BOK Bookamurray Land System

Mostly gently undulating plains and low rises, with numerous salt lakes. Named after Bookamurray Lagoon, one of the northern-most salt lakes in the system. Other named salt lakes in the system include Lake Sunday, Pink Lake, Munkowurlie Lagoon and the huge Lake Fowler depression; also including the saline depression named Winnup Swamp.

Area: 163.2 km^2

Landscape: Plains and low rises with numerous ancient salt lake depressions, some of which are very large. Lake Fowler is the largest in this system and on the Yorke Peninsula. Most of the other ancient salt lakes on the southern Peninsula are in the Weaver Lagoon land system. This system is mostly somewhat lower in elevation than the Weaver Lagoon system to the east, and is divided from it by a rise aligned north-south (indicating a fault line?). Slopes are mostly between 0% and 4%. Calcrete underlies many of soils at shallow depth. These soils are mostly calcareous, with a few non calcareous in lower lying areas (in the north of the system). Blocky structured clayey sediments (Blanchetown Clay equivalent) probably underlie most of the system but have little or no surface expression. Deeper calcareous soils occur mostly on rises. A saline water table is not far below the surface, especially in lower lying areas and depressions. Most areas are affected by saline seepage to some degree, ranging from raised subsoil salinity, to marginal salinity, to non arable saline depressions. The ancient salt lakes are salt encrusted and occupy significant depressions in the landscape. Gypsum-rich deposits are situated beside most salt lakes, completely surrounding many, but are often concentrated on the south-eastern or eastern shore. Drainage, mostly below ground, seems to be to the southwest, as indicated by the alignment of saline drainage depressions.

Annual rainfall: 410 – 445 mm average

Main soils:

B2-B1	shallow calcareous loam on calcrete (around 36% of area)
A4	deep calcareous loam (around 26% of area)
N2	saline soil (around 20% of area)

Minor soils:

B3	shallow loam on calcrete (around 8% of area)
A8	gypseous calcareous loam (approximately 4% of area)

Main features: Surface soils are mostly sandy loams. Subsoils are mostly loamy to light clayey. Most soils are calcareous throughout. Those soils which are not calcareous throughout have alkaline to neutral surface soils. Agricultural use is restricted by shallow stony soils with limited moisture storage capacity, hard carbonate fragments which interfere with many farming practices and restrict water holding capacity, and raised salinity levels where soils are able to be cropped. Calcrete can be ripped for high value horticultural crops, however, this may not greatly increase rooting depth and plant available moisture, as the calcrete is mostly underlain by very highly calcareous sediments which are often clayey, have very high pH, high sodium and boron levels, and raised salinity levels. Calcareous soils have reduced availabilities of certain nutrients; in particular phosphorus, zinc and manganese.

Soil Landscape Unit summary: Bookamurray Land System (BOK)

SLU	% of area	Main features #
ObD	0.03	Dominantly sand over clay soils. Main soils: mostly rubbly loamy sand to sandy loam over poorly structured clay, probably with some shallow on calcrete (soil **G4**-**D3**; **B7**-**B6**). **ObD** arable very low dune (slopes 0-1.5%, 3a, 2s, 3r)
QnK QnT	1.8 1.0	Shallow calcareous and non calcareous soils on calcrete. Main soils: *shallow calcareous loam on calcrete* (soil **B2**) and *shallow loam on calcrete* (soil **B3**). **QnK** mostly arable level plains with some saline seepage (slopes <1%, 4-3r, approx. 2-5% outcrop, 3-2s). **QnT** semi-arable to arable depressions to low lying plains with marginal salinity (slopes <1%, 4-3s, 4-3r).
QsK	6.6	Shallow calcareous and non calcareous soils on calcrete: some non calcareous soils are texture contrast. Main soils: *shallow calcareous loam on calcrete* (soil **B2**) and *shallow loam on calcrete* (soil **B3**). With limited to common areas of *shallow loam over red-brown clay on calcrete* (soil **B6**). **QsK** mostly arable gently undulating plains with some gently undulating rises: with some saline seepage (slopes 0-3%, 1-2e, 4-3r, 1-2% outcrop, 3-2s°, 1-2w).
QqK	11.0	Shallow calcareous and non calcareous soils on calcrete: most non calcareous soils are texture contrast. Main soils: *shallow calcareous loam on calcrete* (soil **B2**). With common to extensive areas of *shallow loam over red-brown clay on calcrete* (soil **B6**) and limited to common areas of *shallow loam on calcrete* (soil **B3**). **QqK** mostly arable gently undulating to undulating plains with some saline seepage (slopes 1-4%, 1-2e, 4-3r, approximately 5% outcrop, 2-3s, 2-1a). Higher elevation than the **QsK** soil landscape unit.
QTK QTP QTT	6.2 2.0 1.9	Shallow calcareous soils on calcrete with deeper soils and shallow non calcareous soils. Main soils: *shallow calcareous loam on calcrete* (soil **B2**). Limited to extensive areas of *deep calcareous loam* (soil **A4**) and minor to common areas of *shallow loam on calcrete* (soil **B3**). Soils become more calcareous toward the south of the system. **QTK** mostly arable gently undulating plains with some saline seepage (slopes 0-2%, 3-2r, 3s). **QTT** semi-arable depression to low lying plain with marginal salinity (slopes <1%, 2-1w, 3-2r, 4s°).
QHA1 QHK1 QHN1	0.6 0.8 0,4	Dominantly shallow calcareous soils on calcrete. Main soils: *shallow calcareous loam on calcrete* (soil **B2** with some **B1** in some soil landscape units). Minor areas of *deep calcareous loam* (soil **A4**). Soils become more calcareous toward the south of the system. **QHA1** non arable stony plains (usually slightly raised) (slopes 0-1.5%, 5-4r, 2s). **QHK1** non arable stony plains (usually slightly raised) with some saline seepage (slopes 0-4%, 5-4r, 3-2s, 1-2e). **QHN1** non arable stony slopes and cliffs with some saline seepage adjacent to Lake Fowler (slopes 5-20%, 5r, 3-2s, 4-3e).
QMA QMK QML QMT	1.1 1.0 0.3 0.3	Shallow calcareous soils on calcrete with some deeper soils. Main soils: *shallow calcareous loam on calcrete* (soil **B2** with some **B1** in some soil landscape units). Limited to common areas of *deep rubbly calcareous loam* (soil **A4**). **QMA** mostly arable slight rise (slopes 0-1.5%, 4-3r, 2s). **QMK** mostly arable gently undulating plains with some saline seepage (slopes 0-1.5%, 3-2s, 4-3r, approx. 5-10% outcrop). **QML** mostly arable slopes with some saline seepage (slopes 1-3%, 3-4r, 2-1e, 3-2s). **QMT** mostly semi arable depression with marginal salinity (slopes <1%, 4-3r, 4-3s).
ShK ShL ShP ShT	23.7 0.3 9.5 3.9	Mostly deeper rubbly calcareous soils with shallow calcareous soils. Main soils: *deep rubbly calcareous loam* (soil **A4**; minor **A1** near coast). Common to extensive areas of *shallow calcareous loam on calcrete* (soil **B2**; minor **B1** near coast). **ShK** mostly arable gently undulating rises and raised plains with some saline seepage (slopes 1-3%, 2-3s, 2-3r, 1-2e). **ShL** mostly arable gently undulating to undulating rises with some saline seepage

