MAO Maoope Land System

Area: 527.5 km^2

Annual rainfall: 550 – 680 mm average

Geology: The land system is formed on calcreted sediments of the Pleistocene Padthaway Formation, which includes clays and limestones or dolomites, deposited in ancient coastal lagoons. Protruding through the Padthaway sediments are scattered calcarenites, probably islands in the old lagoons. Bool Lagoon, Lake Ormerod and the salt lakes to the west of Cockatoo Lake are formed on undifferentiated sediments of lakes and swamps.

Topography: The Maoope Land System is a large interdune corridor on the western side of the Naracoorte Range and borders to the east the Harper Range land system. The corridor has an imperceptible fall to the west. There is a watertable within a metre at some time of the year, and even above the surface for a few months in wet years. Low rises are scattered across the plains and these are lunettes from pre-European swamps. This land system includes Bool Lagoon and Hacks Lagoon Conservation Park, Moyhall Swamp and Cockatoo Lake.

Elevation: 40 – 50 m

Relief: Maximum relief on a couple of lunettes 10 m, otherwise 1 – 2 m

Soils:

Sandy soils (dunes, rises and flats)

H3 Bleached siliceous sand
G2 Bleached sand grading to sandy clay loam
G3 Thick sand over clay
G4 Sand over poorly structured clay
I2 Wet highly leached sand

Stony soils (rises and flats)

B2 Shallow calcareous loam on calcrete
B3 Shallow sandy loam on calcrete
B4 Shallow red loam on calcrete
B5 Shallow dark clay loam on limestone
B6 Shallow loam over red-brown clay on calcrete
B7 Shallow sand over clay on calcrete
B8 Shallow sand on calcrete
RR Limestone outcrop

Heavy soils

E1 Black cracking clay
E3 Brown or grey cracking clay
F1 Loam over brown or dark clay
F2 Sandy loam over poorly structured brown or dark clay
M2 Deep friable gradational clay loam

Other soils

N1 Peat
N2 Saline soil
N3 Wet soil (non to moderately saline)
A1 Highly calcareous sandy loam
A6 Gradational calcareous clay loam

A7 Calcareous clay loam on marl
C5 Gradational dark clay loam
D2 Loam over red clay

Main features: The Maoope Land System is a plain with minor lunettes, swamps and lagoons such as Bool Lagoon, Hacks Lagoon, Moyhall Swamp and Cockatoo Lake. The plains are imperfectly to poorly drained. Soils typically have clay loamy/clayey surfaces and calcrete within 50 cm of the surface. Fertility is generally high on the plains and lunettes. The groundwater table may be at the surface for some time in the year.

Soil Landscape Unit summary: 98 Soil Landscape Units (SLUs) mapped in the Maoope Land System:

SLU	% of area	Main features #
MAB	0.03	Undulating rises formed on calcreted calcarenite. There is greater than 90% shallow soil or calcrete outcrop with greater than 50% bare calcrete. Main soils: limestone outcrop - **RR** (E), shallow sandy loam on calcrete - **B3** (L) and shallow loam over red-brown clay on calcrete - **B6** (L). These soils are very stony and shallow and have very low waterholding capacity and moderate fertility. Drainage is rapid.
MDa MDb	0.22 0.61	Undulating rises formed on calcreted calcarenite. Up to 10 m relief and slopes vary from 3-6%. **MDa** Plains with 0-10% shallow rises and 0-10% marginally saline depressions **MDb** Gently sloping plains with 20-30% shallow rises and 0-10% marginally saline depressions Main plains and rises soils: shallow red loam on limestone - **B4**, shallow sandy loam on calcrete - **B3**, shallow loam over red-brown clay on calcrete - **B6** and shallow calcareous loam on calcrete **- B2.** These soils are moderate to shallow in depth, have high fertility and moderate to moderately low waterholding capacity and are well (rises) to imperfectly (plain) drained. Rockiness is a limitation on the shallow stony rises. Depression soils: shallow dark clay loam on limestone - **B5** (M) and calcareous clay loam on marl - **A7** (M). They are deep, high fertility, high waterholding capacity and are poorly drained. There is a moderate limitation to root growth due to the dispersive subsoil clays. There is moderate salinity where salt tolerant species are evident. Groundwater tables are within two metres of the surface at some time of the year.
MRB	0.06	Isolated shallow (70-80%) to stony (10-20%) undulating rise on the plains that is formed on calcreted calcarenite. Main soils: shallow red loam on limestone - **B4** (E) and shallow loam over red clay on calcrete - **B6** (E). These soils are moderate to shallow in depth, have high fertility, moderate waterholding capacity and are well drained. These soils have high productive potential. Stony soils: shallow calcareous loam on calcrete **- B2** (L) and shallow sandy loam on calcrete - **B3** (L). These soils are shallow, have moderate fertility, moderately low waterholding capacity and rapid drainage. They are calcareous throughout and alkaline at depth and there is a slight limitation to tillage by rockiness.
MVB	0.51	Isolated undulating rise formed on calcreted calcarenites of ancient coastal dunes within the NNW-SSE trending flat. These rises are variably covered by deposits of Molineaux Sand. There is variable surface calcrete, depending on the presence of sand. There is between 10-20% outcropping of calcrete. There are no swamps. Main shallow soils: shallow loam over red-brown clay on calcrete - **B6**, shallow red loam on limestone - **B4**, bleached siliceous sand - **H3** and limestone outcrop - **RR**. The shallow soils are shallow to moderate in depth, have high to moderate fertility and low to moderate waterholding capacity. Drainage is rapid. The calcrete outcrop areas are non-arable as they are very shallow with very low waterholding capacity and moderately low fertility. The presence of surface stones is a limitation for these soils. The sandy soils are deep, have low fertility, moderate waterholding capacity and rapid drainage. Severe water repellence, soil acidity and the susceptibility to wind erosion are limitations.

