

# MUG Murray Lagoon Land System

An old land-locked lake floor, consisting of Murray Lagoon itself, adjacent old lake floor areas, various lunettes, some lower slopes and flats around Murray Lagoon below the level of the adjacent plateau area, and low-lying saline drainage areas. This system is bordered by higher elevation plateau areas directly to the north and west, mallee-covered calcreted remnant dune topography areas to the south, and slightly higher plains with lagoons to the northeast and east. The water-filled lagoon area has been larger in the past. At its greatest extent the Murray Lagoon extended 4 km further east and 5 – 6 km further north-east from its present eastern edge (as evidenced by the extent of stranded lunettes). Extensive clearing of native vegetation in the river catchments feeding into the lagoon make it likely that more water is now entering the lagoon than did in the past. (Perennial native vegetation has higher water use (evapo-transpiration) than annual crop and pasture plants.) However, seasonal variations in rainfall can be relatively large and account for much of the variation in water flow into the lagoon.

**Area:** 41.8 m<sup>2</sup>

**Annual rainfall:** 540 – 565 mm average

**Geology:** Most of this area is underlain by sandy clay sediments. These sediments extend to depth (eg >20 m). Murray Lagoon itself is underlain by Holocene age lacustrine marl; while the old lake floor area consists of older Pleistocene age lacustrine sediment. Some old lake floor sediments include a layer of calcrete or calcrete fragments. Lunettes, some calcreted, others deep sands, are mostly now stranded, and were formed at the lagoon edge when the water-covered area was larger than it is now. In addition, some lunettes can be seen below the water level (on aerial photography of mid January 1985), indicating previous smaller water-covered areas. Recent alluvia, washed down from the plateau area via intermittent stream flows, especially along Timber Creek, have formed saline flats where creeks outflow. Minor low-lying remnants of the plateau, with ironstone gravel layers, occur in the north of this land system. Some early Cambrian age Kanmantoo Group meta-sandstones are exposed on the lower slopes and flats just north and west of Murray Lagoon.

**Topography:** The Land System is a low-lying level plain, which is interrupted in places by remnant lunettes. The Murray Lagoon basin forms a shallow closed depression. The core area of Murray Lagoon is probably permanently water-covered, although water area varies with seasonal and long-term rainfall patterns. The saline lower reaches of Timber Creek, and some saline drainage depressions at the base of the plateau, flow into a broad saline flood plain area which curves into Murray Lagoon. Some stony lower slopes adjacent to Murray Lagoon are included in this Land System.

**Elevation:** Most of the area is from 14 m to 18 m above mean sea level. Some of the lunettes are higher than 20 m in elevation, with the highest lunettes reaching to almost 30 m above sea level. The lower slopes at the edge of the Murray Lagoon area, and the very bottom of the slopes down from the plateau, reach to between 20 m and 30 m above sea level.

**Relief:** Generally less than 2m

**Main Soils:**

<b>F2-F1-G4-G3</b>	<u>Texture contrast soil</u>
<b>B2-B3</b>	<u>Shallow soil on calcrete</u>
<b>B6-N2a-N3a</b>	<u>Shallow clay loamy soil on calcrete</u>



<b>Minor Soils:</b>	<b>N3b-N2b</b>	<u>Wet calcareous soil on marl</u>
	<b>C5-F2-A6</b>	<u>Loamy to clay loamy topsoil over light clay</u>
	<b>D7-K4</b>	<u>Stony texture contrast soil</u>
	<b>I1-H3</b>	<u>Deep sand</u>
	<b>J1-J2</b>	<u>Ironstone soil</u>

**Main Features:** Arable to non-arable low-lying area with poor drainage. Topsoils are generally loamy, sometimes clay loamy, sometimes sandy. The main soils are loamy to clay loamy over sodic clay; and shallow loamy to clay loamy on calcrete. A significant proportion of this system is covered by water, the extent of which varies with seasonal and long-term rainfall. Much of the land area is affected by saline seepage. Salinity levels increase with depth. Many shallow soils over calcrete occur, which are limited by stoniness (calcrete rubble) and low waterholding capacity. Most other soils have clayey subsoils which are usually highly sodic, and so are dispersive and poorly structured (often columnar structure). This sodic clayey subsoil limits root development and prevents adequate drainage, thereby exacerbating waterlogging. Fine carbonate occurs in the subsoil or lower subsoil over most of the area.

