

MAL Malcolm Land System

Low lying gently undulating plain adjacent to Lake Alexandrina between Wellington and Tolderol

Area: 145.3 km²

Annual rainfall: 355 – 400 mm average

Geology: The dominant surficial feature of the landscape is a thin black clay deposited during inundation by lake water during the last high sea level stand. The clay blankets all the lower lying ground with thicknesses of usually less than two metres and often less than 50 cm. The clays overlie buried soils similar to those described for the Brinkley Land System - bleached sands over grey mottled clays or semi hard limestones. Underlying these buried soils are mixed Tertiary or early Quaternary alluvial / lakebed clayey sands and sandy clays, with some heavy clays. The higher land not covered by the black clays is generally formed on sheet or rubbly calcretes, in places overlain by windblown sands.

Topography: The landscape is subdued, with gently undulating low rises alternating with low lying flats. The rises are calcrete based and usually stony, except where overlain by sand spreads or low dunes. The lower lying broader flats or narrow swales between the rises are characterized by salt affected land. The degree of salinization varies from marginal to severe, where saline water tables are permanently at or near the surface. Complexes of salinas, samphire flats and black clay flats are typical of this lower lying ground.

Elevation: 0 - 18 m

Relief: Less than 5 m

Soils: The soils range from shallow coarse textured profiles on calcrete, through deep siliceous and calcareous sands to deep sandy loams over clay and calcareous sandy loams. There is also a variety of wet saline soils on poorly drained flats.

Main soils

Swampy flats

N2/M2 Wet saline clay

Stony flats and rises

B3 Shallow stony non calcareous sandy loam

B2 Shallow stony calcareous sandy loam

Minor soils

Stony flats and rises

A4 Rubbly calcareous sandy loam

B7 Loamy sand over sandy clay on calcrete rubble

Sandy rises

G1 Thick sand over sandy clay loam

H1 Deep shell sand

H2 Moderately deep sand over calcrete

H3 Deep bleached sand

Well drained flats

A1 Gradational highly calcareous grey sand

F1 Sandy loam over black clay

M1 Deep grey sand

Swales (with marginally saline soils and moderately deep water table)



- A5/A6** Calcareous sandy loam
F2 Sandy loam over dispersive clay
G4 Loamy sand over grey dispersive clay
Saline flats (with shallow watertable)
E1/N2 Saline black cracking clay
N2/A7 Shallow calcareous sandy loam
N2/F2 Sandy loam over dark clay
Lunettes
G3 Sand over grey clay

Main features: The Malcolm Land System is a very gently undulating plain, the lower parts of which were inundated by a shallow lake in relatively recent times. These lower lying areas are underlain by saline ground water at shallow depth. Marginally to highly saline black clayey soils and sandy loam texture contrast soils predominate. Scattered salt pans occur where water tables are at the surface. The higher ground is underlain by sheet and rubbly calcrete, with superimposed sandhills and sand spreads. Soils are generally either shallow and stony, or deep, infertile and prone to wind erosion.

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

SLU	% of area	Main features #
HuO HuT	0.6 0.8	Swales underlain by clayey sediments. HuO Swales with up to 10% swampy depressions. HuT Marginally saline swales with 10-30% swampy depressions. Main soils: <u>sandy loam over dispersive clay</u> - F2 (E) and <u>calcareous sandy loam</u> - A5/A6 (E). There are limited areas of soils as listed for ' <i>Saline flats</i> ' (in 'Detailed Soil Profile Descriptions' below). These are areas where saline ground watertables are affecting or have the potential to affect surface soils. Establishment of salt tolerant pastures or other vegetation is the key management issue in these areas.
O-B ODI	3.4 5.7	Sand dunes and spreads, dominated by bleached sands. Many of the sand dunes are uncleared, and many of the cleared dunes have eroded in the past, especially those which have been only partially cleared. O-B Parallel east - west oriented moderate sand dunes. ODI 30-60% moderate sand dunes superimposed on gently undulating calcrete. Main soils: <u>thick sand over sandy clay loam</u> - G1 (E-C) and <u>deep bleached sand</u> - H3 (E-C). Soils as listed under ' <i>Stony flats and rises</i> ' and ' <i>Swales</i> ' (in 'Detailed Soil Profile Descriptions' below) occur between the sand dunes of ODI, on the lower slopes of O-B and on eroded sections of O-B. The sandy soils are infertile and prone to water repellence and wind erosion. Productivity potential is low. Wind erosion control is a management priority on unstable dunes. Most of the cleared dunes are arable, but specialized management techniques and crops such as cereal rye are needed to maintain stability.
QyB QyL	7.9 13.9	Very gently undulating rises formed on sheet and rubbly calcrete and overlain by up to 30% low sandhills. There is variable surface calcrete. QyB Rises with negligible salinity. QyL Rises with up to 5% saline swampy depressions. Main soils: <u>shallow stony non calcareous and calcareous sandy loam</u> - B3/B2 (E) and <u>rubbly calcareous sandy loam</u> - A4 (L), and <u>loamy sand over sandy clay on calcrete rubble</u> - B7 (C) on stony rises, with <u>deep bleached sand</u> - H3 (L), <u>moderately deep sand over calcrete</u> - H2 (L) and <u>thick sand over sandy clay loam</u> - G1 (L) on sandhills. The soils are either shallow and stony with restricted water holding capacities, or deep, infertile and prone to wind erosion.