NIa	0.11	Small deeper sandy texture contrast plain with 0-10% marginally swamps. Main soils: sand over poorly structured clay - **G4** (E) and thick sand over clay - **G3** (E). These soils are moderately deep, have moderately low fertility and moderate to high waterholding capacity. There is a moderate limitation to root growth due to dispersive subsoil clays. The plains are imperfectly drained and the swamps are imperfect to poorly drained. The plains have some subsoil salinity and the swamps moderate salinity.
NJA NJF NJG NJJ NJL NJM NJU NJja NJm	2.92 4.41 0.01 2.91 0.09 1.69 12.20 0.03 1.31	Flat plains with occasional swamps formed on calcreted sediments of the Padthaway Formation. There variable areas of swamps, salt pans and stony rises which may be only 1 m high. **NJA** Plain with 0-10% swamps **NJF** Plains with 30-40% swamps and 20-30% lunettes **NJG** Depression **NJJ** Plains with 20-30% swamps and 0-10% stony rises **NJL** Plains with 0-10% swamps and 0-10% sandy rises and 0-10% stony rises **NJM** Plains with 20-30% stony rises and 0-10% swamps **NJU** Plains with 20-30% swamps and 20-30% lunettes **NJa** Plains with 0-10% marginally saline swamps **NJm** Plains with 20-30% stony rises and 0-10% marginally saline swamps Plain soils: deep friable gradational clay loam - **M2** (C), black cracking clay - **E1** (C), gradational calcareous clay loam - **A6** (L), loam over brown or dark clay – **F1** (L), shallow dark clay loam on limestone - **B5** (M), wet soil - **N3** (L), calcareous clay loam on marl - **A7** (M), gradational dark clay loam - **C5** (M) and sandy loam over poorly structured brown or dark clay - **F2** (M). These soils are moderate to deep with high fertility and waterholding capacity. Drainage is imperfect to poor on the plains and poor to very poor in the swamps. There is a slight to moderate limitation to root growth due to the dispersive subsoil clays. Salinity is the minor saline swamps are moderate to moderately high and there is evidence of salt tolerant plants. Stony rises and lunette soils: shallow loam over red-brown clay on calcrete - **B6** (L), shallow red loam on limestone - **B4** (L) and shallow calcareous loam on calcrete - **B2** (L). These soils are shallow, have high fertility, moderately low waterholding capacity and are well drained. Rockiness may be a slight limitation and there are subsoil carbonates. Sandy rise soils: thick sand over clay - **G3** (E), bleached siliceous sand - **H3** and wet highly leached sand - **I2**. These soils are deep, have low fertility and moderate waterholding capacity and are well drained. Water repellence, soil acidity and the susceptibility to wind erosion are limitations.
NKA NKF NKu	0.33 2.49 3.71	Flat shallow plains with occasional very low stony rises and swamps formed on calcreted sediments of the Padthaway formation. Groundwater tables are within two metres of the surface. **NKA** Plains with 0-10% swamps **NKF** Plains with 30-40% swamps and 20-30% lunettes **NKu** Plains with 30-40% stony plains and 10-20% saline swamps Main soils: shallow dark clay loam on limestone - **B5** (C), shallow calcareous loam on calcrete - **B2** (L), wet soil - **N3** (L) and deep friable gradational clay loam - **M2** (L). The plain and swamp soils are shallow to moderate in depth, have high fertility, moderately low to moderate waterholding capacity and drainage is imperfect to poor. There may be some interference to tillage due to surface rocks. Subsoil salinity is evident. The swamps are moderately deep, have high fertility, moderate waterholding capacity and poor drainage. Subsoil salinity is evident and the saline swamps have moderate salinity. Lunettes and stony rise soils: shallow loam over red-brown clay on calcrete - **B6** (L), shallow red loam on limestone - **B4** (L) and shallow calcareous loam on calcrete - **B2** (M). These soils are shallow, have high fertility, moderately low waterholding capacity and are well to imperfectly drained. Rockiness may be a moderate limitation and there are some soils that are calcareous throughout the profile.

NNu	2.74	Flat plains with 20-30% swamps and 30-40% stony rises (generally less than 1 m). Main soils: gradational dark clay loam - **C5** (C), brown-grey cracking clay - **E3** (C) and saline soil - **N2** (L). These soils are deep, have high fertility and waterholding capacity. There is a slight to severe limitation to root growth due to the dispersive subsoil clays in the plains and swamps respectively. Drainage on the plains is imperfect to very poor. Some areas are permanently inundated in the swamps. There is subsoil-only to moderate whole-soil salinity on the plains and extreme in the swamps. The majority of the swamps are bare. Stony rise soils: shallow dark clay loam on limestone - **B5** (L), shallow loam over red-brown clay on calcrete - **B6** (L), shallow red loam on limestone - **B4** (L). These soils are shallow, have high fertility, low waterholding capacity and are well drained. Rockiness is a limitation and maybe subsoil carbonates.
NOA NOF NON NOU NOm	1.10 0.14 0.19 0.15 2.25	Moderately deep heavy textured plains with shallow clay loamy rises (generally less than 1 m). **NOA** Plain with 0-10% swamp and 0-10% stony rises **NOF** Plains with 30-50% swamps **NON** Plains with 20-30% stony rises and 10-30% swamps **NOU** Plains with 20-30% swamps and 20-30% stony rises **NOm** Plain with 20-30% stony rises with 0-10% swamps Main soils: deep friable gradational clay loam - **M2**, shallow dark clay loam on limestone - **B5** (C), calcareous clay loam on marl - **A7** (M) and wet soil - **N3**. These soils are moderate to deep, have high fertility and waterholding capacity and the plains are imperfectly drained and the swamps poor to very poor. The swamps may have subsoil salinity. The stony rise soils are the same as **NKF** landscape unit and are shallow, have moderate fertility, moderately low waterholding capacity and are well drained. The soils are calcareous throughout and rockiness may be a limitation.
NPA NPC	0.28 0.49	Moderately deep heavy plains with 0-10% swamps and 0-10% stony rises (generally less than 1 m). Groundwater tables are within two metres of the surface. **NPA** plains with 0-10% swamps **NPC** Plains with 0-10% swamps and 0-10% stony rises Main soils: deep friable gradational clay loam - **M2** (E), black cracking clay - **E1** (E), wet soil - **N3** (L) and shallow dark clay loam on limestone - **B5** (C). These soils are of moderate depth, have high fertility and moderately low to moderate waterholding capacity. Drainage is imperfect on the plains and poor in the swamps. Minor stony rise soils: shallow red loam on limestone - **B4** (M), shallow calcareous loam on calcrete - **B2** (M) and **B5**. These soils are very shallow, have moderate fertility, very low waterholding capacity and are well drained. Soils are calcareous in the subsoil and rockiness may be a limitation.
NYF	1.39	Shallow heavy textured plain with 30-40% swamps. Groundwater tables within two metres of surface. Main soils: shallow dark clay loam on limestone - **B5** (V), deep friable gradational clay loam - **M2** (L) and wet soil - **N3** (L). Soils are shallow to moderately deep, have high fertility, moderately low waterholding capacity and imperfect drainage on the plains and poor in the swamps. Slight limitation to root growth due to the dispersive subsoil clays. There may be some subsoil salinity.
NZA NZF	0.08 1.00	Shallow texture contrast plains with up to 50% swamps formed on calcreted sediments of the Padthaway formation. Groundwater tables are within two metres of the surface. **NZA** Plain with 0-10% swamps **NZF** Plain with 30-50% swamps Main soils: sand over poorly structured clay - **G4** (E), thick sand over clay - **G3** (E), calcareous clay loam on marl - **A7**, wet soil - **N3** (L), deep hard gradational sandy loam - **M4** and shallow dark clay loam on limestone - **B5**. Soils have shallow to moderate depth; have moderate fertility and moderately low waterholding capacity. There is a nil to moderate limitation to root growth due to the dispersive subsoil clays. Drainage is imperfect on the plains and poor to very poor in the swamps and the watertable can be above the surface for several months in the swamps. There may be some subsoil salinity.