### Soil Landscape Unit summary: Murray Lagoon Land System (MUG)

SLU	% of area	Main features #
ZF-	17.1	Non-arable lagoons. These areas are generally underlain by impermeable marl.
ZT-	0.7	Main soils: wet soils ( <i>Hydrosols</i> ).
ZU-	9.6	<p><b>ZF-</b> – shallow lake. Slightly brackish lake which is almost permanently inundated. This area designates the core lake area of Murray Lagoon. The water sits upon a substrate/subsoil of highly calcareous and impermeable clay (marl), effectively forming a perched water table. This lake area includes a small shallower area (approx. 1% of lake area) which would be seen as a small island when the lake level was low.</p> <p><b>ZT-</b> – a complex of a saline lagoon (VIIs) and a marginally saline depression/lagoon area (IVs), which is often submerged. These areas include depression and low-lying areas which are only submerged during times of high water-levels.</p> <p>Main soils: <u>wet calcareous soil on marl</u> - calcareous clay loam over olive clay, sometimes with calcrete fragments, overlying marl in highly saline lagoon areas <b>N2b</b> (<i>Calcarosolic Oxyaquic Hydrosol</i>). And sandy loam to clay loamy topsoil over a sandy to loamy bleached sub-surface layer, over olive clay, overlying marl, in depression areas <b>N2</b> (Hypercalcic Sodosolic Hydrosol).</p> <p><b>ZU-</b> – lagoon area which is usually submerged. These areas cover the margins of Murray Lagoon. This area is usually inundated, and some melaleuca trees occur. Water perches on a subsoil of light grey to pale yellow highly calcareous impermeable clay (marl). This area includes some submerged low lunettes (approx. 2m high).</p> <p><b>ZR-</b> – saline lagoon which is sometimes to often submerged (VIIs). This area includes some margin areas of Murray Lagoon and some other lagoons on the Timber Creek flood plain. These areas are underlain by a grey to pale yellow highly calcareous impermeable clay subsoil (marl). These areas are mostly bare, however, some melaleuca trees occur at the lagoonal margins. Salinity levels are high due to salt build-up from cycles of wetting and drying.</p> <p>Main soils: thick calcareous dark clay loam to loam over grey loam, overlying marl <b>N2c</b> (Epicalcareous Hypersalic Hydrosol). With 10% of area consisting of recent alluvial deposits of thick to very thick topsoil with alternate layers of dark organic rich loamy soil and lighter coloured sandy soil, over grey clay, overlying marl <b>N2b</b> (Calcareous Sodosolic Oxyaquic Hydrosol).</p> <p><b>ZQ-</b> – marginally saline lagoon which is often submerged, with melaleuca trees (IV-Vs). These areas are often inundated and are usually covered by melaleuca trees. Infrequent drying out keeps surface salinity levels low enough for the melaleuca trees to survive.</p> <p>Summary: lagoonal depressions, either water-filled or subject to seasonal inundation.</p>
ZR-	8.9	
ZQ-	1.4	



