

# HAR Hartley Land System

Broad low hills east of Hartley

**Area:** 95.9 km<sup>2</sup>

**Annual rainfall:** 375 – 455 mm average

**Geology:** The system is probably a basement high, underlain by metasandstones and schists of the Kanmantoo Group. Although outcrops were not observed, rock occurs within a metre of the surface in places and there are scattered surface fragments. The bulk of the land is covered by Tertiary sediments, mainly clayey sands to sandy clays, but with some younger heavy clays (Blanchetown Clay equivalent) as well. However, the distinguishing feature of the System is the extent of calcrete, which has formed a cap over much of the land as a result of the hardening of windblown Woorinen Formation carbonates. The calcrete is generally in sheet form, but rubbly forms also occur. Where the calcrete has been eroded or dissolved, the underlying Tertiary sediments directly underlie the soils. Overlying the landscape are deposits of sand, derived from the reworking by wind of sandy soils.

**Topography:** The landscape is a system of broad gently inclined low hills, with slopes of 2-12%. The highest point is in the north-west (Bremer). The hills have been dissected by streams in the past, some of which are still distinguishable as water courses. Elsewhere there are distinctive elongate troughs or trenches where the calcrete has apparently been dissolved. In the south west is a depression which appears to have been carved out by the Bremer River. Linear sandhills are draped over the slopes in places. The main surface features are expanses of calcrete interspersed with sandy soils.

**Elevation:** 30 m in the south east to 158 m in the north-west

**Relief:** Up to 80 m

**Soils:** Most soils have sand to sandy loam surface textures with variable highly calcareous material at shallow depth. Three groups of calcareous material occur:

- Sheet calcrete is very hard at the top but grades with depth to soft very highly calcareous pale brown sandy loam to clay loam with decreasing rubble content and overlies Tertiary heavy clay at depths ranging from 100 cm to 10 m.
- Rubbly calcrete comprises abundant calcrete nodules (Class IIIB or IIIC carbonates) in a pale brown very highly calcareous clayey sand to light clay matrix which grades to brown, yellow, red and grey clayey sand to sandy clay sediments from about 70 cm.
- Fine carbonate consists of highly calcareous clayey sand to clay (with few if any nodules) grading to Tertiary sediments.

#### Main soils

- B2** Shallow calcareous loamy sand over calcrete
- G4** Sand over dispersive sandy clay on Tertiary sediments
- B7** Sand over sandy clay on calcrete
- A4a** Rubbly calcareous sandy loam
- B8** Bleached sand over calcrete

#### Minor soils

*Soils formed on sheet calcrete*

- B3** Shallow gradational sandy loam on calcrete



*Soils formed on rubbly calcrete*

**C1** Sandy loam over sandy clay over rubble

*Soils formed on Tertiary sediments capped by fine carbonates*

**D3** Sandy loam over red clay

**F2** Sandy loam over dispersive brown clay

**A4b** Calcareous sandy clay loam

*Soils formed on drift sand*

**H3** Deep bleached sand

**Main features:**

The Hartley Land System is characterized by broad calcreted slopes. Although there is a wide range of soils, the majority of the land is either sandy, or shallow and stony. Much of the stony ground is non arable. The sandy soils may have clayey subsoils but all are infertile, and prone to water repellence and wind erosion. Limited areas of deeper sandy loams, mainly in depressions, are potentially productive.