Nkf	0.37	Shallow texture contrast plain with 20-30% swamps. Groundwater tables are within two metres of the surface. Main soils: shallow sand over clay on calcrete - **B7**, sand over poorly structured clay - **G4** (E), deep friable gradational clay loam - **M2** (L), shallow dark clay loam on limestone - **B5** and wet soil - **N3** (L). These soils are moderate to shallow in depth, have moderately low to high fertility, moderately low waterholding capacity and imperfect to poor drainage. There is a slight to moderate limitation to root growth due to the dispersive subsoil clays. Salinity levels are up to moderate and some salt tolerant species may be evident in the swamps.
NlC NlF NlG NlJ NlM NlU	1.59 0.70 0.13 0.41 2.57 1.59	Shallow heavy plains with 30-40% stony rises (generally less than 1 m) and swamps. Groundwater tables are within two metres of the surface. **NlC** Level plain with 0-10% swamps and 0-10% stony rises **NlF** Plain with 30-40% swamps **NlG** Depression **NlJ** Plain with 30-40% swamps and 0-10% stony rises **NlM** Plains with 20-30% stony rises and 0-10% swamps **NlU** Plains with 30-40% swamps and 30-40% stony rises Main plain soils: shallow dark clay loam on limestone - **B5** (E), shallow calcareous loam on calcrete - **B2** (E), deep friable gradational clay loam - **M2** (M) and wet soil - **N3** (L). These soils are shallow to very shallow, have high fertility and low to moderate waterholding capacity depending on the depth of the soil. Surface rockiness may be a slight limitation. Drainage is well to imperfect on the plains and poor in the swamps. Stony rise soils: shallow red loam on limestone - **B4** (M), shallow calcareous loam on calcrete - **B2** and shallow dark clay loam on limestone - **B5**. These soils are very shallow, have moderate to high fertility, very low water-holding capacity and are well drained. Surface rockiness may be a slight limitation and the subsoils are calcareous.
NmA	1.9	Shallow texture contrast plains with 0-10% swamps. Groundwater tables are within two metres of the surface. Main soils: sand over poorly structured clay - **G4** (V), shallow dark clay loam on limestone - **B5** (L) and wet soil – **N3** (M). The soils are shallow to moderate in depth, have moderately low fertility and moderately low waterholding capacity. Drainage is imperfect on the plains and poor in the swamps. There is a moderate limitation to root growth due to the dispersive subsoil clays.
NoY	0.36	Slightly elevated plain with 10-20% stony rises and 10-20% depressions. Main soils: shallow loam over red-brown clay on calcrete - **B6** (L), shallow red loam on limestone - **B4** (L), loam over brown or dark clay - **F1**, shallow calcareous loam on calcrete - **B2** (E), shallow dark clay loam on limestone - **B5** (L) and deep friable gradational clay loam - **M2** (M). The plains and depressions are moderate to shallow in depth, have high fertility and moderately low waterholding capacity. The plain is well drained and the depression well to imperfect. The stony rises are shallow, have high fertility, very low waterholding capacity and are well drained. Surface rockiness may be a limitation. Overall these soils have high productive potential.
NxM Nxa Nxj Nxm	5.15 0.07 0.49 0.79	Shallow plains formed on calcreted sediments of the Padthaway Formation. Up to 30 % stony rises (generally less than 1 m) and up to 20% swamps. Groundwater tables within two metres of surface. **NxM** Level plain with 20-30% stony rises and 0-10% swamps **Nxa** Marginally saline plain with 0-10% marginal saline swamps **Nxj** Marginally saline plain with 10-20% marginal saline swamps and 0-10% stony rises **Nxm** Marginally saline plain with 20-30% stony rises and 0-10% marginally saline swamps Main soils: shallow calcareous loam on calcrete - **B2** (V), shallow dark clay loam on limestone - **B5** (E), deep friable gradational clay loam - **M2** (M) and shallow red loam on limestone - **B4** (L). These soils are shallow to moderate, have high fertility and moderately low waterholding capacity. Drainage on plains is imperfect and swamps poor. The marginally saline soils have slight salinity (subsoil) on the plains and moderate in the swamps. Stony rise soils: shallow to very shallow; have moderate fertility and low waterholding capacity. Drainage is slightly imperfect and surface rockiness and the soils being calcareous throughout may be a limitation.