ZA- ZB-	10.4 4.3	<p>Non-arable saline flats and depressions, including the Timber Creek flood plain. Bare and samphire covered land with some marginally saline areas supporting annual pasture grasses.</p> <p>Main soils: <u>texture contrast soil</u> - medium thickness to very thick sandy loam to clay loam, sometimes sandy or clayey, with a sub-surface layer of sandy to sandy loam which is often bleached; over yellow-brown to olive-brown mottled clay, often with fine carbonate in the lower subsoil <b>F2-F1</b> (<i>Calcic-Eutrophic Brown Sodosol</i>). With 0-10% <u>ironstone soil</u> - loamy topsoil with ironstone gravel over yellow-brown to olive-brown sodic mottled clay <b>J1</b> (<i>Ferric Brown Sodosol</i>).</p> <p><b>ZA-</b> – saline flats, depressions and very gently sloping land (Vs). Greater than 50% of area is bare or samphire covered and highly saline; while the remaining areas are marginally saline and grass covered.</p> <p><b>ZB-</b> – saline flats and depressions (VIIs). Mostly bare or samphire covered and highly saline; with only minor marginally saline grassy areas.</p> <p>Summary: highly salinized land.</p>
ZL1 ZL2 ZL3 ZL4 ZL6 ZL8	0.7 0.7 1.3 0.4 0.2 1.8	<p>Semi-arable lunettes. Calcreted and sandy lunettes. Their positions indicate former or present lake margins. Also included is a finger of land with clay loam over clay soils which may be a lunette feature. Many lunettes are now some distance from present lagoon margins. Calcreted lunettes are mostly covered with native scrub; the clay loamy lunette mostly with phalaris grass; and sandy lunettes with pasture grasses and native scrub.</p> <p>Main soils on calcreted lunettes: sandy loam with a sub-surface layer of loamy sand, over a clay loamy subsoil with abundant fine carbonate, overlying calcrete at shallow depth <b>B6b</b> (<i>Petrocalcic Hypercalcic Chromosol</i>). And sandy loam with a sub-surface layer of loamy sand, over a clay loamy subsoil, overlying calcrete <b>B6c</b> (<i>Petrocalcic Chromosol</i>). And very shallow to shallow loamy sand on calcrete <b>B8-B2</b> (<i>Petrocalcic Tenosol-Calcarosol</i>).</p> <p>Main soils on clay loamy lunette: cracking clay loamy topsoil over sodic clay, overlying clay with abundant fine carbonate <b>C5b</b> (<i>Vertic-Sodic Calcic Brown Dermosol</i>).</p> <p>Main soils on sandy lunettes: <u>deep sand</u> - loamy sand with a bleached sub-surface layer, overlying sand usually with accumulations of iron/organic compounds <b>I1-H3</b> (<i>Podosol-Tenosol</i>).</p> <p><b>ZL1</b> – low calcreted lunette (1-2m)  <b>ZL2</b> – calcreted lunette (2-5m)  <b>ZL3</b> – high calcreted lunette (approx.10m)  <b>ZL4</b> – clay loamy lunette (2-5m)  <b>ZL6</b> – low sandy lunette (1-2m)  <b>ZL8</b> – high sandy lunette (approx.10m)</p> <p>Summary: usually with low water holding capacity due to sandy or shallow soil. The sandy lunettes are also subject to possible wind erosion risk and water repellence. The clay loamy lunette has cracking clay loam surface soil with a relatively poor surface physical condition.</p>
VCA VCB VCC	6.6 1.1 0.5	<p>Arable to non-arable old lake floor flats with sandy to loamy soils over calcrete. Much of the soil material is probably derived from wind-borne deposition from the adjacent calcreted dune areas.</p> <p>Main soils: <u>shallow soil on calcrete</u> (with some very shallow) - slightly to moderately calcareous sandy loam (some sandy) on calcrete <b>B2-B3</b> (<i>Petrocalcic Calcarosol-Tenosol</i>). And shallow slightly calcareous fine sandy loam with a loamy sub-surface layer including some calcrete fragments, over clay loamy subsoil including fine carbonate and some calcrete fragments, overlying calcrete <b>B2</b> (<i>Petrocalcic Supracalcic Calcarosol</i>). With 0-20% <u>loamy to clay loamy topsoil over light clay</u> - fine sandy loam with a sub-surface layer of fine sandy loam with fine carbonate, overlying light grey clay loam with fine carbonate <b>A6-F2</b> (<i>Hypercalcic Calcarosol-Sodosol</i>).</p> <p><b>VCA</b> – low to moderately saline flats (III-IIIs)  <b>VCB</b> – marginally saline flats (IVs)  <b>VCC</b> – highly saline flats (Vs)</p> <p>Summary: the main issues are saline seepage and waterlogging in these low-lying areas, and the shallow and stony nature of most of these soils. Flooding is also a possibility in some areas.</p>