**Soil Landscape Unit summary:** 11 Soil Landscape Units (SLUs) mapped in the Hartley Land System:

SLU	% of area	Main features #
GQB	17.6	Gently undulating to undulating rises formed on Tertiary sediments, capped in places by calcretes. Slopes are 2-12%. Low linear sandhills cover up to 30% of the land surface. Main soils: <u>sand over dispersive brown clay</u> - <b>G4</b> (E), with <u>sand over sandy clay on calcrete</u> - <b>B7</b> (L) and <u>bleached sand over calcrete</u> - <b>B8</b> (L) where calcrete is at or near the surface, <u>sandy loam over dispersive brown clay</u> - <b>F2</b> (M) on lower slopes, and <u>deep bleached sand</u> - <b>H3</b> (C) on sandhills. The soils are mostly sandy, although deep sands are restricted to the sandhills. Low fertility, water repellence and wind erosion potential are all significant limitations. Perched water tables can be expected in wet seasons. Where the clay is within 30 cm of the surface, waterlogging causes loss of productivity.
GWB	10.6	Gently undulating to undulating slopes formed on Tertiary sediments, capped in places by calcretes. Linear sandhills occupy less than 10% of the land surface. Slopes are 2-10%. Main soils: <u>sand over dispersive brown clay</u> - <b>G4</b> (E), with <u>sand over sandy clay on calcrete</u> - <b>B7</b> (C) and <u>bleached sand over calcrete</u> - <b>B8</b> (L) where calcrete is at or near the surface, <u>sandy loam over dispersive brown clay</u> - <b>F2</b> (L) on lower slopes, and <u>deep bleached sand</u> - <b>H3</b> (M) on sandhills. The soils are mostly sandy, although deep sands are restricted to the sandhills. Low fertility, water repellence and wind erosion potential are all significant limitations. Where the clay is within 30 cm of the surface, waterlogging causes loss of productivity.
HqA	3.4	Depression formed on sandy clay to clayey sand sediments (possibly old alluvium of the Bremer River). There is minor surface calcrete stone. Main soils: <u>shallow gradational sandy loam on calcrete</u> - <b>B3</b> (C) and <u>sandy loam over red clay</u> - <b>D3</b> (C), with <u>calcareous sandy loam</u> - <b>A4b</b> (L), <u>sandy loam over sandy clay over rubble</u> - <b>C1</b> (L), and <u>rubbly calcareous sandy loam</u> - <b>A4a</b> (L). Most of these soils are moderately deep with reasonable fertility and water holding capacity and good drainage. Productive potential is moderately high.
O-C	0.7	Low to moderate linear sandhills overlying the undulating landscape of GWB (above). Main soil: <u>deep bleached sand</u> - <b>H3</b> (D). These soils are infertile and prone to water repellence and wind erosion.
QMB	43.1	Stony rises formed on sheet and rubbly calcrete. Slopes are 2-6%. There is extensive surface calcrete stone and areas of sheet rock. Main soils: <u>shallow calcareous loamy sand over calcrete</u> - <b>B2</b> (V), with <u>rubbly calcareous sandy loam</u> - <b>A4a</b> (L), <u>shallow gradational sandy loam on calcrete</u> - <b>B3</b> (M) and <u>sand over sandy clay on calcrete</u> - <b>B7</b> (M). This land is too stony and the soils too shallow for cropping. Productive potential is limited by lack of soil moisture storage capacity.



QVB	2.6	Stony slopes underlain by calcrete and highly calcareous Woorinen Formation sediments. Slopes are 2-5%. Main soils: <u>shallow calcareous loamy sand over calcrete</u> - <b>B2</b> (E), <u>sand over sandy clay on calcrete</u> - <b>B7</b> (C), <u>sandy loam over red clay</u> - <b>D3</b> (L) and <u>rubbly calcareous sandy loam</u> - <b>A4a</b> (L). The dominant soils are shallow with restricted waterholding capacity and marginal fertility. The land is semi arable - stoniness prevents cultivation in places.
QXE	1.7	Elongate solution depressions within the calcreted slopes of QMB. The depressions are well defined, sometimes by low cliffs. Much of the hard calcrete has been dissolved, so soils are underlain by Tertiary sediments, or basement rock. There is extensive surface calcrete stone. Main soils: <u>rubbly calcareous sandy loam</u> - <b>A4a</b> (E), with <u>shallow gradational sandy loam on calcrete</u> - <b>B3</b> (C) and <u>shallow calcareous loamy sand over calcrete</u> - <b>B2</b> (L). This land is potentially arable due to the higher proportion of deeper soils relative to the surrounding slopes. However, restricted areas reduce the feasibility of cropping.
QdB	2.3	Rises with slopes of 2-5% formed on partly calcreted Tertiary sediments. Main soils: <u>shallow calcareous loamy sand over calcrete</u> - <b>B2</b> (E), <u>sand over dispersive sandy clay</u> - <b>G4</b> (E) and <u>rubbly calcareous sandy loam</u> - <b>A4a</b> (C). This land has features in common with <b>QMB</b> and <b>GWB</b> .
QhE	2.2	Drainage depressions underlain by Tertiary sediments, commonly calcreted. In places, basement rock is within a metre of the surface. There are low stony benches throughout, and up to 20% surface calcrete. Main soils: <u>sandy loam over sandy clay over rubble</u> - <b>C1</b> (C), <u>sandy loam over red clay</u> - <b>D3</b> (C) and <u>rubbly calcareous sandy loam</u> - <b>A4a</b> (C) with <u>shallow calcareous loamy sand over calcrete</u> - <b>B2</b> (L) on benches. The shallow soils over calcrete have limited waterholding capacities and are commonly too shallow and stony for cultivation. The deeper soils are potentially productive with no significant limitations, other than their intimate association with shallower soils.
QnB	0.7	Upper slopes formed on calcrete overlain by sand spreads. There are extensive calcrete sheet rock outcrops. Main soils: <u>shallow calcareous loamy sand over calcrete</u> - <b>B2</b> (E) and <u>bleached sand over calcrete</u> - <b>B8</b> (E). The mixture of shallow stony soils and moderately deep sands is unfavourable for cropping. The land is also high in the landscape, so wind exposure can be expected.
RAB	15.1	Slopes and rises with slopes of 2-5%, formed on sheet calcrete. There is 10-20% surface calcrete, with sheet rock exposed in places. Main soils: <u>bleached sand over calcrete</u> - <b>B8</b> (E) and <u>shallow calcareous loamy sand over calcrete</u> - <b>B2</b> (E), with <u>sand over sandy clay on calcrete</u> - <b>B7</b> (L). These soils are generally too shallow or too sandy for cropping.

