

MGL Magulla Land System

Rises and low hills in the Nantawarra - South Hummocks - Beaufort area

Area: 178.8 km²

Annual rainfall: 335 – 475 mm average

Geology: The Land System is underlain by quartzites of the Tent Hill Formation. However, the rocks are only at or near the surface in relatively small areas on steeper ridges. The bulk of the land surface is formed on clays, which appear to be derived from either the deep weathering of the underlying quartzite, or local reworking of the weathered material. The clays contain variable quartzite fragments. Some of the clayey sediments may be Tertiary remnants. There are minor areas of silcrete where residual Tertiary sediments have been altered to silica rich rocks. There is also a small dunefield. The land is mantled by windblown carbonates (Woorinen Formation) as subsurface rubble layers or soft segregations. In places these deposits are over a metre thick.

Topography: The Magulla Land System is a prominent feature rising gradually over 200 m above the Wakefield coastal plain. The underlying quartzite basement rocks which are responsible for the relief form three prominent rounded north south ridges, namely the Kangaroo Hill - Mt. Templeton Range on the eastern side, the Middle Range towards the western side and a smaller intervening range. These ranges are gently inclined to moderately steep with relief of up to 100 m. Between the ranges are undulating rises with slopes of up to 12% formed on clayey sediments. Flanking both the ranges and the rises are outwash fans with slopes of up to 10%. Drainage depressions associated with the fans are moderately well defined and generally flow in a southerly direction.

Elevation: 250 m (Mt. Templeton) to 20 m in the south adjacent to the Wakefield Plains

Relief: Maximum local relief is 100 m

Soils: Calcareous loams are the most common soils, formed on highly weathered rocks, fresh weathered rocks, unconsolidated outwash sediments, or windblown calcareous materials. Loamy gradational and texture contrast soils are sub dominant. Shallow stony soils, deep sands and sand over clay soils are minor.

Main soils

Soils formed on unconsolidated sediments

- C3** Gradational clay loam - common (rises and fans)
- A3** Calcareous loam - common (outwash fans)
- A6** Calcareous clay loam - limited (outwash fans and rises)
- A5** Rubbly calcareous loam over clay - limited (fans)

Soils formed on basement rock or silcrete

- A2** Shallow rubbly calcareous loam - limited (rises)

Minor soils

Soils formed on unconsolidated sediments

- D2** Hard loam over red clay - rises and fans
- D3** Sandy loam over dispersive red clay - rises and fans
- C1** Gradational loam - fans



Soils formed on basement rock or silcrete

- C2** Gradational loam over rock - rises
L1 Shallow stony loam - steeper rocky slopes
D7 Sandy clay loam over dispersive red clay - rises

Soils formed on Woorinen Formation carbonates and on sand hills

- A4a** Rubbly calcareous loam - swales
A4b Calcareous sandy loam - swales
H2 Deep sand - sand hills
G1 Loamy sand over red sandy clay - sand hills

Main features: The Magulla Land System is very gently undulating to moderately steep land comprising two main components. Undulating to moderately steep slopes formed directly on quartzite basement rock are subdominant in terms of area, but are the most conspicuous feature. These slopes are semi arable. Steeper rocky slopes have little potential for uses other than grazing, but the more gentle slopes, although stony, exposed and with moderately shallow soils are arable. The bulk of the land is very gently inclined to undulating with generally deep, moderately fertile and well structured soils having loam to clay loam surfaces and more clayey subsoils. Most are alkaline throughout. Main limitations are chemical - high subsoil boron levels and moderate subsoil salinity. Rainfall decreases to the west and the south, imposing an overall limitation on productive potential.

Soil Landscape Unit summary: 18 Soil Landscape Units (SLUs) mapped in the Magulla Land System:

SLU	% of area	Main features #
ATC ATI	1.9 2.3	Moderately inclined strongly dissected stony slopes of 15-30%, formed on quartzite with up to 20% surface quartzite and minor rock outcrop. ATC With minor watercourse erosion. ATI With moderate watercourse erosion. Main soils: <u>gradational loam over rock - C2 (E)</u> and <u>shallow rubbly calcareous loam - A2 (E)</u> with <u>shallow stony loam - L1 (C)</u> . Land all non arable due to moderately steep slopes, erosion potential and rockiness. Soils generally shallow and stony, although moderately fertile due to relatively high clay contents. Much of the land subject to wind exposure, reducing potential pasture productivity.
EBC EBD EBH EBI	5.4 0.4 5.3 5.1	Rises and low hills with rounded crests formed on quartzites. There is up to 20% surface quartzite and calcrete fragments. EBC Rounded low hills and rises to 40 m high with slopes of 4-12%. EBD Low hills to 40 m high with slopes of 10-18%. EBH Low rounded hills to 70 m high with slopes of 4-15% and eroded watercourses. EBI Low hills and moderate slopes to 50 m with slopes of 10-20% and eroded watercourses. Main soils: <u>shallow rubbly calcareous loam - A2 (E)</u> , with <u>hard loam over red clay - D2 (C)</u> , <u>gradational loam over rock - C2 (C)</u> , <u>gradational clay loam - C3 (L)</u> , <u>shallow stony loam - L1 (M)</u> and <u>rubbly calcareous loam - A4a (M)</u> . Although soils are stony and often shallow, land is mostly arable, except for the steeper slopes of EBI and some steeper sections associated with narrow rocky gullies elsewhere. All areas, especially the steeper slopes of EBD and EBI are susceptible to erosion. Minor limitations to agriculture include some hard setting surfaces, subsoil boron toxicity and mild salinity and alkalinity in calcareous soils. Significant areas on the rounded crests are highly exposed.
EQB	0.5	Gentle slopes of 2-3% formed on silcreted Tertiary remnant. Up to 20% surface silcrete and calcrete. Main soils: <u>calcareous loam - A2 (E)</u> , <u>shallow stony loam - L1 (E)</u> and <u>sandy clay loam over dispersive red clay - D7 (E)</u> . Semi arable with patches of shallow stony soils restricting cultivation.



IVB IVE	9.3 2.1	Outwash fans and drainage depressions formed on Tertiary clays. IVB Fans with slopes of 2-3%. IVE Drainage depressions and lower slopes of 1-2%. Main soils: <u>calcareous clay loam</u> - A6 (E), <u>rubbly calcareous loam over clay</u> - A5 (C), and <u>sandy loam over dispersive red clay</u> - D3 (C) with <u>gravelly calcareous loam</u> - A3 (L). This land has mostly deep moderately fertile soils, although D3 soils are poorly structured. The main soil limitations are caused by chemical barriers to root growth (high subsoil boron and moderate salinity).
IYB	2.8	Gently inclined low rises on the outwash fans of IVB, with slopes of 2-4% and up to 10% surface quartzite and calcrete stone. Main soils: <u>rubbly calcareous loam over clay</u> - A5 (E) and <u>gradational clay loam</u> - C3 (E). This land is similar to IVB, but is stonier, with increased likelihood of restricted soil moisture holding capacity.
IZB IZC	12.2 16.6	Rises and low hills formed on a complex of weathered basement quartzites and heavy clay, the latter probably derived from rock weathering. IZB Very gently undulating slopes of 1-3%. IZC Undulating low hills with slopes of 3-12% and relief of 60 m. Main soils: <u>gradational clay loam</u> - C3 (E) and <u>calcareous clay loam</u> - A6 (C), with <u>rubbly calcareous loam over clay</u> - A5 (L), <u>sandy loam over dispersive red clay</u> - D3 (M), <u>hard loam over red clay</u> - D2 (M), <u>gravelly calcareous loam</u> - A3 (M), <u>shallow rubbly calcareous loam over rock</u> - A2 (M), <u>gradational loam over rock</u> - C2 (M), and <u>rubbly calcareous loam</u> - A4a (M). This land is fully arable, although steeper slopes require contour banking to control water erosion. The soils are generally medium textured and calcareous, affecting fertility (through induced nutrient deficiencies) to some extent. The main soil limitations are moderate to high levels of boron and salt, sometimes at moderately shallow depth. Poor soil structure resulting in waterlogging and difficult workability occurs on some mid to lower slopes.
KNB KNC KNE KNH KNJ	14.8 10.9 7.1 2.3 0.7	Outwash fans and drainage depressions formed on sandy clay loam to clay sediments with variable quartzite gravel. KNB Fans with slopes of 2-3%. KNC Fans with slopes of 3-10%. KNE Broad drainage depressions with slopes of 2-4%. KNH Fans with slopes of 4-10% and eroded watercourses. KNJ Drainage depressions with slopes of 3-6% and eroded watercourses. Main soils: <u>gravelly calcareous loam</u> - A3 (E), <u>hard loam over red clay</u> - D2 (C), <u>calcareous clay loam</u> - A6 (L) and <u>rubbly calcareous loam over clay</u> - A5 (L), with <u>gradational clay loam</u> - C3 (M), <u>gradational loam</u> - C1 (M) and <u>sandy loam over dispersive red clay</u> - D3 (M). Generally good agricultural potential, having deep, fertile and mostly well drained soils. Potential for water erosion, especially on slopes of KNC and KNH, which are susceptible to runoff from adjacent higher ground. Watercourse erosion has been a problem in KNH and particularly the larger watercourses in KNJ. Minor soil limitations include hard setting surface soils in places, boron toxicity, salinity and alkalinity.
UIf	0.3	Dunefields superimposed on gently undulating rises, with 30-60% moderate sandhills, underlain by medium textured, mixed non rubbly and rubbly calcareous deposits. Main soils: <u>deep sand</u> - H2 (C) with <u>loamy sand over red sandy clay</u> - G1 (L) on sandhills, and <u>calcareous sandy loam</u> - A4b (E) with <u>rubbly calcareous loam</u> - A4a (C) in swales, lower slopes and low rises. Soil conditions change rapidly across the dune-swale landscape. All the land is arable, but the dunes have moderate limitations due to low fertility, restricted waterholding capacity, and wind erosion potential. The heavier textured swales are more fertile with minor limitations due to boron toxicity, wind and water erosion potential and moderate fertility.