VDA VDB VDC	4.3 1.2 1.7	<p>Arable to non-arable old lake floor flats with clay loamy soils over calcrete. This soil material is probably originally derived from sediments settling in the waters of former lake areas.</p> <p>Main soils: <u>shallow clay loamy soil on calcrete</u> - slightly to non-calcareous clay loamy topsoil (some loamy), over olive sodic clay with some calcrete fragments, over olive sodic clay with fine carbonate, overlying calcrete <b>B6-N2a-N3a</b> (<i>Petrocalcic Grey-Brown Sodosol-Hydrosol</i>). With 10-30% <u>loamy to clay loamy topsoil over light clay</u> - clay loamy topsoil (some loamy) over red-brown light clay, over alkaline brown clay, overlying yellow-brown light clay with fine carbonate and some calcrete fragments <b>C5-F2</b> (<i>Sodic Hypercalcic Brown-Red Dermosol-Sodosol</i>).</p> <p><b>VDA</b> – low to moderately saline flats (III-IIs)  <b>VDB</b> – marginally saline flats (IVs)  <b>VDC</b> – highly saline flats (Vs)</p> <p>Summary: the main issues are saline seepage and waterlogging, the shallow and stony nature of many of these soils, and sodic soils. Flooding is also a possibility in some areas.</p>
VEA VEB	4.7 4.8	<p>Arable to semi-arable old lake floor flats with sandy to loamy and clay loamy soils over calcrete. This soil material probably originally derived from sediment settling in the waters of former lake areas, with probably some wind-borne deposition of material from the adjacent calcreted dune area.</p> <p>Main soils: <u>shallow soil on calcrete</u> (some very shallow) - slightly to moderately calcareous loamy soil on calcrete <b>B2-B3</b> (<i>Petrocalcic Calcarosol-Tenosol</i>). And <u>shallow clay loamy soil on calcrete</u> - slightly calcareous to non-calcareous clay loamy topsoil, over olive sodic clay with some calcrete fragments, over olive sodic clay with fine carbonate, overlying calcrete <b>B6-N2a-N3a</b> (<i>Petrocalcic Grey-Brown Sodosol-Hydrosol</i>). With 10-20% <u>loamy to clay loamy topsoil over light clay</u> - clay loamy to loamy topsoil over clay loamy to clayey subsoil with fine carbonate <b>C5-A6</b> (<i>Hypercalcic Brown Dermosol-Calcarosol</i>).</p> <p><b>VEA</b> – low to moderately saline flats (III-IIs)  <b>VEB</b> – marginally saline flats (IVs)</p> <p>Summary: Main issues are saline seepage and waterlogging, the shallow and stony nature of many of these soils, and the sodic nature of many subsoils. Flooding is also a possibility in some areas.</p>
VMA VMC	0.4 2.6	<p>Arable to non-arable old lake floor flats with clay loamy soil. This soil material is most likely derived from sediment settling in the waters of former lakes.</p> <p>Main soils: <u>wet calcareous soil on marl</u> - calcareous clay loamy topsoil, over olive clay loamy material with calcrete fragments, overlying light grey to pale yellow clay with abundant fine carbonate (marl) <b>N3b-N2b</b> (<i>Calcarosolic Oxyaquic Hydrosol</i>).</p> <p><b>VMA</b> – low to moderately saline flats (III-IIs)  <b>VMC</b> – highly saline flats (Vs)</p> <p>Summary: these areas are characterised by wetness/waterlogging, saline seepage and sodic soils. Flooding is also a possibility in some areas.</p>
VNA	5.1	<p>Mostly arable old lake floor flats with sandy to loamy soil. Part of an old lake floor, but also influenced by outwash from the adjacent plateau area. Some parts can be flooded at times, although this area is generally slightly raised above the adjacent saline flats.</p> <p>Main soils: <u>ironstone soil</u> - thick light sandy loam with a sub-surface layer of clayey sand to light sandy loam which is often bleached and usually includes ironstone gravel; over olive-brown to olive sodic clay; overlying white clay with fine carbonate (marl) <b>J1-F2</b> (<i>Hypercalcic Ferric Brown Sodosol</i>).</p> <p><b>VNA</b> – low to moderately saline flats (II-IIIs)</p> <p>Summary: Main issues: some saline seepage, the sodic nature of clayey subsoils, and the presence of ironstone gravel reducing fertility through phosphorous fixation. Flooding also a possibility.</p>
PaQ	0.9	<p>Non-arable low-lying flats adjacent to Murray Lagoon. This area is likely to flood when Murray Lagoon water levels are very high.</p> <p>Main soils: <u>texture contrast soil</u> - thick sandy topsoil over sodic clay with abundant fine carbonate in subsoil or lower subsoil <b>G3</b> (<i>Brown Sodosol</i>). Some soils probably contain calcrete fragments.</p>