NyA NyO Nya Nyf	0.50 1.00 0.36 0.25	Moderately deep heavy-textured (clayey) plains with 10-50% saline swamps and 0-10% sandy rises formed on calcreted sediments of the Padthaway formation. Groundwater tables are within two metres of the surface. **NyA** Plain with 0-10% swamps **NyO** Plains with 20-30% stony rises and 10-20% sandy rises **Nya** Plain with 0-10% marginally saline plain **Nyf** Plain with 30-50% marginally saline swamps Main soils: loam over red clay - **D2**, shallow red loam on limestone - **B4** (L), brown-grey cracking clay - **E3**, shallow dark clay loam on limestone - **B5**, wet soil - **N3**. The plain and swamp soils are moderately deep, have high fertility and moderate waterholding capacity. The plains are imperfectly drained and the swamps poorly drained. There is a slight to moderate limitation to root growth due to the dispersive subsoil clays on the plains and swamps respectively. Salinity levels vary from nil (plains) to moderate in the marginally saline swamps. The stony rise soils are shallow to very shallow, have moderate fertility and low waterholding capacity. Drainage is slightly imperfect and surface rockiness and the soils being calcareous throughout may be a limitation. Sandy rise soils: thick sand over clay - **G3** (M), bleached siliceous sand - **H3** (M) and sand over poorly structured clay – **G4** (M). These soils are deep with moderately low fertility, moderate waterholding capacity and are slightly imperfectly drained. Water repellence, soil acidity and the susceptibility to wind erosion are limitations.
XRA XRB XRC XRe	1.37 0.01 0.02 0.12	Heavy soils of lake margins and swamps with minor lunettes. **XRA** Lake margin of Moyhall Swamp **XRB** Eroded lake margin **XRC** Swamp **XRe** Swamp with 0-10% lunette Lake margin soils: black cracking clay - **E1** (C), deep friable gradational clay loam - **M2** (C), wet soil - **N3** (E) and calcareous clay loam on marl - **A7** (L). These soils are deep, have moderate fertility and high waterholding capacity. Drainage is poor and there is some subsoil salinity. The soils can be calcareous throughout. These soils are generally bare and only provide opportunistic grazing. Swamp soils: **N3**, brown-grey cracking clay - **E3** and **M2**. These soils are deep, have high fertility and waterholding capacity. Drainage is poor to very poor and seasonally inundated for up to 3 months. Lunette soils: shallow red loam on limestone - **B4** (M), shallow loam over red-brown clay on calcrete - **B6** (M) and shallow calcareous loam on calcrete - **B2** (M). These soils are shallow to moderate in depth, have high fertility, moderately low waterholding capacity and are well drained. Subsoil carbonates and rockiness may be limitations.
XTC	0.13	Swamp with heavy soils. Main soils: black cracking clay - **E1** (E), deep friable gradational clay loam - **M2** (E), wet soil - **N3** (L) and calcareous clay loam on marl - **A7** (L). These soils are deep, have moderate fertility and high waterholding capacity. Drainage is poor and there is some subsoil salinity. The soils can be calcareous throughout.
XaJ XaK	0.06 0.05	Creek beds. **XaJ** Mosquito Creek **XaK** Eroded creeks (Morambro and Naracoorte Creeks) The soils within the creek system vary, however the main soil is wet soil - **N3** (D). They are deep, have moderate fertility, high waterholding capacity and are poorly drained. Dispersive subsoil clays have a moderate limitation. The Creeks in some areas are permanently filled (waterholes). This landscape unit is not suitable for agricultural production.
Xb-C	0.70	Shelly and calcareous high lunette on the eastern and southern edge of Bool Lagoon. Main soils: highly calcareous sandy loam - **A1** (E), shallow calcareous loam on calcrete - **B2** (E) and shallow red loam on limestone - **B4** (C). These soils are moderate in depth, have high fertility, moderate waterholding capacity and are well drained. Surface rockiness and the presence of carbonates may be a limitation.

