CRN Cronulla Land System

A system dominated by rising ground consisting of slopes and rise surfaces, and including numerous drainage depressions and drainage ways.

Area: 72.1 km^2

Landscape: A system dominated by rising ground consisting of slopes and rise surfaces, and including numerous drainage depressions and drainage ways. Many of the slopes, although very gentle, are long, and have suffered from water erosion – mostly scouring of drainage lines and drainage ways. Steeper slopes have signs of rilling in places. The system is in all probability underlain in part by a pre-Adelaidean Proterozoic age metamorphosed bedrock high (Crawford, A.R., 1965). Surrounding this are Permian age sediments associated with glacial activity. The bedrock has been overlain by a blanket of calcareous loess (Woorinen Formation). Calcrete layers have formed within these sediments. Soils are underlain by unconsolidated highly calcareous clay loamy sediments, or sometimes calcrete. It was expected that clayey sediments (Hindmarsh Clay equivalent) would be found lying between the bedrock and the calcareous-rich surface sediments, but such clays were not encountered in field work. However, these may occur at depth.

Calcareous loess is thickest on the western side of the system. On the eastern side of the system in relatively low lying parts, are significant areas of loamy and clay loamy soils with non calcareous surface layers. These are either remnant calcareous loess sediments in which the fine carbonate has been largely leached from surface layers, or else, these are exposed older sediments.

Annual rainfall: 405 - 445 mm average

Main soil: **A4** Calcareous loam (around 64% of area)

Other soils: **B2** Shallow calcareous loam on calcrete (around 21% of area)
C4 Hard gradational loam (around 11% of area)

Main features: Land in this system is mostly arable, however, a few areas of non arable stony land occur. Many soils are underlain by calcrete at shallow depth and/or contain hard carbonate rubble – these limit profile water holding capacity and hence productive potential. Surface stones also interfere with many farming practices.

Surface textures are mostly loams, and the most common soils are calcareous loams, some with calcrete at shallow depth.

Signs of water erosion are evident on many slopes. Rilling and some scouring of areas where water flow converges were observed. Many slopes are long, and so are more erodible than would be expected by slope angle alone. Careful surface management, and in some areas engineering solutions such as contour banking, are needed to minimise the risk of water erosion.

Most soils have hardsetting surfaces. Most subsoils are clay loamy, and are hard and dispersive – this has an affect on root exploration of soil layers. Corresponding very high sodium levels in subsoils also limit root growth due to a toxic effect. The dispersive nature of these soils decreases rainfall acceptance, thereby increasing runoff.

Saline seepage and/or the accumulation of cyclic salt affect many areas – usually reflected as raised subsoil salinity levels. Saline patches occur on a few lower slopes where saline groundwater nears the land surface.

Calcareous soils are common throughout this system. These restrict the availability of certain nutrients: deficiencies of the major nutrient phosphorus and the trace element zinc are common, while deficiencies of the trace elements manganese and iron are possible. Temporary trace element deficiencies can occur in cold and wet conditions with susceptible crops. This is particularly true for soils with highly calcareous surfaces.

Soil Landscape Unit summary: Cronulla Land System (CRN)