		(slopes 2-4%, 2-1e, 2-3s, 2-3r). **ShP** mostly arable plains with some saline seepage (slopes <1%, 2-3r, 3s). **ShT** semi-arable to arable depressions and low lying plains with marginal salinity (slopes <1%, 2-1w, 2r, 4-3s°).
SAQ	0.6	Mostly deep calcareous soils. Main soils: mostly non rubbly and gypseous *deep calcareous loam* (soils **A8**-**A4**). **SAQ** semi arable slope with marginal salinity adjacent to Lake Fowler (slopes 2-20%, mostly between 2% and 8%, 4-5s, 1-2r).
MaYA MaYB	0.2 0.3	Relict calcreted coastal dunes. Main soils: dominated by shallow carbonate sands (soil **B1**), some moderate depth to deeper *carbonate sands* (soil **H1**), and some bare calcrete (**RR**). **MaYA** non arable low relict coastal dunes (dune height mostly <5m). **MaYB** non arable moderate height relict coastal dunes (dune height mostly 5-15m).
MeYA MeE	0.3 0.02	Relict calcreted coastal dunes. Main soils: shallow carbonate sands, highly calcareous, and calcareous loamy sands and sandy loams on calcrete (soils **B1**-**B2**). With some deeper highly calcareous soils (soils **A1**). **MeYA** mostly arable undulating plains to low rolling relict dunes (slopes 0-3%, 3-2s, 3a, 3-2y). **MeE** depression area with marginal salinity (slopes <1%, 4s, 3-2a, 2y).
M-A	0.1	Relict calcreted coastal dunes. Bare calcrete (**RR**) and shallow bare carbonate sands on calcrete (soil **B1**). **M-A** non arable coastal ledges (slopes 0-3%, 3y, 6-5r).
WGD	0.5	Coastal dunes. Main soils: *carbonate sands* (soil **H1**), with some shallow carbonate sand (soil **B1**), and minor areas or bare calcrete (**RR**). **WGD** non arable low to moderate height coastal dunes (dune height from less than 5m to just over 20m; calcrete is rarely more than a few metres from the land surface).
WAB	0.5	Coastal cliffs and beaches. **WAB** calcarenite cliffs, and carbonate sand beaches and tidal flats, with a few areas of rocky reef (cliffs up to 30m high).
WT-	0.1	Rocky reefs.
ZL-	0.1	Gypseous lunettes. Main soils: *gypseous calcareous sand* (soil **A8**). **ZL-** gypsum-rich lunettes (5-15m high, 3s, 5a).
ZA- ZB- ZC- ZD- ZX-	2.6 1.1 1.4 13.7 5.7	Dominantly saline soils. Main soils: *saline soils* (soil **N2**). The ZA- soil landscape unit includes extensive areas of *shallow calcareous loam on calcrete* (soil **B2**) and *deep calcareous loam* (soil **A4**). The ZX- soil landscape unit has extensive to very extensive areas of *gypseous calcareous loam* (soil **A8**). **ZA-** non arable to semi-arable salinized depressions and margins to salt lakes (3-5w, 5-4s, 1-2a, 1-2f, 4-3r). **ZB-** non arable saline depressions (5-7w, 7-5s, 2-1a, 2-1f, 2-4r). **ZC-** small and shallow salt lakes, and saline lake margins (7-5w, 7s, 2a, 2f, 1r). Can include gypsic lagoon surrounds when area is small. **ZD-** ancient (large) salt lakes (7w, 8s, 2a, 2f, 1r). **ZX-** complex of very low lunette deposits (some on lagoon margin slopes) with salt lakes, saline land, and lagoon margin slopes and cliffs (slopes 0-10%, 3-7w, 7s, 3a, 1-2f, 1-2r). Can include some slopes with stony shallow calcareous soil on calcrete and lesser salinity (soil **B2**).