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:

- A2** Shallow rubbly calcareous loam (Paralithic / Lithic, Supracalcic / Lithocalcic Calcarosol)
10 - 20 cm calcareous sandy loam to clay loam over rubbly Class III B / III C carbonate at 20 cm, grading to soft highly calcareous sandy clay loam over quartzite or silcrete at depths ranging from 40 cm to more than 100 cm.
- A3** Gravelly calcareous loam (Regolithic, Calcic Calcarosol)
10 - 25 cm gravelly calcareous loam to clay loam becoming more clayey with depth over Class I carbonate at 35 cm, grading to quartz gravelly alluvium at depths ranging from 70 cm to more than 100 cm.
- A4a** Rubbly calcareous loam (Regolithic, Supracalcic / Lithocalcic Calcarosol)
Calcareous sandy loam to clay loam grading to Class III B or III C carbonate rubble at about 30 cm, overlying a very highly calcareous light clay.
- A4b** Calcareous sandy loam (Regolithic, Hypercalcic Calcarosol)
Calcareous sandy loam grading to a very highly calcareous sandy clay loam over soft (less than 20% rubble) Class III A carbonate at about 50 cm.
- A5** Rubbly calcareous loam over clay (Regolithic, Supracalcic Calcarosol)
Calcareous loam to clay loam over rubbly Class III B carbonate from about 25 cm grading to a very highly calcareous clay loam, over Tertiary or alluvial medium clay at about 90 cm.
- A6** Calcareous clay loam (Pedal, Hypercalcic Calcarosol)
10 - 20 cm calcareous loam to clay loam grading to very highly calcareous light to medium clay with abundant fine carbonate becoming more clayey with depth over quartzite gravelly alluvium or deeply weathered quartzite at depths ranging from 60 cm to more than 100 cm.
- C1** Gradational loam (Supracalcic, Red Kandosol)
15 - 25 cm loam grading to a weakly structured clay loam over Class III B rubble at 30 cm merging with quartz gravelly clay loamy alluvium at 100 cm.
- C2** Gradational loam over rock (Hypercalcic / Supracalcic, Red Dermosol)
10 - 25 cm clay loam grading to a well structured red clay with abundant soft to rubbly carbonate from 35 cm over weathering quartzite at 80 cm.
- C3** Gradational clay loam (Hypercalcic / Supracalcic, Red Dermosol)
10 - 25 cm clay loam grading to a well structured red clay with soft to rubbly carbonate at 40 cm merging with heavy clay/deeply weathered quartzite or quartz gravelly clayey alluvium at 100 cm.
- D2** Hard loam over red clay (Hypercalcic, Red Chromosol)
15 - 30 cm hard sandy loam to loam abruptly overlying a red well structured clay with soft to slightly rubbly carbonate from 50 cm grading to deeply weathered quartzite / quartzite gravelly alluvium or heavy clay deeper than 100 cm.
- D3** Sandy loam over dispersive red clay (Calcic, Red Sodosol)
30 - 45 cm hard quartz gravelly sandy loam with a bleached A2 layer abruptly overlying a coarsely structured dispersive red clay, calcareous from 70 cm grading to clayey weathering material or alluvium from 100 cm.
- D7** Sandy clay loam over dispersive red clay (Calcic, Red Sodosol)
Up to 20 cm hard sandy clay loam over a dispersive coarsely structured red clay, calcareous from about 25 cm, grading to silcrete at about 100 cm.
- G1** Loamy sand over red sandy clay (Lithocalcic / Hypercalcic, Red Chromosol)
Medium thickness loamy sand abruptly overlying a massive red sandy clay loam to sandy clay with soft to rubbly Class III A, B or C carbonate from about 45 cm.
- H2** Deep sand (Hypocalcic Calcarosol)
Thick calcareous sand grading to a highly calcareous clayey sand between 50 and 100 cm.
- L1** Shallow stony loam (Lithic, Leptic Tenosol)
Up to 50 cm stony sandy loam to loam, often with fine or rubbly carbonate from about 30 cm, overlying quartzite or silcrete.

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