Xc-A Xc-B	0.27 1.20	Low (A) and medium (B) mainly calcareous lunettes that are found on the flat plains where old swamps may have existed. Main soils: shallow calcareous loam on calcrete - **B2** (E), shallow red loam on limestone - **B4** (E) and shallow loam over red-brown clay on calcrete - **B6** (C). These soils are shallow, have moderate to high fertility, moderately low waterholding capacity and are well drained. The soils are strongly alkaline below the topsoil due to the presence of carbonates. Surface rockiness is a high limitation as there may be up to 50% rock exposed.
Xd-A Xd-B Xd-C XdCA	0.68 2.95 0.99 0.06	Mainly uniform and texture contrast lunettes that range in height from low (A), medium (B) to high (C) that are found on the flat plains where old swamps may have existed. There is a lunette that surrounds a freshwater swamp (XdCA). Main soils: shallow red loam on limestone - **B4** (E), shallow loam over red-brown clay on calcrete - **B6** (E) and shallow calcareous loam on calcrete - **B2** (C). These soils are moderate to shallow in depth, have high fertility, moderate waterholding capacity and are well drained. Subsoil carbonates and rockiness may be a slight limitation however these soils have high productive potential.
Xe- Xe-A Xe-B	0.10 0.24 0.13	Mainly texture contrast lunettes that vary in height from low (A) to medium (B) that are found on the flat plains where old swamps may have existed. Main soils: shallow sand over clay on calcrete - **B7** (E), shallow loam over red-brown clay on calcrete - **B6** (E) and shallow calcareous loam on calcrete - **B2** (C). These soils are moderate in depth, have moderate to high fertility, moderate waterholding capacity and are well drained. There is a slight limitation to root growth due to the dispersive subsoil clays. Subsoil carbonates and rockiness may be a slight limitation
Xl-	5.06	Fresh water lakes that include Bool Lagoon, Little Bool Lagoon, Cockatoo Lake and Hacks Lagoon Conservation Park. They are permanently inundated.
Xq-	1.62	Fresh to marginally saline swamps that are at least seasonally inundated. They include Lake Ormerod and Lake Wonwarrie. Main soils: wet soil - **N3** (D) which are deep with moderately low fertility and high waterholding capacity. Drainage is very poor and are seasonally inundated for greater than 3 months.
XuC Xuf	0.05 0.03	Non-saline wet swamps (**XuC**) with swamps and 20-30% stony rises (**Xuf**). Main soils: wet soil - **N3** (V). These soils are deep; have high to moderate low fertility and high waterholding capacity. Drainage is very poor. The swamps are seasonally inundated for greater than 3 months. There is a slight limitation to root growth due to the dispersive subsoil clays. Shallow stony soils: shallow calcareous loam on calcrete - **B2** (M), shallow sandy loam on calcrete - **B3** (M) and shallow dark clay loam on limestone - **B5** (M). These soils are semi-arable as they are very shallow and very stony. They have moderately low fertility; very low waterholding capacity and they are imperfectly drained. They have very little elevation. Rockiness is a major limitation and the soils are calcareous throughout.
Xw- XwD	2.77 0.02	Wetland of low salinity (**Xw-**) which includes Moyhall Swamp and wetlands of marginal salinity (**XwD**). Main soils: wet soil - **N3** (V), saline soil - **N2** (C) and sand grading to sandy clay loam - **G2** (L). These soils are deep, have moderately low fertility and high waterholding capacity. Drainage is very poor. The swamps are seasonally inundated for greater than 3 months. There is a slight limitation to root growth due to the dispersive subsoil clays. Salinity levels vary from subsoil salinity to moderately high and salt tolerant species are evident.
XxC	0.03	Peaty swamp that includes soils of peat N1 (E) and wet soil - **N3** (E). These soils are deep, have high fertility and high waterholding capacity. Drainage is very poor. The swamps are seasonally inundated for greater than 3 months.
Xz- XzD	0.81 1.00	Complex of lunettes and swamps with associated plains **Xz-** Lake margin **XzD** Plain with 0-10% lunette Main soils: calcareous clay loam on marl - **A7** (L), shallow dark clay loam on limestone - **B5** (M) and deep friable gradational clay loam - **M2**. These soils are deep, have high fertility and high waterholding capacity. Drainage is poor and the water table is seasonally above the surface for up to 3 months. Salinity levels are moderate to moderately high and salt tolerant species are common. The lunette soils are the same as **Xd-A** landscape unit and are moderate to shallow in

		depth, have high fertility, moderate waterholding capacity and are well drained. Subsoil carbonates and rockiness may be a slight limitation however these soils have high productive potential.
ZD-	4.12	Salt lakes that are seasonally or usually filled formed on calcareous clays and marls. Main soil: saline soil - **N2** (D) which is deep, poor fertility and high waterholding capacity. Salinity levels are very high to extreme and the watertable is at the surface for 3-10 months. The swamps are too saline for any production other than opportunistic light grazing, but protection of halophytic vegetation must be considered.
ZE-	0.04	Complex of samphire, saltpans and salt lakes that are seasonally or usually filled formed on calcareous clays and marls. Main soil: saline soil - **N2** (D) which is deep, poor fertility and high waterholding capacity. Salinity levels are very high to extreme and the watertable is at the surface for 3-10 months. The swamps are too saline for any production other than opportunistic light grazing, but protection of halophytic vegetation must be considered
ZGA	0.82	Lake margin surrounding salt lakes that were once part of the lake, now only seasonally waterlogged. Main soils: calcareous clay loam on marl - **A7**, deep friable gradational clay loam - **M2** and shallow dark clay loam on limestone - **B5** (M). These soils are deep, have moderately low fertility and high waterholding capacity. Drainage is imperfect to poor and the water table is above the surface for up to 3 months. Salinity levels are moderately high and salt tolerant species are common.
ZH- ZHf	1.44 0.05	Complex of saline land with varying degrees of salinity. **ZH-** Saline swamp **ZHf** Saline swamp with 40-50% swampy margin Main soils: saline soil - **N2**, calcareous clay loam on marl - **A7**, deep friable gradational clay loam - **M2** and shallow dark clay loam on limestone - **B5** (M). These soils are deep, have moderately low fertility and high waterholding capacity. Drainage is poor to very poor and the water table is above the surface for up to 10 months. Salinity levels are very high the swamps are too saline for any production other than opportunistic light grazing, but protection of halophytic vegetation must be considered. The swamp margins are imperfectly drained and salinity levels are moderate to moderately high and salt tolerant species are evident.
ZI-	1.08	Salt lake with 10-20% lunettes. Salt lake soil: saline soil - **N2** and they are deep, have low fertility and high waterholding capacity. Drainage is very poor to permanently inundated and the water table is above the surface for 3-10 months. The swamps are too saline for any production other than opportunistic light grazing, but protection of halophytic vegetation must be considered. Lunette soils: shallow red loam on limestone - **B4**, shallow loam over red-brown clay on calcrete - **B6** and shallow calcareous loam on calcrete - **B2**. These soils are shallow to moderate in depth, have high fertility, moderate waterholding capacity and are well drained. They have high productivity potential, however subsoil carbonates and surface rockiness may be a limitation.
ZJ-	0.79	Complex of saline land with 10-20% lunettes. Swampy soils: saline soil - **N2** are deep, have low fertility and high waterholding capacity. Drainage is very poor to permanently inundated and the watertable is above the surface for 3-10 months. The saline land has high to very high salinity and has low productive potential with opportunistic light grazing being most suited. The lunette soils are the same as **ZI-** landscape unit and also gypseous calcareous loam - **A8** which are moderate in depth, have high fertility and moderate waterholding capacity and are rapidly drained. They have high productivity potential, however subsoil carbonates and surface rockiness may be a limitation.
ZLwC ZlxA ZLxB ZLxC ZLyB	0.18 0.92 1.55 1.69 0.05	Very small rising lunettes surrounding saline swamps with height distinguished by A – low lunettes, B – medium lunettes and C – high lunettes. **ZLw** Mainly calcareous lunettes (B2, B4) **ZLx** Mainly uniform lunettes (B4, B6) **Zly** Mainly texture contrast lunettes (B7, B6) Main soils: shallow red loam on limestone - **B4**, shallow loam over red-brown clay on calcrete - **B6**, shallow calcareous loam on calcrete - **B2**, shallow sand over clay on calcrete - **B7** and gypseous calcareous loam - **A8**. These soils are shallow to moderately deep, have high fertility, moderate waterholding capacity