Classes in the 'Soil Landscape Unit summary' table (eg. 2-1e, 3w, 2y, etc) describe the predominant soil and land conditions, and their range, found in Soil Landscape Units. The number '1' reflects minimal limitation, while increasing numbers reflect increasing limitation. Letters correspond to the type of attribute:

a - wind erosion	e - water erosion	f - flooding	g - gullying
r - surface rockiness	s - salinity	w - waterlogging	y - exposure

Detailed soil profile descriptions:

Main soils:

B2-B1 *Shallow calcareous loam on calcrete* [Petrocalcic Calcarosol]
Shallow rubbly soils on calcrete. Surface soil texture is usually sandy loam or fine sandy loam, or sometimes loam. Surface soils can have a weak granular structure and are grey, brown or red-brown. Subsoil textures are clay loam, loam, light clay or sandy loam. (Carbonate sands with sandy surface and subsoil occur along the coast.) Very shallow soils may not have a distinct subsoil. Clay loamy and light clayey subsoils can be sodic and dispersive. Subsoils typically contain accumulations of hard carbonate rubble. Soils are calcareous throughout, being moderately to very highly calcareous; or can be carbonate dominant along the coast (**B1** soil). An accumulation of fine carbonate occurs in the clay loamy to light clayey substrate below the calcrete, and this often grades to a blocky red clay, especially in lower lying areas. Conditions in the substrate are usually unsuitable for root growth, as pH is very high, boron and sodium levels are high, and salinity levels are raised.

A4 *Deep calcareous loam* [Lithocalcic, Supracalcic and Hypercalcic Calcarosol]
These are moderately deep to deep soils with calcareous grey loamy (mostly loam) surface soils which grade to highly calcareous clay loam, light clay or occasionally sandy loam textures. There is usually an accumulation of hard carbonate rubble in the profile, and an abundant accumulation of fine carbonate below this. Most profiles are rubbly to very rubbly. Profiles are usually deep and well drained, and are typically found on rising ground.

N2 *Saline soil* [Hypersalic-Salic Hydrosol]
In the very highly saline ancient salt lakes, these soils are bare of vegetation and have a thin surface salt crust, which is underlain by sediments rich in salt crystals and 'fluffy' gypsum. A typical profile has calcareous sandy loam to light clay overlying green-grey to olive-brown non calcareous clay.
A range of saline soil profiles occur on land which is not so highly saline. Shallow soils on calcrete are the most common. Deep clay loamy soils with hard carbonate rubble often occur where calcrete has been 'dissolved'. In these areas samphire, sea barley grass, and bare patches are common.

Minor soils:

B3 *Shallow loam on calcrete* [Petrocalcic Tenosol-Chromosol]
Shallow to very shallow rubbly soils on calcrete. Surface soil texture is usually sandy loam or fine sandy loam. Surface soils can have a weak granular structure, are red-brown, and may be slightly calcareous. Very shallow soils typically have no distinct subsoil. Subsoils are red-brown to red with textures of clay loam, loam or sandy loam. Clay loamy subsoils are often sodic and dispersive. Subsoils typically contain accumulations of hard carbonate rubble. An accumulation of fine carbonate occurs in the clay loamy to light clayey substrate below the calcrete, and this usually grades to a blocky red clay. Conditions in the substrate are usually unsuitable for root growth, as pH is very high, boron and sodium levels are high, and salinity levels can be high. These soils typically occur in low lying areas.

A8 *Gypseous calcareous loam*
[Gypsic Lithocalcic-Supracalcic-Hypercalcic Calcarosol or Hypergypsic Calcarosol]
These saline and gypsum-rich soils occur beside salt lakes. They are composed of wind-deposited sediments which are derived from the surfaces of the lakes. A typical profile has a silty loam surface soil which grades to a silty clay loam subsoil. Powdery or flakey gypsum accumulations occur in the subsoil. These soils are calcareous throughout and fine carbonate content increases with depth. Accumulations of hard carbonate rubble can also occur in the profile. These soils have naturally high salinity levels and are too saline to be used for agricultural production. Saline watertables affect many soils.

Further information: DEWNR Soil and Land Program