MNK Monkoora Land System

Flats and sandy rises in the Monkoora - Mt. Charles area

Area: 89.5 km^2

Annual rainfall: 495 – 515 mm average

Geology: The land lies within a lagoon depression of an ancient coastal dune system. The old dunes, forming the eastern and western margins of the Land System, consist of indurated shell sand (calcarenite). The sediments between the dunes are calcareous clays and limestones of the Padthaway Formation, and are usually calcreted at the surface. Siliceous Molineaux Sands overlie the landscape, particularly in the south.

Topography: The Monkoora Land System is a flat plain lying between The Black Range to the west and the discontinuous remnants of a parallel range to the east. The flats grade very gently to the north west where surface water is trapped in a wedge formed by the intersection of the Black Range and an east-west sand ridge of the Kumorna Land System. This area is subject to extensive inundation. This is exacerbated by saline water tables underlying the land which are rising and are within a metre of the surface of the flats. In the south are extensive dune fields comprising moderate to high jumbled sand hills. The regional water table is near the surface of lower lying swales between the dunes, and isolated saline swamps have formed.

Elevation: 15 - 40 m

Relief: Sand dunes are up to 20 m high

Soils: The soils fall into three broad categories. Sand over clay soils occur on moderately well to poorly drained flats, variable wet saline soils occur on poorly drained flats, and deep sands characterize the rises.

Main soils

N2/G4	Sand over saline grey clay	} imperfectly to poorly drained flats
B7/N2	Sand over saline clay on calcrete	}
N2a	Wet saline sand	} swampy flats
N2b	Wet saline sand over calcrete	}
N2c	Wet saline calcareous loam	}
G2	Sand grading to sandy clay loam	} sand dune complexes
H3	Deep bleached sand	}

Minor soils

B7a	Sand over brown clay on calcrete	} moderately well drained flats
B7b	Sand over grey clay on calcrete	}
G4	Sand over brown sodic clay	} imperfectly drained flats
F2/M4	Sandy loam over brown clay	}
G3	Thick sand over clay	} sand dune complexes

Main features: The Monkoora Land System is a flat plain with sandy texture contrast soils often shallow over rubbly calcrete. Variable sandy soils with very low fertility, and subject to water repellence and wind erosion are very extensive in the south. However, the most significant feature of the land is the problem of flooding, waterlogging and salinization caused by rising groundwater tables and the topography of the area which does not allow surface drainage. A substantial proportion of the flats is only capable of supporting salt tolerant pasture species.

Soil Landscape Unit summary: 10 Soil Landscape Units (SLUs) mapped in the Monkoora Land System:

SLU	% of area	Main features #
NAe	13.4	Flat plains formed on calcreted sediments of the Padthaway Formation. Rising saline groundwater tables are affecting this land. Watertables are within a metre or so of the surface. Main soils: sand over saline clay on calcrete - **B7/N2** (E), sand over grey clay on calcrete - **B7b** (E) and sand over brown clay on calcrete - **B7a** (L). Key properties: Drainage: Imperfectly drained due to a combination of perching on subsoil clays and shallow watertables. Fertility: Moderately low. Physical condition: No surface soil structure impediments to root growth. Subsoil clays of grey soils (B7b) are slightly limiting. AWHC: Moderate. Salinity: Moderately high. This land is at risk of increasing salinization if watertables continue to rise. Erosion potential: Water: Low. Wind: Low to moderately low. Water repellence: Slight. Rockiness: Up to 2% surface calcrete stone. Summary: Flats dominated by soils with sandy surfaces and clayey subsoils over calcrete. Drainage is imperfect, fertility is moderately low. Salinity is an increasing problem. Productivity is reduced over most of the land.
O-D	0.6	Low linear dunes formed on Molineaux Sand. Main soils: sand grading to sandy clay loam - **G2** (E) and deep bleached sand - **H3** (E). Key properties: Drainage: Rapidly to well drained. Fertility: Low to very low. Physical condition: There are no impediments to root growth. AWHC: Moderately low to moderate. Salinity: Low. Erosion potential: Water: Low. Wind: Moderate to high. Water repellence: High. Rockiness: Nil. Summary: Isolated low sandy rises with very low fertility, well drained soils prone to water repellence and erosion.
OAE	6.5	Jumbled sand dunes, 10-20 m high formed on Molineaux Sand. Main soils: deep bleached sand - **H3** (E) and sand grading to sandy clay loam - **G2** (E) on dunes, with thick sand over clay - **G3** (L) in swales. Key properties: Drainage: Rapid on dunes. Well drained in swales. Fertility: Very low to low. Physical condition: No restrictions to root growth. AWHC: Moderately low to moderate. Salinity: Low. Erosion potential: Water: Low. Wind: High. Water repellence: High. Rockiness: Nil. Other: Saline seepage at base of some sand hills. Summary: Deep very infertile water repellent sands prone to wind erosion if disturbed.