QzZ	9.6	Low benches formed on sheet calcrete. There is extensive surface calcrete and near surface rocky reefs. Main soils: <u>shallow stony non calcareous and calcareous sandy loam</u> - B3/B2 (D). These soils are shallow, stony and generally non arable.
U-B UUK UUR	0.3 9.7 0.3	Sand dunes and spreads dominated by brown and red sands. U-B Isolated moderate sandhills adjacent to the shoreline. UUK Sand spreads (50% of area) superimposed on low rises. UUR Sand spreads (50% of area) superimposed on low rises with up to 10% saline flats. Main soils: <u>moderately deep sand over calcrete</u> - H2 (E-V) with <u>deep shelly sand</u> - H1 (L) on isolated sandhills near the shore. Areas not covered by sands have soils over calcrete similar to those in QyB/QyL, although as they are associated with sandhills, soil depth is greater. Lower lying swales are similar to HuO / HuT. The sands are infertile and prone to wind erosion.
VvM	2.9	Flats on the fringe of the lake between the outflows of the Bremer River and Mosquito Creek. There are 5-10% saline swamps and sporadic low rises. Main soils: <u>black cracking clay</u> - E1 (E) and <u>sandy loam over dispersive clay</u> - F2 (E), with <u>wet saline clay</u> - N2/M2 (M) in swamps and <u>shallow stony calcareous loam</u> - B2 (L) on rises. These flats are moderately to highly saline. Some of this land has been irrigated, but generally soil salinity and waterlogging are too limiting. Most of the land is suitable for the establishment of salt tolerant pastures, but the combination of clayey textures and elevated salt levels restricts water availability.
VwM	7.8	Very gently undulating flats with up to 10% saltpans. Main soils: <u>saline black cracking clay</u> - E1/N2 (C), <u>shallow calcareous sandy loam</u> - N2/A7 (C), <u>sandy loam over dispersive clay</u> - F2 (L) and <u>loamy sand over grey dispersive clay</u> - G4 (L). <u>Wet saline clay</u> - N2/M2 (L) occurs in swampy depressions. Most of this land is marginally to moderately saline. Salinity and waterlogging are the main limitations to productivity.
VxJ VxN	6.5 1.5	Near shore flats with minor saltpans and low parallel rises adjacent to the lake. VxJ Flats. VxN Complex of low parallel ridges (50%) and narrow swales (50%), producing a corrugated land surface. Main soils on VxJ flats: <u>sandy loam over black clay</u> - F1 (E) and <u>gradational highly calcareous grey sand</u> - A1 (E) and <u>deep grey sand</u> - M1 (L). Main soils of VxN: <u>deep shell sand</u> - H1 (E) on rises with soils as for VxJ in swales. Variable soil salinity is the main limitation to productivity. The soils of the flats are deep and fertile, but water tables are shallow. The ridges are not affected but are very narrow, with infertile erosion prone soils.
ZC-	12.9	Saline flats with bare saltpans covering more than 75% of the area. The rest is mixed samphire and moderately saline flats. Main soils: <u>wet saline clay</u> - N2/M2 (V) with <u>saline black cracking clay</u> - E1/N2 (L) and <u>sandy loam over dispersive dark clay</u> - N2/F2 (M).
ZD-	1.3	Salt lake.
ZH- ZJ-	11.3 3.4	Saline flats with a mosaic pattern of flats, salt pans and lunettes. ZH- Complex of about 80% saline flats and 20% salt pans. ZJ- Complex of 70% saline flats, 20% saltpans and 10% lunettes. Main soils: <u>saline black cracking clay</u> - E1/N2 (C) and <u>sandy loam over dispersive dark clay</u> - N2/F2 (C) with <u>wet saline clay</u> - N2/M2 (E) in wetter areas, and <u>sand over grey clay</u> - G3 (L) on lunettes. This land is too wet and saline (flats), or too infertile and wind erosion prone (lunettes) for any uses other than light grazing. Establishment of salt tolerant grasses is difficult due to the clayey soils.
ZL-	0.2	Low ridges. Main soil: <u>sand over grey clay</u> - G3 (D). These soils are infertile and prone to wind erosion. They have little agricultural value.