SLU	% of area	Main features #
IYB IYH IYE IYL IYZ	7.7 2.4 1.5 1.3 3.5	Land dominated by non calcareous and calcareous loams. Main soils: *hard gradational loam* **C4** in drainage lows/drainage ways/flats. And *calcareous loam* **A4** on very slight rises. With some *shallow calcareous loam on calcrete* **B2**, possibly grading to *shallow loam on calcrete* **B3**. **IYB** – gently undulating rise surface with drainage lows (slopes 0-1.5%). **IYH** – slopes with some rilling and some vague drainage lows (slopes 2-5%). **IYE** – drainage depression (slopes 0.5-1%). **IYL** – slopes with some vague drainage lows (slopes). **IYZ** – rise surface with a few vague drainage lows (slopes 0-1%).
QKL QKO	1.5 0.5	Land dominated by shallow calcareous soil on calcrete. Main soils: *shallow calcareous loam on calcrete* **B2**, with some *calcareous loam* **A4**. **QKL** – low rise (slopes 0-2%). **QKO** – drainage depression, showing minor highly saline patches and significant areas of marginal salinity (slopes 0-1%, 3-4s°).
QqB	0.2	Land dominated by shallow soil on calcrete. Main soils: *shallow calcareous loam on calcrete* **B2**, possibly grading to some *shallow loam over clay on calcrete* **B6** and some *shallow loam on calcrete* **B3**. **QqB** – low stony rise (slopes 0-2.5%, 4-5r): approximately 20-30% non arable stony land.
QTA QTB QTL QTLs QTb	3.2 2.7 3.2 1.4 1.4	Land dominated by shallow soil on calcrete. Main soils: *shallow calcareous loam on calcrete* **B2** grading to *shallow loam on calcrete* **B3**. Also with some rubbly *calcareous loam* **A4**. There may be minor areas of *hard gradational loam* **C4** in lows. **QTA** – rise surface (slopes 0-1%). **QTB** – lower slopes with drainage ways/lows (slopes 0-1.5%). **QTL** – slightly elevated gently undulating plain/slight slopes with some drainage lows/ways (slopes 0-1%). **QTLs** – slightly elevated plains/slight slopes with a drainage line which is eroded and salinised in parts (slopes 0-1%, 3-4s°). **QTb** – plains and slight slopes, at the base of very long slopes with drainage lines (slopes 0-1%, 3s°). Water runs onto and across this unit. Minor signs of the surface expression of saline seepage are evident.
RAB RAC RAL	0.2 0.3 1.2	Land dominated by shallow soil on calcrete. Main soils: *shallow loam on calcrete* **B3** grading to *shallow calcareous loam on calcrete* **B2** and *shallow loam over clay on calcrete* **B6**. With some *calcareous loam* **A4**, and some *hard gradational loam* **C4**. **RAB** – rise (slopes 0-2%). **RAC** – slopes with minor rilling (slopes 2-3.5%). **RAL** – lower slopes with minor rilling (slopes 1-3%).
ShK ShKg ShL ShLg ShO	1.8 13.4 6.6 15.0 3.0	Land dominated by soils formed in rubbly calcareous loess. Main soils: rubbly *calcareous loam* **A4**, with some *shallow calcareous loam on calcrete* **B2**. **ShK** – low rises/plains with some drainage lows/drainage ways in places (slopes 0-1%). **ShKg** – gently undulating plains with some drainage lines and drainage ways (slopes 0-1%). **ShL** – rises and slopes (slopes 0-2%). **ShLg** – rises and slopes with some drainage lines and drainage ways on long slopes (slopes 0-2.5%): approximately 5% non arable stony land. **ShO** – sloping drainage area with numerous drainage lines and drainage ways (slopes 0.5-1.5%): approximately 5% non arable stony land.

SMc SMLg SMZ	6.2 18.4 3.2	Land dominated by soils formed in calcareous loess. Main soils: *calcareous loam* **A4**. There may be *hard gradational loams* **C4** in some drainage lows. **SMc** – long slope with numerous eroded drainage lines (slopes 0.5-2%). **SMLg** – slopes and rises with a few drainage lines and some drainage ways/drainage lows (slopes 0.5-2.5%). **SMZ** – rise surfaces (slopes 0-1%).
ZA-	0.1	Salinised land. Main soils: probably *shallow calcareous loam on calcrete* **B2**. **ZA-** – salinised depression (4-5s).

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 soil:

A4 *calcareous loam* [Regolithic Lithocalcic-Hypercalcic Calcarosol]
Grey brown medium thickness calcareous loamy topsoil grading to clay loamy, light clayey, or loamy subsoil with abundant fine carbonate. Loam is the usual surface texture, and clay loam is the usual subsoil texture. Profiles very often contain abundant hard carbonate rubble. Surfaces are hardsetting. Subsoils are usually dispersive, and often strongly alkaline.

Other soils:

B2 *shallow calcareous loam on calcrete* [Petrocalcic Calcarosol]
Grey brown calcareous loam, with calcrete at shallow depth. A few very shallow non arable variants occur. Soil textures are sometimes sandy loamy, clay loamy or light clayey. Surfaces are hardsetting. Profiles often contain abundant hard carbonate rubble. These grade to *shallow loams on calcrete* **B3**, with non to slightly calcareous surfaces, in some places, especially in the east and south of the system. They may also grade to shallow texture contrast soil on calcrete in a few places in the east of the system: *shallow loam over clay on calcrete* **B6**.

C4 *hard gradational loam* [Brown-Red Kandosol]
Medium thickness brown loamy topsoil overlying brown to red brown loamy to clay loamy subsoil which grades to a highly calcareous lower subsoil. These soils can be underlain by calcrete at moderate depth. Topsoils are hardsetting. Subsoils are dispersive. Mostly found in relatively low lying areas on rise surfaces and slopes on the east side of the system. This soil variant is rare elsewhere on the Yorke Peninsula.

References: Crawford, A. R. (1965). `The Geology of Yorke Peninsula'. *Bull. geol. Surv. S. Aust., 39*.

Further information: DEWNR Soil and Land Program