

FLC Flinders Chase Land System

This land system encompasses the plateau surfaces and upper slopes of much of the highly dissected plateau area within Flinders Chase National Park.

Area: 158.7 km²

Annual rainfall: 620 – 795 mm average

Geology: The vast majority of this system is underlain by Pliocene age mottled clayey sediments, which overlie metasandstone bedrock. Surfaces are loamy to sandy, often containing ironstone gravel. On the high remnant plateau surfaces, the mottled clayey sediments are often within 50 cm of the surface, with a thin layer of ironstone gravel above. On many lower lying areas there has been a build up of ironstone gravel and topsoil material derived from the high remnant plateau surfaces, resulting in thick ironstone layers and greater depth to mottled clayey sediments. In wetter areas the ironstone gravel has often been 'dissolved' and is no longer present. In some of the lowest lying wetter areas, topsoil material from higher elevations has deposited to form deep sandy soils. On many slopes, metasandstone bedrock comes near to the surface, and soils commonly contain quartz fragments, and less often metasandstone fragments. These rocks are mostly early Cambrian age Kanmantoo Group Middleton Sandstone consisting of medium grained grey metasandstone.

Topography: Mostly remnant plateau surfaces and upper slopes. Plateau surfaces can be at various levels: high surfaces often step down to lower lying surfaces. Drainage is mostly to the south west, south and west via the creeks and rivers of the Breakneck River land system, and to a lesser extent the Rocky River land system. Plateau surface elevations grade gently from 300m in the very north east to about 40m in the very south west of the system. Slopes vary from 0 to 12%. A few lagoonal depressions occur on the plateau surface, the major one being Larrikin Lagoon.

Elevation: From 300 m in the north east to 40 m in the south-west

Relief: From less than 10 m to around 30 m

Main soils:

J2b	Shallow ironstone soil on mottled clayey substrate
J2a	Ironstone soil
M1	Deep sandy loam with ironstone gravel
K4	Acid sandy loam over brown clay on rock

Minor soils

F1-G5	Sandy loam to loamy sand over acid clay
J3	Shallow soil on ferricrete or dense ironstone gravel
H3	Bleached siliceous sand
I2	Wet highly leached sand
N3a	Wet sandy loam to clay loam over grey clay

Main features: Topsoils are typically sandy loams, with some loamy sands. The majority of soils are underlain by a relatively impermeable clayey subsoil or substrate. These impermeable clays limit infiltration and drainage, and combined with high rainfall result in waterlogging and wetness. Where ironstone gravel occurs it limits fertility by 'fixing' phosphorous. Soils in this system can be strongly acidic with aluminium levels which are toxic to plants. The land system is covered by native vegetation: all of the area is within the Flinders Chase National Park. So nature conservation is the main issue in this



land system. Native vegetation is typically dominated by low mallee and/or banksia (especially in wetter or less fertile areas). Some patches of relatively tall stringybarks and other eucalypts occur in more fertile and better drained areas. There is much evidence of high bushfire frequency, especially on the higher plateau surfaces. Regrowth of banksia and bullock is common.

Soil Landscape Unit summary: Flinders Chase Land System (FLC)