		and are rapidly drained. They have high productivity potential, however subsoil carbonates and surface rockiness may be a limitation.
ZP- ZPf	0.08 0.10	Low lying areas with no obvious salinity. **ZP-** Salty depression **ZPf** Plain with 10-20% swamps Main soils on plains: deep friable gradational clay loam - **M2**, shallow dark clay loam on limestone - **B5** (M), black cracking clay - **E1** and loam over brown or dark clay - **F1**. These soils are moderately deep, have high fertility and moderate waterholding capacity. Drainage is imperfect and there is some subsoil salinity. The salty depressions and swamp soils are saline soil - **N2** and are deep, have poor fertility and high waterholding capacity. They are very poorly drained with the watertable above the surface for 3-10 months. Salinity levels are moderate to moderately high and salt tolerant species are common.
ZQ- ZQA ZQf	0.72 0.16 0.07	Marginally saline swamps formed on calcareous clays and marls with minor lunettes and varying salinity. **ZQ-** Salty lake **ZQA** Non saline plain **ZQf** Non saline plain with 20-30% swamps and 0-10% lunettes Main salt lake soils: wet soil - **N3** (E), saline soil - **N2** (E) and calcareous clay loam on marl - **A7** (E). These soils are deep, low fertility, high waterholding capacity and very poor drainage. There is a high limitation to root growth due to the dispersive subsoil clays. Salinity is high to very high due to the watertable seasonally above the surface for 3-10 months. Salt tolerant species is evident and production from the swamps is only from opportunistic light grazing. Plain soils: shallow dark clay loam on limestone - **B5**, sand over poorly structured clay - **G4** and shallow calcareous loam on calcrete - **B2**. Soils are shallow to moderately deep, have moderate to high fertility and moderately low to moderate waterholding capacity. Drainage is imperfect and there is a nil to moderate limitation to root growth due to the dispersive subsoil clays. Swamp soils: **B5** and deep friable gradational clay loam - **M2** and there is high salinity in which salt tolerant species are common. Lunette soils are the same as **ZI-** landscape unit and are shallow to moderate in depth, have high fertility, moderate waterholding capacity and are well drained. They have high productivity potential, however subsoil carbonates and surface rockiness may be a limitation.
ZR-	0.45	Salty depression in which the main soil is saline soil - **N2** (E). These soils are deep, have very low fertility and high waterholding capacity. Drainage is very poor. There is a high limitation to root growth due to the dispersive subsoil clays. Salinity is high to very high due to the watertable seasonally above the surface for over 3 months. Salt tolerant species is evident and production from the swamps is only from opportunistic light grazing,
ZS-	0.20	Saline depression formed on calcareous clays and marls. These are natural features, representing the lowest points in the local landscape. They are 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: saline soil - **N2** (D). These soils are very poorly drained with extreme salinity and are seasonally inundated for over 3 months. The swamps are too saline for any production other than opportunistic light grazing, but protection of halophytic vegetation must be considered.
ZT- ZTf	0.17 0.18	Complex of saline and marginally saline land in the form of plains and swamps. **ZT-** Saline swamp **ZTf** Plain with 30-35% saline flats and 30-35%saline swamps Saline swamp soils: saline soil - **N2** (D) and wet soil - **N3** (M). These swamps are seasonally inundated for 3-10 months. Salinity levels are moderately high to very high and tea tree, samphire are common. The swamps are too saline for any production other than opportunistic light grazing, but protection of halophytic vegetation must be considered. Plain soils: calcareous clay loam on marl - **A7**, shallow dark clay loam on limestone - **B5**, **N2** and deep friable gradational clay loam - **M2**. Soils moderately deep to deep; have moderately low to low fertility and high waterholding capacity. Drainage is imperfect to poor and seasonally inundated for up to 3 months. Moderate limitation to root growth due to the dispersive subsoil clays. Salinity levels vary from moderately high to high; salt tolerant species are common. Productive potential is low.