OAK	10.9	Low to moderate rises formed on Molineaux Sand. Main soils: sand grading to sandy clay loam - **G2** (E), thick sand over clay - **G3** (E) and deep bleached sand - **H3** (C). Key properties: Drainage: Rapidly to well drained. Fertility: Low to very low. Physical condition: There are no impediments to root growth. AWHC: Moderately low to moderate. Salinity: Low. Erosion potential: Water: Low. Wind: Moderate to high. Water repellence: High. Rockiness: Nil. Summary: Isolated low sandy rises with very low fertility, well drained soils prone to water repellence and erosion.
OSS	5.5	Jumbled dunes up to 20 m high with up to 10% swampy swales where saline watertables are near the surface. Main soils: deep bleached sand - **H3** (E) and sand grading to sandy clay loam - **G2** (E) on dunes, with thick sand over clay - **G3** (L), sand over sodic grey wet clay - **N2/G4** (M) and variable wet saline soils - **N2a/N2b/N2c** (M) in swales. Key properties: Drainage: Rapid (rises). Poor (swampy swales). Fertility: Very low to low (rises). Moderate is swales. Physical condition: No limitations in surface soils. Clayey subsoils in some swales are sodic and restrict root growth. AWHC: Moderately low (rises). Moderate (swales). Salinity: Low (rises). Very high (swales). Erosion potential: Water: Low. Wind: High. Low to moderate in swales. Water repellence: High (rises). Low in swampy swales. Rockiness: Nil. Summary: The land is dominated by low fertility sandhills prone to water repellence and wind erosion. Swampy swales are generally confined between sandhills and the salinity is unlikely to expand significantly.
OSX	17.4	Undulating low to moderate sandy rises, with up to 10% poorly drained and saline swampy swales and flats. Swamp clays and marls underlie the flats. Saline watertables are at or near the surface in the low points of the landscape. Main soils: sand grading to sandy clay loam - **G2** (E) on low rises and lower slopes, deep bleached sand - **H3** (E) on higher ground, thick sand over clay - **G3** (L) on better drained flats, sand over saline grey clay - **N2/G4** (M) on poorly drained flats and variable wet saline soils - **N2a/N2b/N2c** (M) in swamps. Key properties: Drainage: Well drained (rises). Poorly drained (flats). Fertility: Very low to low (rises) to moderately low (flats). Physical condition: Surface soils are not limiting. Subsoils on rises are either sandy or friable clays, but on flats are sodic and likely to impede root growth. AWHC: Moderately low to moderately high. Salinity: Low to moderate low (rises). High to very high (flats). Erosion potential: Water: Low. Wind: Low (flats). Moderately high to high (rises). Water repellence: High on rises. Low on flats. Rockiness: Nil. Summary: Most of the land has deep to moderately deep low fertility sands prone to water repellence and wind erosion. Flats are saline with low productive potential unless sown to salt tolerant species.
ZS-	3.4	Saline swamps formed on calcareous clays and marls. These are natural features, representing the lowest points in the local landscape. They are usually seasonally inundated. Vegetation is commonly a reflection of the level of salinity. Cutting grass is common on moderately saline land, tea tree and samphire on highly saline land, while extremely saline land is usually bare.