		<p><b>PaQ</b> – level to gently undulating plain which is marginally saline (IVs)</p> <p>Summary: this area gets very wet and is marginally saline. Flooding is a distinct possibility.</p>
PkK PkU	3.4 1.3	<p>Arable to semi-arable flats and very gentle slopes formed on clayey sediments.</p> <p>Main soils: <u>texture contrast soil</u> - light sandy loam with a sub-surface layer of loamy sand to light sandy loam which is often bleached and sometimes includes some ironstone gravel, over olive-brown to yellow-brown sodic clay. These soils are underlain by highly calcareous clayey sediments when adjacent to Murray Lagoon. The olive-brown coloured clays occur in the wetter lower lying areas. <b>G3-G4-J1</b> (<i>Brown-Grey Sodosol</i>).</p> <p><b>PkK</b> – level to very gently sloping with &lt;10% saline seepage (II-III). Flats adjacent to the slopes below plateau area. Areas which have rarely been affected by lagoon waters.</p> <p><b>PkU</b> – level to very gently sloping with 10-50% saline seepage (IVs). Drainage flats adjacent to Murray Lagoon, with alluvia derived from the plateau area deposited on older lagoonal sediments. Areas of topsoil have been washed away exposing highly saline subsoils.</p> <p>Summary: these areas are affected by saline seepage and waterlogging; subsoils are sodic; and flooding is a possibility in lower-lying areas.</p>
FHK	1.1	<p>Arable flats and very gentle slopes formed on a low-lying plateau remnant areas with loamy soils and ironstone gravel. These areas constitute islands of arable land surrounded by saline drainage depressions.</p> <p>Main soils: <u>ironstone soil</u> - neutral to acidic loamy topsoil with ironstone gravel over neutral yellow-brown sodic clay with mottles <b>J2</b> (<i>Ferric Brown Sodosol</i>).</p> <p><b>FHK</b> – level to very gently sloping with &lt;10% saline seepage (II-III)</p> <p>Summary: affected by some saline seepage, and with sodic subsoils; ironstone gravel reduces fertility by fixation of phosphorous.</p>
DRN DRP	2.4 0.2	<p>Semi-arable slopes, lower slopes and flats formed on weathering meta-sandstone.</p> <p>Main soils: <u>stony texture contrast soil</u> - sandy loam (some loamy sand) with a sub-surface layer of loamy sand to sandy loam with rock fragments which is often bleached, over alkaline olive-brown to yellow-brown sodic clay, sometimes with fine carbonate in lower subsoil, overlying weathering meta-sandstone <b>D7-K4</b> (<i>stony Brown Sodosol</i>). With 10-30% <u>texture contrast soil</u> - sandy loam with sub-surface layer of loamy sand or sandy loam which is often bleached, over olive-brown to yellow-brown sodic clay, often with fine carbonate in lower subsoil <b>F2-F1</b> (<i>Calcic Brown Sodosol</i>).</p> <p>Approximately 5% of the area is rocky flats: with extensive (20-50%) rock outcrops; and <u>stony texture contrast soil</u> - thick loamy sand with a sub-surface layer of loamy sand and with abundant meta-sandstone fragments, over sandy loam with weathering rock, over neutral olive sodic clay with weathering rock, overlying weathering meta-sandstone <b>K4</b> (<i>stony Brown Sodosol</i>); and very shallow loamy sand on meta-sandstone <b>L1</b> (rocky Rudosol); and medium thickness loamy sand over sandy loam over meta-sandstone <b>L1</b> (rocky Tenosol).</p> <p><b>DRN</b> – moderate slopes with &lt;10% saline seepage (slopes 10-18%, IVe, II-III); with approx 10-20% flats and lesser slopes with marginal salinity (slopes 0-3.5%, IVs), and including 0-5% rocky flats.</p> <p><b>DRP</b> – low rise: level to very gently sloping with marginal salinity (IVs)</p> <p>Summary: these areas are subject to saline seepage, waterlogging, and have reduced waterholding capacity due to stoniness; water erosion is a risk on sloping land; and clayey subsoils are sodic.</p>

