NEF Neales Flat Land System

Footslopes and outwash fans extending from Eudunda to two km north of Dutton

Area: 69.9 km^2

Annual rainfall: 340 – 465 mm average

Geology: The land is formed on a variety of basement rocks including interbedded siltstones and quartzites of the Wilyerpa Formation, Appila Tillites and Tapley Hill siltstones, with a ridge of Backstairs Passage Formation sandstones. All rocks are metamorphosed to some extent - phyllites, metasandstones and quartzites are the main lithologic types. Extensive erosion of the escarpment along the western edge of the Land System has resulted in the deposition of thick alluvial sediments between the basement rock rises. These sediments are mainly fine grained. All rocks and sediments are mantled by secondary carbonates which are generally soft, but rubbly forms also occur.

Topography: The Neales Flat Land System comprises undulating to moderately steep rises up to 30 m high forming a discontinuous footslope belt on the eastern edge of the Mt. Rufus Land System. Between the rises are gently inclined outwash fans formed on alluvial sediments. In the north, the fans are more extensive and flatten out towards the east. Minor to moderate and occasionally severe watercourse erosion is a feature of the fans. The fans in the north are interrupted by two north - south trending rocky ridges. The more easterly is an extension of the Cooke Hill Land System; the western ridge is an extension of the Coronation Hill Range (part of the Peep Hill Land System).

Elevation: 380 m to 260 m

Relief: Maximum relief is 50 m (rocky ridges)

Soils: Sandy loam over red clay soils and calcareous loams are the most common soils, although they vary with respect to depth and structure. Typical soils are:

Main soils

D3	Hard sandy loam over dispersive red clay - common (outwash fans)
D2	Hard sandy loam over red clay - common (outwash fans)
A4	Rubbly calcareous loam - limited (fans)
A2	Shallow calcareous loam on rock - limited (rises)
A6	Deep calcareous loam over clay - limited (flats and outwash fans)

Minor soils

D7	Hard stony clay loam to sandy loam over dispersive red clay on rock - footslopes
D1	Hard loam over red clay on rock - rises in the east
L1/B3	Shallow stony loam to sandy loam - rocky ridges
D3/D7	Hard loam over dispersive red clay on deeply weathered rock
B2	Shallow calcareous loam over calcrete - stony rises
A3	Deep calcareous loam - drainage depressions
B6	Loam over red clay on calcrete – slopes
C5	Clay loam over black clay - footslopes

Main features: Although it includes a range of land types, the Neales Flat Land System is characterized by poorly structured texture contrast soils. These are very extensive on outwash fans and also extensive on rising ground. These soils have low infiltration rates, are difficult to work effectively without further damaging structure and cause patchy emergence. They are highly erodible, and there is considerable evidence of past erosion (as gullies and scalds) to illustrate the effects of inappropriate surface management. However, these soils are moderately deep and inherently fertile, and can be productive. Boron levels of more than 15 mg/kg and water pH values of more than 9.5 can occur at shallow depth - tolerant cultivars are required to overcome these barriers. There is a range of other soils, the most common of which are calcareous loams, both on fans and rises. These are well structured, but often shallow and rubbly, with consequent limited waterholding capacity.

Soil Landscape Unit summary: 19 Soil Landscape Units (SLUs) mapped in the Neales Flat Land System:

SLU	% of area	Main features #
AKA	2.1	Ridge, 15 m high and with slopes of 6-12% formed on highly resistant metasandstones of the Backstairs Passage Formation. There is 10-20% surface sandstone and up to 10% outcropping rock. Main soils: shallow stony sandy loam - **L1** (V) with hard stony clay loam over dispersive red clay on rock - **D7** (C) and shallow calcareous loam on rock - **A2** (L). This land is very rocky with shallow soils and although small areas have sufficient soil depth for cropping, most of the land is only suited to rough grazing. About half is still under scattered scrub which provides useful shelter.
ARC ARI	1.7 0.8	Ranges formed on interbedded metasiltstones and quartzites of the Wilyerpa Formation. There is 20-50% surface quartzite including up to 10% rocky outcrop. **ARC** Range to 40 m high with slopes of 10-30%. **ARI** Range to 50 m high with slopes of 10-30% and eroded Watercourses. Main soils: hard stony clay loam over dispersive red clay on rock - **D7** (E) and shallow stony loam - **L1** (E) with shallow calcareous loam on rock - **A2** (L). Except for some minor lower slopes with deeper soils, this land is too rocky and generally too steep for farming, although soils are commonly moderately deep. There is extensive scrub cover providing stock shelter.
DMC DMH	1.8 4.7	Footslopes and rises formed on phyllites of the Wilyerpa Formation, with up to 20% surface stone. **DMC** Rises to 20 m with slopes of 3-10%. **DMH** Rises to 30 m with slopes of 4-12% and eroded Watercourses. Main soils: hard stony clay loam over dispersive red clay on rock - **D7** (V), with shallow stony loam - **L1** (L), shallow calcareous loam on rock - **A2** (M) and clay loam over black clay - **C5** (M). The predominant soils are moderately deep and fertile but poorly structured. Hard setting surfaces and dispersive subsoils cause excessive runoff, sub surface waterlogging, reduced waterholding capacity and patchy emergence/early growth. High subsoil boron and pH restrict rooting depth and effective water holding capacity. The soils are highly erodible, and as they often occur on footslopes, potential for erosion is high. Watercourses are particularly vulnerable.
DSD DSI	2.1 2.3	Moderately steep low rises to 30 m high formed on phyllites of the Wilyerpa Formation. Slopes are 10-20% and there is up to 10% outcropping rock and variable surface stone, up to 20%. **DSD** Watercourses mainly stable. **DSI** Watercourses generally eroded. Main soils: hard stony clay loam over dispersive red clay on rock - **D7** (E) and shallow stony loam - **L1/B3** (E), with shallow calcareous loam on rock - **A2** (L). This land is moderately steep and marginal for cropping due to the potential for erosion. Rocky outcrops limit productive potential and increase runoff.
DTD	0.7	Ridges and rises to 30 m high with slopes of 10-20% formed on metasandstones. There is about 20% rock outcrop in linear reefs. Main soils: hard stony clay loam over dispersive red clay on rock - **D7** (E) and shallow stony sandy loam - **L1** (E), with shallow calcareous loam on rock - **A2** (L). This land is semi arable due to rocky outcrop and moderate slopes. The soils between the reefs are generally moderately deep and fertile but poorly structured with hard setting surfaces and sometimes dispersive subsoils. These conditions cause excessive runoff which adds to the erosion hazard.

EGB EGC	0.9 13.4	Rises formed on metamorphosed Appila Tillites and Tapley Hill siltstones with up to 20% surface calcrete and siltstone fragments. **EGB** Low rises less than 10 m high with slopes of less than 4%. **EGC** Footslopes and rises to 30 m high with slopes of 4-10%. Main soils: shallow calcareous loam on rock - **A2** (E) and hard loam over red clay on rock - **D1** (E), with shallow calcareous loam over calcrete - **B2** (M) and loam over red clay on calcrete - **B6** (M). These soils are moderately shallow to very shallow, are moderately fertile, and generally well structured, although the D1 soils have a tendency to set hard.
JDo	2.5	Creek flats formed on fine grained alluvium with slopes of less than 2% and eroded Watercourses. Up to 5% of the land is affected by scalding. Main soils: hard sandy clay loam over (dispersive) red clay - **D3/D2** (E) with deep calcareous loam over clay - **A6** (C) and rubbly calcareous loam - **A4** (L). These soils are deep and inherently fertile but historic erosion has in places exposed sodic, saline and high boron subsoil materials which restrict rooting depth. Uneroded areas, where these limiting layers are deeper are moderately productive, but perennial vegetation is needed on damaged areas to prevent further erosion.
JGB JGC JGG JGH JGJ JGl JGm	1.4 1.2 41.9 5.6 5.3 3.4 4.6	Outwash fans and drainage depressions formed on fine grained alluvial sediments with up to 10% surface quartzite and calcrete. **JGB** Fans with slopes of 2-3%. **JGC** Fans with slopes of 3-10% and minor water course erosion. **JGG** Fans with slopes of 2-3% and moderate water course erosion. **JGH** Fans with slopes of 3-10% and moderate water course erosion. **JGJ** Drainage depressions with eroded Watercourses. **JGl** Fans with slopes of 2-3%, eroded Watercourses and minor scalding. **JGm** Fans with slopes of 3-10%, eroded Watercourses and minor scalding. Main soils: hard sandy loam over dispersive red clay - **D3** (E) and hard sandy loam over red clay - **D2** (C) with rubbly calcareous loam - **A4** (L), deep calcareous loam over clay - **A6** (L), hard loam over dispersive red clay on deeply weathered rock - **D3/D7** (L), and deep calcareous loam - **A3** (M). The dominant soils are deep and moderately fertile but poorly structured, with hard setting surfaces and dispersive subsoils. Low infiltration rates, sub surface waterlogging after heavy rain, reduced waterholding capacity and patchy emergence can be expected. High subsoil boron and pH levels limit rooting depth and consequently effective waterholding capacity. However, reasonable productivity can be achieved through the use of gypsum, modified surface management practices and boron tolerant varieties. Erosion potential on steeper slopes is moderate to high - gully erosion and scalding scars indicate historic erosion damage.
JYH	3.6	Footslope complex of outwash fans and low basement rock rises. Slopes are 2-8%, usually steepest adjacent to the escarpment on the western margin. Watercourses are commonly eroded. There is 10-20% surface quartzite and calcrete stone. Main soils: hard sandy loam over (dispersive) red clay - **D3/D2** (E) with hard loam over dispersive red clay on deeply weathered rock - **D3/D7** (C), deep calcareous loam over clay - **A6** (L) on fans and shallow calcareous loam on rock - **A2** (C) on rises. This land is fully arable with moderately deep soils limited mainly by poorly structured surfaces. These tend to shed water (increasing erosion potential), reduce waterholding capacity and affect emergence. High subsoil boron and pH levels limit rooting depth and effective waterholding capacity.

