizon, overlying a yellow brown and grey brown sandy clay with coarse prismatic structure, grading to a grey, brown and yellow mottled clayey sand.

F1c Sandy loam over brown clay (Bleached-Mottled, Hypocalcic, Brown Chromosol)

Thick loamy sand to sandy clay loam with a strongly bleached A2 horizon, overlying a yellowish brown, grey and red mottled clay grading to fine grained alluvium, weakly calcareous at base.

M1 Deep sandy loam (Regolithic, Brown-Orthic Tenosol / Eutrophic, Brown Kandosol)

Thick brown sandy loam, overlying a grey to brown silty sand to silty clay loam with weak prismatic structure, grading to variable sandy, gritty and clayey alluvial sediments.

M2 Deep black clay loam (Melanic, Eutrophic, Black Dermosol)

Thick black silty loam to clay loam with strong granular structure, overlying a black to dark brown clay with strong blocky structure, becoming yellow and grey mottled with depth.

Further information: [DEWNR Soil and Land Program](#)