# 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 - gullyng  
r - surface rockiness      s - salinity      w - waterlogging      y - exposure



**Detailed soil profile descriptions:****Main Soils:**

- F2-F1-G4-G3** Texture contrast soil (*Brown-Grey Sodosol*). Medium thickness, with a few thick, sandy loam (or sometimes loamy sand or even clay loam) with a sub-surface layer of loamy sand to sandy loam which is often bleached, and occasionally includes ironstone gravel; over olive-brown, yellow-brown or olive sodic mottled clay, often with fine carbonate in the lower subsoil. Underlain by marl when adjacent to lagoon areas. The olive coloured clay subsoils occur in the wettest areas. Old lake floor flats and depressions, remnant plateau flats, and other flats and slopes.
- B2-B3** Shallow soil on calcrete (*Petrocalcic Calcarosol-Tenosol*). Slightly to moderately calcareous (or occasionally non calcareous) sandy loam or sometimes loamy sand, often with calcrete fragments, and sometimes with a layer of loamy to clay loamy subsoil containing abundant fine carbonate; on calcrete at shallow depth. Old lake floor flats and calcreted lunettes.
- B6-N2a-N3a** Shallow clay loamy soil on calcrete (*Petrocalcic Sodosol-Hydrosol*). Moderate thickness, slightly calcareous to non-calcareous clay loam; over olive to olive-brown sodic mottled clay with some calcrete fragments; over olive sodic clay often with abundant fine carbonate; on calcrete at shallow depth. Old lake floor flats.

**Minor Soils:**

- N3b-N2b** Wet calcareous soil on marl (*Calcarosolic Hydrosol*). Medium thickness, calcareous clay loam to loam; often overlying an olive clay loam layer which often includes calcrete fragments; on light grey to pale yellow clay with abundant fine carbonate (marl). Lagoon margins and lagoon floors.
- C5-F2-A6** Loamy to clay loamy topsoil over light clay (*Hypercalcic Dermosol-Sodosol-Calcarosol*). Medium thickness loamy to clay loamy topsoil; over clay loam to light clay; sometimes overlying sodic clay; which overlies light clay with abundant fine carbonate (marl) maybe including some calcrete fragments. Old lake floor flats and depressions, and a clayey lunette.
- D7-K4** Stony texture contrast soil (*stony Brown Sodosol*). Medium thickness topsoil with sandy loam surface soil and loamy sand to sandy loam subsurface soil which is often bleached and includes rock fragments; overlying olive-brown to yellow-brown sodic mottled clay or light clay, sometimes with fine carbonate in the lower subsoil; on weathering meta-sandstone. Slopes, and some small rises and flats.
- I1-H3** Deep sand (*Podosol-Tenosol*). Medium thickness loamy sand overlying bleached sand. Underlain by clay at depth (>1 m). Sandy lunettes and a few saline depressions.
- J1-J2** Ironstone soil (*Ferric Brown Sodosol*). Neutral to acidic loamy topsoil with ironstone gravel, over neutral yellow-brown sodic clay with mottles. Usually with fine carbonate in lower subsoil. Low-lying remnant plateau flats and very gentle slopes.

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