SLU	% of area	Main features #
FnB FnBg FnZ	6.3 0.05 16.7	<p>Mostly high level plateau surfaces with shallow ironstone soils.</p> <p>Main soils: shallow ironstone soil underlain by 'mottled zone' clayey substrate material J2b (<i>Ferric Brown Kurosol</i>); which can include some deeper ironstone soil J2a (<i>Ferric Brown Kurosol-Chromosol</i>). (Weathered rock may occur at around a metre on some slopes: soils on these areas will have some quartz and even some metasandstone fragments in the profile.) With limited areas of shallow ironstone soil on ferricrete or very dense and thick ironstone gravel J3 (<i>Petroferric Tenosol</i>). Minor to limited areas of loamy texture contrast soil where the ironstone has been removed F1 (<i>Brown Kurosol-Chromosol</i>).</p> <p>FnB – summit rise areas or upper plateau slopes (slopes 1-4%, 2-1e, 3w, 2y) FnBg – slopes with drainage line/s (slopes 1-3%, 2-1e, 3-4w, 2-1g, 1-2y) FnZ – mostly high level, and a few mid level in the west, plateau surfaces (slopes 0-2%, 1-2e, 3-4w, 2y)</p> <p>Summary: strongly acidic, highly leached and infertile high plateau surfaces with high bushfire frequencies. The ironstone can be relatively thin in these areas because over the ages it has been transported to adjacent lower lying plateau areas. These areas often have a gibber type pavement of ironstone gravel on the land surface: sometimes small quartz fragments are also evident, especially on sloping ground. Shallow topsoils exacerbate the effects of waterlogging, and shallow soils have low water holding capacities. These areas are typically dominated by banksia and/or very low mallee; bullock also occurs.</p>
FXB FXZ	4.7 20.1	<p>Mid level plateau surfaces and upper slopes with shallow and moderate depth ironstone soils.</p> <p>Main soils: ironstone soil J2a (<i>Ferric Brown Kurosol-Chromosol</i>); shallow ironstone soil underlain by 'mottled zone' clayey substrate material J2b (<i>Ferric Brown Kurosol</i>); shallow ironstone soil on ferricrete or very dense and thick ironstone gravel J3 (<i>Petroferric Tenosol</i>); and minor to limited areas of ironstone soil with thick and dense subsoil layers of ironstone gravel M1 (<i>Ferric Tenosol</i>). With minor areas of texture contrast soil on weathered rock K4 (<i>Stony Brown Kurosol-Chromosol</i>).</p> <p>FXB – upper slopes (slopes 1-3.5%, 2-1e, 4-3w) FXZ – plateau surfaces (slopes 0-2%, 1-2e, 4-3w)</p> <p>Summary: similar to 'Fn' areas but with fewer shallow soils. These areas are typically strongly acidic and infertile mid level plateau surfaces with relatively high bushfire frequencies. Extensive areas of shallow topsoil exacerbate the effects of waterlogging, and shallow soils have low water holding capacities. These areas are typically dominated by low mallee.</p>
FVA FVB FVBg FVBx FVC FVCg FVE FVL FVZ	0.2 10.3 2.1 0.4 4.0 2.3 0.1 0.3 0.1	<p>Upper slopes, crests, plateau surfaces and plains with ironstone soils and soils formed on weathered rock.</p> <p>Main soils: ironstone soil J2a (<i>Ferric Brown Kurosol-Chromosol</i>), which can include shallow ironstone soil underlain by 'mottled zone' clayey substrate material J2b (<i>Ferric Brown Kurosol</i>). With limited to extensive areas of texture contrast soil on weathered rock K4 (<i>Stony Brown Kurosol-Chromosol</i>) especially on steeper and lower slopes. With minor to limited areas of ironstone soil with thick and dense subsoil layers of ironstone gravel M1 (<i>Ferric Tenosol</i>).</p> <p>FVA – relatively low lying gently undulating plains (slopes 0-1%, 1e, 4-3w) FVB – upper slopes (1-4%, 2-1e, 3-4w)</p>