ZV-	1.07	Complex of non-saline to marginally saline swamps with 30-35% plains and 30-35% lunettes. The swamp soils and plain soils are the same as **ZTf** landscape unit. The swamps are seasonally inundated for 3-10 months and salinity levels are moderate high and salt tolerant species are evident. The plains are fertile, have high waterholding capacity and imperfect drainage. The water table is within 2m of the surface at some time in the year. Lunette soils: shallow red loam on limestone - **B4**, shallow loam over red-brown clay on calcrete - **B6** and shallow calcareous loam on calcrete - **B2**. These soils are shallow, have high fertility, moderate waterholding capacity and are well drained. They have high productivity potential, however subsoil carbonates and surface rockiness may be a limitation.
ZW-	0.16	Complex of marginally saline lagoon with 20-30% lunettes. The lagoon is permanently inundated and has moderately high salinity. Main soil: saline soil - **N2**. The lunette soils are the same as **ZV-** and are shallow, have high fertility, moderate waterholding capacity and are well drained. They have high productivity potential, however subsoil carbonates and surface rockiness may be a limitation.
ZX- ZXf	0.67 0.25	Complex of saline plains with swamps, lagoon and 20-30% lunettes. **ZX-** Lagoon with 20-30% lunette **ZXf** Extensive swamps and plains with 20-30% lunettes The lagoon is very poorly drained to permanently inundated and has moderately high salinity. The plain and swamp soils are the same as **ZTf** landscape unit and are deep; have low to high fertility and high waterholding capacity. Drainage on the plains is imperfect and very poor in the swamps. The watertable is within 2 m of the surface at some time in the year on the plains and above the surface in the swamps for 3-10 months. Salinity levels vary from moderately high to very high on the plains and swamps respectively. Salt tolerant species are common on the plains and production from the swamps is only from opportunistic light grazing. The lunette soils are the same as **ZV-** and are shallow, have high fertility, moderate waterholding capacity and are well drained. They have high productivity potential, however subsoil carbonates and surface rockiness may be a limitation.
Zqf	0.77	Saline flats have extensive swamps. Groundwater tables are often within two metres of the surface. Plain soils: sandy loam over poorly structured brown or dark clay - **F2**, sand over poorly structured clay - **G4** and shallow calcareous loam on calcrete - **B2**. These soils are predominantly deep but there is some shallow soil, have moderate to moderately low fertility, high waterholding capacity and poor to imperfect drainage. Salinity levels are moderately high. Swamp soils: saline soil - **N2** and are deep, have moderately low fertility, high waterholding capacity and very poor drainage. Salinity levels are high and only provide opportunistic grazing.
Zrv	0.03	Sandy surfaced swampy flat with 10-20% sandy rises and 10-20% stony rises. Main soils: saline soil - **N2**, wet soil - **N3** and shallow dark clay loam on limestone - **B5**. These swampy flats are deep with high fertility and waterholding capacity. Drainage is very poor and seasonally inundated for greater than 3 months. Salinity levels are high to very high and greater than 50% of land surface has salt tolerant species only. This landscape unit is not suitable for agricultural production, only opportunity grazing. Sandy rise soils: bleached siliceous sand - **H3** and are deep, have low fertility, moderate waterholding capacity and are well drained. Water repellence and wind erosion are limitations. Stony rise soils: shallow sandy loam on limestone - **B3** and shallow sand on calcrete - **B8**. These rises are shallow, have moderately low fertility, and waterholding capacity and rapid drainage. Rockiness may be a limitation.

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:

(In alphabetic order)

A1 Highly calcareous sandy loam (Supravescent Calcarosol)
Deep to moderate depth carbonate dominant soils. Loamy sand to sandy loam over sandy loam to sandy clay loam. Carbonate dominates the soil profile as a whole, however, the surface soil may not be carbonate dominant, but must contain 30% or more carbonate.

A6 Gradational calcareous clay loam (Pedal Hypercalcic-Lithocalcic Calcarosol on clayey subsoil)
Calcareous loams to clay loams grading into brown-red clay. Often rubbly.

B2 Shallow calcareous sandy loam on calcrete (Petrocalcic Calcarosol)
Up to 40 cm calcareous loamy sand to sandy loam with variable calcrete rubble overlying calcreted calcarenite - rises.

B3 Shallow sandy loam on calcrete (Petrocalcic Rudosol)
Medium thickness non calcareous sandy loam, often having a slight clay increase with depth, over calcreted calcarenite shallower than 50 cm - rises.

B4 Red sandy loam over calcrete (Petrocalcic, Red Dermosol)
Medium thickness red sandy loam grading to friable red clay loam over calcreted calcarenite within 50 cm.

B5 Shallow dark clay loam on limestone (Petrocalcic, Black Dermosol)
Black clay loam to light clay over calcreted limestone at shallow depth, grading to highly calcareous clay - flats.

B6 Shallow sandy loam over red-brown clay on calcrete (Petrocalcic, Red Kandosol)
Medium thickness sandy loam with slight ironstone gravel overlying a weakly structured reddish brown sandy clay on calcarenite within 50 cm - rises.

B7 Shallow sand over sandy clay on calcrete (Petrocalcic, Brown Chromosol)
Medium thickness sand overlying brown friable sandy clay to clay on limestone or calcreted sandy clay within 50 cm - flats.

B8 Shallow sand on calcrete (Petrocalcic, Bleached-Leptic Tenosol)
Thick bleached sand over calcreted calcarenite within 50 cm - rises.

C5 Gradational dark clay loam (Calcic-Hypercalcic Brown-Grey-Black Dermosol-Calcarosol)
Dark clay loam over abundant 'soft lime'. >10% carbonate is the cut off between this and M2 soils.

D2 Loam over red clay ((Mottled, Hypercalcic Red Chromosol)
Medium to thick sandy loam to clay loam overlying a well structured red clay grading to red mottled clay with limestone segregations at depth.

E1 Black cracking clay (Black Vertosol)

E3 Brown or grey cracking clay (Brown-Grey Vertosol)

F1 Loam over brown or dark clay (Melanic, Hypercalcic, Black/Brown Chromosol
Medium thickness dark brown sandy loam over a thin to medium sand layer over a structured brown to black clay grading to a brown mottled clay with limestone segregations at depth.

F2 Sandy loam over brown or dark poorly structured clay (Mottled, Mesonatric, Grey/Black Sodosol)
Medium thickness brown sandy loam over a thin to medium thickness pale sand layer over a columnar structured dispersive grey to black clay grading to brown mottled clay with depth.

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.

G4 Sand over dispersive brown clay (Hypercalcic, Brown Sodosol)
Thin to medium thickness sand sharply overlying brown and yellow or grey mottled dispersive clay with strong columnar structure, calcareous with depth.

H3 Bleached siliceous sand (Bleached-Orthic, Argic Tenosol)
Medium thickness organically darkened sandy surface over thick bleached sand over yellow sand continuing below 100 cm

M2 Deep friable gradational clay loam (Red-Brown-Grey- Black Dermosol)
Deep well structured red clay loamy soil.

M4 Deep hard gradational sandy loam (Hard Brown-Dark Kandosol- Dermosol)
Deep dark brown loamy to clay loamy soil grading to clay at depth. Hardsetting surface often with prismatic structures in the subsoil.

N1 Peat (Organosol)
Peaty soil.

N2c Wet saline clay loam (Dermosolic, Salic Hydrosol)
Medium thickness dark grey to black clay loam to clay grading to well-structured dark grey clay with minor carbonates and a water table within 100 cm.