		Main soils: sand over saline grey clay - **N2/G4** (E), wet saline sand over calcrete - **N2b** (C), wet saline sand - **N2a** (C), and wet saline calcareous loam - **N2c** (L). Key properties: Drainage: Very poorly drained. Fertility: Not applicable. Physical condition: Not applicable. AWHC: Not applicable. Salinity Very high to extreme. Erosion potential: Water: Low. Wind: Low. Water repellence: Nil. Rockiness: Nil. Other: Seasonal inundation. Summary: The swamps are too saline for any production other than opportunistic light grazing, but protection of halophytic vegetation must be considered.
ZnG	3.7	Complex of saline flats (50%), low sand rises (40%) and swamps (10%), formed on limestones and clayey sediments of the Padthaway Formation, partially overlain by Recent windblown sands. Main soils: sand over saline grey clay - **N2/G4** (E) and sand over saline clay on calcrete - **B7/N2** (C) on flats, deep bleached sand - **H3** (L) and sand grading to sandy clay loam - **G2** (M) on rises, and variable wet saline soils - **N2a/N2b/N2c** (L) in swamps. Key properties: Drainage: Imperfectly to poorly drained, due to shallow water tables and low permeability subsoils. Sandy rises are rapidly drained. Swamps are very poorly drained. Fertility: Moderately low (flats) to very low (sandy rises). Physical condition: Surface soils - no limitations. Subsoils - sodic clays restrict root growth. AWHC: Moderate. Salinity: High (flats), low (sand rises), very high to extreme (swamps). This land is affected by rising saline groundwater tables. Erosion potential: Water: Low Wind: Low (flats). High (sand rises) Water repellence: Slight to nil (flats). High (sand rises) Rockiness: Nil. Summary: Imperfectly to poorly drained saline flats, with low rises of infertile sandy soils. Productive potential of the flats depends on establishment of salt tolerant species.
ZnJ Znj	20.8 17.8	Flat plains with occasional small (unmappable) swamps, and sandy or stony rises formed on clayey and limestone sediments of the Padthaway Formation. The land is seasonally waterlogged and affected by saline groundwater tables. Znj is land where salinity is higher and which is subject to inundation in wet years. Main soil is sand over saline grey clay - **N2/G4** (E) and sand over saline clay on calcrete - **B7/N2** (C), with sandy loam over brown clay - **F2/M4** (L). Key properties: Drainage: Imperfectly to poorly drained, due to shallow water tables and sodic clay subsoils. Fertility: Moderately low. Physical condition: Surface soil is not limiting. Sodic subsoils prevent satisfactory root growth. AWHC: Moderate. Salinity: High (ZnJ) to very high (Znj). Land influenced by rising saline watertables. Erosion potential: Water: Low Wind: Low. Water repellence: Nil. Rockiness: Nil. Summary: Flats with poorly drained saline soils requiring salt tolerant species for productive pasture growth (ie clovers and conventional perennial grasses will not persist on most of this land).

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:

Soils of moderately well to poorly drained and swampy flats

F2/M4 Sandy loam over brown clay (Hypercalcic, Brown Sodosol / Kandosol)
Firm sandy loam over a brown coarsely structured clay, grading to a highly calcareous sandy clay loam.

B7/N2 Sand over saline clay on calcrete (Petrocalcic, Sodosolic, Salic Hydrosol)
Bleached sand overlying a coarsely structured mottled grey sandy clay loam to clay, with a calcrete pan within 50 cm and a saline water table at depth.

G4 Sand over dispersive brown clay (Lithocalcic / Petrocalcic, Brown Sodosol)
Medium thickness sand sharply overlying a coarsely structured dispersive brown and yellow mottled clay over rubbly or sheet calcrete.

N2/G4 Sand over sodic grey wet clay (Hypercalcic / Lithocalcic, Grey Sodosol or Sodosolic, Hypercalcic Hydrosol)
Medium thickness loamy sand abruptly overlying a grey and yellow brown mottled clay (seasonally saturated), with rubbly to soft carbonate at depth.

N2a Wet saline sand (Sandy Calcarosolic / Tenosolic Salic Hydrosol)
Thick bleached (calcareous) sand over a grey and yellow mottled clayey sand in a water table at about 100 cm. Thin black clay loam to clay commonly veneers the surface

N2b Wet saline sand over calcrete (Petrocalcic, Calcarosolic, Salic Hydrosol)
Highly calcareous sandy soil with variable calcrete pans and fragments and a saline water table within 100 cm. Thin black clay loam to clay commonly veneers the surface.

N2c Wet saline calcareous loam (Calcarosolic, Salic Hydrosol)
Grey very highly calcareous loam grading to a pale grey clay loam over a white very highly calcareous silty clay loam by about 30 cm, with a water table within 100 cm.

Soils on better drained flats

B7a Sand over brown clay on calcrete (Petrocalcic, Brown Chromosol)
Medium thickness sand overlying yellow brown clay on limestone or calcreted sandy clay within 50 cm.

B7b Sand over grey clay on calcrete (Petrocalcic, Grey Chromosol)
Medium thickness loamy sand abruptly overlying a grey brown firm clay with calcreted lagoonal sediments within 50 cm.

Soils on sand dune complexes

G2 Sand grading to sandy clay loam (Mesotrophic, Yellow Kandosol)
Thick bleached sand, organically darkened at surface, over a yellow and red friable massive sandy clay loam.

G3 Thick sand over clay (Eutrophic / Calcic, Brown Chromosol)
Thick to very thick bleached sand to loamy sand with an organically darkened surface abruptly overlying a friable yellowish brown and red sandy clay, with or without soft carbonate accumulations.

H3 Deep bleached sand (Arenic, Bleached-Orthic Tenosol)
Thick to very thick bleached sand, organically darkened at the surface over yellow sand continuing below 100 cm.

Further information: DEWNR Soil and Land Program