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

(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 on sheet calcrete

These soils are shallow on sheet calcrete which is very hard at the top but grades with depth to soft very highly calcareous pale brown sandy loam to clay loam with decreasing rubble content and overlies Tertiary clayey sand to sandy clay or Pleistocene heavy clay at depths ranging from 100 cm to 10 m.

- B2** Shallow calcareous loamy sand over calcrete (Petrocalcic Calcarosol)  
Medium thickness moderately calcareous brown loamy sand to light sandy clay loam with variable calcrete fragments, overlying sheet calcrete or heavy rubble.
- B3** Shallow gradational sandy loam on calcrete (Petrocalcic, Red Kandosol)  
Medium thickness loamy sand to sandy loam grading to a red massive sandy clay loam over sheet calcrete at about 30 cm.



- B7** Sand over sandy clay on calcrete (Petrocalcic, Brown Chromosol)  
Thin brown sand to sandy loam with a pink A2 horizon, overlying an orange sandy clay loam to light clay with calcrete fragments. At 30 cm is a layer of massive or rubbly calcrete.
- B8** Bleached sand over calcrete (Petrocalcic, Bleached-Leptic Tenosol)  
Medium to thick greyish brown loose sand with a bleached A2 layer containing minor calcrete fragments, overlying sheet calcrete.

#### **Soils formed on calcrete rubble**

These soils are underlain by pale brown very highly calcareous clayey sand to light clay with abundant calcrete rubble or nodules (Class IIIB or IIIC carbonates) which grade to brown, yellow, red and grey clayey sand to sandy clay sediments from about 70 cm.

- A4a** Rubbly calcareous sandy loam (Supracalcic / Lithocalcic Calcarosol)  
Medium thickness brown calcareous loamy sand to light sandy clay loam with minor calcrete nodules, overlying carbonate rubble.
- C1** Sandy loam over sandy clay over rubble (Lithocalcic, Red Kandosol)  
Medium thickness reddish loamy sand to light sandy clay loam, overlying a red brown weakly structured sandy clay loam to light clay, grading to carbonate rubble.

#### **Soils formed on Tertiary sediments capped by fine carbonates**

These soils are underlain by highly calcareous sandy clay loam to clay grading to brown, red and grey clayey sand to sandy clay sediments within 100 cm.

- A4b** Calcareous sandy clay loam (Hypercalcic Calcarosol)  
Calcareous sandy clay loam grading to a very highly calcareous sandy light clay at about 20 cm over Tertiary sandy clay from about 70 cm.
- F2** Sandy loam over dispersive brown clay (Hypercalcic, Brown Sodosol)  
Thin sandy loam sharply overlying a dispersive brown clay, highly calcareous from about 30 cm, grading to Tertiary sediments from about 50 cm.
- D3** Sandy loam over red clay (Hypercalcic, Red Sodosol)  
Thin to medium thickness soft sandy loam, overlying a red coarsely structured sandy clay to clay, very highly calcareous with limited hard nodules and some gypsum from 40 cm and grading to Tertiary sediments at about 85 cm.
- G4** Sand over dispersive sandy clay (Calcic, Brown Sodosol)  
Medium to thick loose grey sand with a bleached A2 layer, abruptly overlying a brown, yellow and red mottled coarsely structured sandy clay loam to sandy clay, calcareous from about 50 cm, grading to Tertiary sediments.

#### **Soils formed on drift sand**

- H3** Deep bleached sand (Basic, Arenic, Bleached-Orthic Tenosol)  
Very thick bleached sand, organically darkened at the surface, grading to a yellow sand over clayey sand at depths ranging from 70 to 200 cm.

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