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:*Stony flats and rises*

- A4** Rubbly calcareous sandy loam (Supracalcic / Lithocalcic Calcarosol)
Calcareous sandy loam to loamy sand with increasing carbonate nodules with depth.
- B2** Shallow stony calcareous loam (Petrocalcic Calcarosol)
Medium thickness calcareous sandy loam to clay loam over Class III C carbonate rubble.
- B3** Shallow stony non calcareous sandy loam (Petrocalcic, Leptic Rudosol)
Medium thickness loamy sand to sandy loam over calcrete.
- B7** Loamy sand over sandy clay on calcrete rubble (Lithocalcic / Supracalcic, Brown Chromosol)
Medium thickness sand to sandy loam over a brown sandy clay loam to sandy clay grading to Class III B or III C rubble from about 20 cm, over calcrete at about 30 cm.

Sandy rises

- G1** Thick sand over sandy clay loam (Hypercalcic, Brown Sodosol)
Thick to very thick red to grey sand over a brown sandy clay loam to sandy clay, highly calcareous with depth, becoming sandier from about 100 cm.
- H1** Deep shell sand (Shelly Rudosol)
More than 100 cm coarse sand comprising mainly crushed shells.
- H2** Moderately deep sand over calcrete (Petrocalcic, Brown-Orthic Tenosol)
Between 30 and 120 cm sand with a paler coloured A2 layer over calcrete.
- H3** Deep bleached sand (Arenic, Bleached-Orthic Tenosol)
Very thick bleached sand with an organically darkened surface grading to a yellow sand at variable depth.

Well drained flats

- A1** Gradational highly calcareous grey sand (Effervescent, Hypercalcic, Grey Chromosol / Kandosol)
Highly calcareous sand to sandy loam over a very highly calcareous grey sandy loam to sandy clay, over shell sand within 50 cm.
- F1** Sandy loam over black clay (Sodic, Calcic, Black Chromosol)
Thin to medium dark grey loamy sand to sandy clay loam, overlying a black sandy clay to heavy clay with coarse prismatic structure, calcareous at shallow depth, grading to a buried white mottled shelly sand from about 50 cm.
- M1** Deep grey sand (Regolithic, Grey-Orthic Tenosol)
Thick to very thick dark grey sand, paler coloured with depth, continuing below 100 cm.

Marginally saline swales and flats

- A5/A6** Calcareous sandy loam (Supracalcic / Hypercalcic Calcarosol)
Medium thickness calcareous loamy sand to light sandy clay loam, overlying a highly calcareous sandy clay loam from 40 cm grading to brown, red and grey sandy clay to clay from 70 cm.
- F2** Sandy loam over dispersive clay (Hypercalcic, Brown Sodosol)
Thin sandy loam sharply overlying a dispersive brown clay, highly calcareous from about 30 cm, grading to grey and red clay from about 50 cm.
- G4** Loamy sand over grey dispersive clay (Lithocalcic, Grey Sodosol)
Thin soft loamy sand to light sandy loam abruptly overlying a grey columnar clay, calcareous with depth over semi hard carbonate from about 40 cm.



*Saline flats***E1/N2** Saline black cracking clay (Salic, Pedal, Aquic Vertosol)

Medium thickness black clay with coarse blocky structure, overlying a dark grey sticky heavy clay with coarse prismatic structure, grading to a buried sand over clay soil at 50 cm.

N2/A7 Shallow calcareous sandy loam (Lithocalcic Calcarosol)

Medium thickness black calcareous loamy sand to fine sandy clay loam, overlying shell grit, semi-hard limestone or soft marl, grading to highly calcareous grey clay. Buried sand over clay soil at 50 cm.

N2/F2 Sandy loam over dispersive dark clay (Calcic, Brown Sodosol)

Medium thickness dark brown fine sandy loam to sandy clay loam, overlying a dark fine sandy clay to medium clay with strong blocky structure, becoming yellowish mottled and calcareous (Class I carbonate) from 65 cm.

N2/M2 Wet saline clay (Dermosolic Hydrosol / Aquic Vertosol)

Thin (may be absent) dark clay loam over a dark grey stiff clay, becoming lighter grey with yellow mottles at depth, and with variable rubbly to semi hard calcrete within 50 cm. Gypsum crystals and iron segregations are common. Sandier lenses with shells may occur below 100 cm. Highly saline watertable usually within 100 cm.

*Lunettes***G3** Sand over grey clay (Grey Sodosol)

Thick to very thick coarse grey sand with a bleached A2 layer over a grey mottled clay becoming sandier with depth.

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