N3 Seasonally waterlogged, non-to-marginally saline equivalents of associated soils listed above, viz.:

N3c	Wet **G3**
N3d	Wet **B5**
N3e	Wet **B7**

RR Bare rock

WW Water

(Grouped on landscape position)

Sandy soils (dunes, rises and flats)

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

G2 Bleached sand grading to sandy clay loam (Sandy Petrocalcic, Brown Chromosol-Kandosol)
Medium to thick sand with a bleached A2 layer abruptly overlying a brownish friable light sandy clay loam to sandy clay over calcreted calcarenite

G3 Thick sand over clay (Mesotrophic, Mottled-Hypernatric, Grey Sodosol or Brwon Chromosol))
Thick to very thick organically stained sand with a pale sand layer directly overlying a grey to brownish poorly structured sodic clay that grades to a yellowish brown calcareous clay at depth. The Chromosols have similar profiles except they do not have sodic clays, but better structured clays.

G4 Sand over poorly structured clay (Mesonatric, Brown/Grey Sodosol)
Thick organically stained sandy surface overlying a pale sand layer overlying a brown poorly structured clay on limestone or calcrete usually within 100 cm.

I2 Wet highly leached sand (Podosol) (Humeosesquic, Semiaquic Podosol)
Organically darkened sand to loamy sand grading to greyish sand overlying dark sands with organic-aluminium compounds that are saturated for a short term.

Stony soils (rises and flats)

B2 Shallow calcareous loam on calcrete (Petrocalcic, Supracalcic Calcarosol)
Dark coloured clay loam over a structured dark clay directly overlying calcrete or calcarenite within 30 cm

B3 Shallow sandy loam on calcrete (Bleached-Leptic Tenosol)
Thin to medium organically darkened sand over bleached sand over calcarenite within 50 cm.

B4 Shallow red loam on calcrete (Haplic, Petrocalcic, Red Dermosol)
Medium thickness red loam to clay loam over a red strucutred clay directly overlying calcarenite/calcrete within 50 cm

B5 Shallow dark clay loam on limestone (Haplic, Petrocalcic, Black Dermosol)
Thin to medium thickness black clay loam grading to black well structured clay directly overlying calcrete within 50 cm.

B6 Shallow loam over red-brown clay on calcrete (Petrocalcic, Red Chromosol)
Thin to medium thickness brownish sandy loam to loam over a well structured red to red-brown clay loam to clay on calcrete or calcarenite within 50 cm

B7 Shallow sand over clay on calcrete (Mesotrophic, Petrocalcic, Grey/Brown Sodosol)
Medium thickness organically stained sand grading to bleached sand over a grey to brown sodic poorly structured clay directly overlying calcrete within 50 cm

B8 (Petrocalcic, Orthic Tenosol)
Loamy sand to loam with variable rubble and slight clay increase with depth overlying calcreted calcarenite shallower than 50 cm. Extensive on stony rises.

RR Limestone outcrop (Petrocalcic, Leptic Rudosol)
Thin brown to red clay loam to clay with little development over calcrete or calcarenite within 20 cm.

Heavy soils

E1 Black cracking clay (Haplic, Supracalcic, Black Vertosol)
Medium to thick thickness surfaced well structured black light-medium clay, which cracks when dry, grading to a structured black to brownish calcareous clay at depth.

E3 Brown or grey cracking clay (Episodic, Gery Vertosol)
Very thin grey clayey surface over a sodic poorly structured grey clay with light grey and yellow/brown mottles to depth

F1 Loam over brown or dark clay (Calcic, Mottled-Sodic, Brown Chromosol)
Medium thickness sandy loam to loam over a pale loamy sand horizon directly overlying a brown structured clay grading to a sodic clay and calcareous clay at depth.

F2 Sandy loam over poorly structured brown or dark clay (Calcic, Mottled-Hypernatric, Grey/Brown Sodosol)
Thin brown sandy loam to clay loam directly overlying grey or brown sodic poorly structured clay with calcareous segregations at depth.

M2 Deep friable gradational clay loam (Mottled, Calcic, Black Dermosol)
Thin to medium thickness black clay loamy surface grading to black structured clay grading to a mottled grey calcareous clay at depth.

Other soils

N1 Peat (Sapric Organosol)
Thick surfaced decomposed organically dominated clay loam grading to dark clay at depth or a marly subsoil. These soils are generally found in swampy areas and are wet for greater than 3 months.

N2 Saline soil (Sub-Humose, Supratidal Hydrosol)
Wet medium thickness black clay loam over a structured black clay which becomes massive and mottled at depth. The soil is saline throughout, dispersive and calcareous at depth

N3 Wet soil (non to moderately saline) (Melanic, Dermosolic, Redoxic Hydrosol)
Medium thickness wet black clay grading to grey poorly structured clay with depth which can be slightly calcareous at depth

A1 Highly calcareous sandy loam (Supravescent, Petrocalcic Calcarosol)
Medium thickness brownish sandy loam grading to a brownish sandy loam to sandy clay loam soil directly overlying calcarenite within 50 cm. The soil is dominated by carbonate thorughout.

A6 Gradational calcareous clay loam (Pedal Hypercalcic Calcarosol)
Medium to thick dark loams to clay loam grading to grey clay to depth. The soil is calcareous throughout and rubbly carbonate material is sometimes present.

A7 Calcareous clay loam on marl (Marly Calcarosol)
Medium to thick grey to black clay loam to clay grading to grey clay overlying a light grey marly subsoil to depth. The soil is calcareous throughout, however the topsoil may only have a small percentage of fine carbonates present.

C5 Gradational dark clay loam (Pedal, Calcic Black Dermosol)
Thin thickness black clay loam to clay grading to black mottled structured clay which is increasing in carbonates with depth.

D2 Loam over red clay (Mottled, Hypercalcic, Red Chromosol)
Medium to thick thickness red to brown loam over red well structured red clay grading to red mottled massive clay and calcareous at depth.

Further information: DEWNR Soil and Land Program