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

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

Detailed soil profile descriptions:

A2 Shallow calcareous loam on rock (Paralithic, Hypercalcic / Lithocalcic Calcarosol)
10 - 25 cm calcareous loam grading to a very highly calcareous light brown clay loam with variable carbonate rubble, merging with basement rock at about 60 cm.

A3 Deep calcareous loam (Regolithic, Calcic Calcarosol)
Calcareous loam with only minor increases in clay and carbonate with depth.

A4 Rubbly calcareous loam (Regolithic, Supracalcic / Lithocalcic Calcarosol)
15 - 20 cm calcareous loam overlying Class III B/C carbonate rubble grading to alluvium below 100 cm.

A6 Deep calcareous loam over clay (Regolithic / Pedal, Hypercalcic Calcarosol)
10 - 25 cm calcareous loam grading to a very highly calcareous light brown clay loam over clayey alluvium below 100 cm.

B2 Shallow calcareous loam over calcrete (Petrocalcic, Lithocalcic Calcarosol)
25 - 50 cm calcareous fine sandy loam to loam with Class III C carbonate rubble at shallow depth over calcrete underlain by very highly calcareous rubbly clayey sand.

B6 Loam over red clay on calcrete (Petrocalcic, Red Chromosol)
20 - 30 cm hard loam over a well structured red clay with a calcrete pan within 50 cm.

C5 Clay loam over black clay (Calcic, Black Dermosol)
20 - 30 cm dark clay loam grading to a well structured black clay, calcareous from 45 cm, over phyllite at 60 cm.

D1 Hard loam over red clay on rock (Lithocalcic / Hypercalcic, Red Chromosol)
15 - 20 cm hard gravelly loam abruptly overlying a well structured red clay, with rubbly to soft carbonate from 30 cm, grading to weathering metasiltstone from 55 cm.

D2 Hard sandy loam over red clay (Hypercalcic, Red Chromosol)
15 - 40 cm hard quartz gravelly sandy loam to clay loam abruptly overlying a well structured red clay, calcareous from 50 cm continuing below 100 cm.

D3 Hard sandy loam over dispersive red clay (Hypercalcic, Red Sodosol)
15 - 40 cm hard quartz gravelly sandy loam to clay loam abruptly overlying a coarsely structured and dispersive red clay, calcareous from 50 cm continuing below 100 cm.

D3/D7 Hard loam over dispersive red clay on deeply weathered rock (Hypercalcic, Red Sodosol)
15 - 30 cm hard quartz gravelly sandy loam to clay loam abruptly overlying a red coarsely structured dispersive clay, calcareous from 50 cm grading to very highly weathered rock continuing below 200 cm.

D7 Hard stony clay loam to sandy loam over dispersive red clay on rock (Calcic, Red Sodosol)
15 - 30 cm hard quartzite gravelly clay loam to sandy loam abruptly overlying a red coarsely structured dispersive clay, calcareous from 45 cm grading to weathering phyllite at 75 cm.

L1/B3 Shallow stony loam to sandy loam (Lithic / Petrocalcic, Leptic Tenosol)
Up to 40 cm stony loam to sandy loam directly overlying basement rock or calcrete.

Further information: DEWNR Soil and Land Program