		<p>FVBg – upper slopes with some drainage lines (slopes 1-4%, 2e, 3-4w, 2-1g) FVBx – exposed summit rise area (slopes 1-3%, 2-1e, 3w, 2y) FVC – upper slopes (4-8%, 3e, 3-4w) FVCg – upper slopes with some drainage lines (slopes 4-12%, 3e, 3-4w, 2-1g) FVE – upper drainage depression (slopes 1-4%, 3-2e, 4-5w, 1-2y) FVL – upper slopes with minor saline seepage (slopes 1.5-4%, 2-3e, 4-3w, 2-3^{os}) FVZ – plateau surface (slopes 0-2%, 1-2e, 3w, 2y)</p> <p>Summary: plateau areas and slopes below plateau surfaces. These areas are often indicated by small quartz fragments on the land surface. Slopes ameliorate the effect of waterlogging, especially on steeper slopes, so that these areas can be relatively well drained. Areas typically dominated by stringybark gums or low mallee.</p>
FQA FQE	1.4 0.5	<p>Gently undulating plains and drainage depressions with ironstone soils with mostly thick sandy topsoils. Main soils: thick sandy, with some sandy loam, ironstone soil J2a (sandy <i>Ferric Brown Kurosol-Sodosol-Chromosol</i>). Minor to limited areas of loamy sands over clay G5 (sandy <i>Brown Kurosol-Sodosol-Chromosol</i>) especially in lower lying areas. (Weathered rock may occur at depths of less than one metre.)</p> <p>FQA – gently undulating plains, often somewhat low lying (slopes 0-3%, 1-2e, 4-3w, 2-1y) FQE – drainage depressions (slopes 0-1%, 5w, 1e, 1y, 1-2s)</p> <p>Summary: the sandy topsoils are derived from the adjacent coastal areas with sands on calcreted calcarenite. Subsoils are sodic and dispersive in drainage depressions. Native vegetation dominated by low mallee.</p>
FRB FRBx FRC FRE FRZ FRZw	5.3 0.2 0.3 0.1 11.1 2.7	<p>Lower level plateau surfaces and slopes with ironstone soils. Main soils: loamy ironstone soil J2a (<i>Ferric Brown Kurosol-Chromosol</i>). (Weathered rock may occur at around a metre on some slopes: soils on these areas will have some quartz and even some metasandstone fragments in the profile.) And extensive areas of ironstone soil with thick and dense subsoil layers of ironstone gravel, typically with light sandy loam surface textures M1 (<i>Ferric Tenosol</i>). With minor areas of thick loamy sands to sandy loams over clay, typically in slight depressions with relatively tall eucalypts or other eucalypts G5-F1 (<i>Brown Kurosol-Chromosol</i>). Minor areas of deep bleached sands can occur H3 (<i>sandy Tenosol</i>).</p> <p>FRB – slopes (0-4%, 2-1e, 3-4w) FRBx – exposed summit rise area (slopes 1-3%, 2-1e, 3-4w, 2y) FRC – slopes (3-8%, 3-2e, 3w) FRE – plateau surface depression/drainage area (slopes 0-2%, 4w, 1-2e) FRZ – lower level plateau surfaces (slopes 0-2%, 1e, 3-4w) FRZw – less well drained plateau surfaces (slopes 0-2%, 1e, 4w, 1-2s)</p> <p>Summary: areas below the level of the higher plateau surfaces with some colluvial deposits. Deeper topsoils ameliorate the effect of waterlogging, especially on sloping ground, so that these areas are often better drained than other ironstone plateau areas (other ‘F’ soil landscape units). Native vegetation typically dominated by mallee or sometimes stringybark. [Close to an ‘Fz’ land unit.]</p>
PoA PoE PoZ	0.9 1.0 6.6	<p>Low level and low lying plateau areas mostly with texture contrast soils. Main soils: thick loamy sands to sandy loams over clay G5-F1 (<i>Brown Kurosol-Chromosol-Sodosol</i>). And various ironstone soils: J2a (<i>Ferric Brown Kurosol-Chromosol</i>) and some M1 (<i>Ferric Tenosol</i>). With minor to common areas of deep bleached sand, especially in slight depressions H3 (<i>sandy Tenosol</i>).</p> <p>PoA – relatively low lying plateau surface areas (slopes 0-2%, 1-2e, 4w). Native vegetation typically dominated by mid-sized stringybarks. PoE – poorly drained depression areas on the plateau surface (slopes 0-1%, 1e, 5-4w). Native vegetation typically dominated by banksia and low mallee. PoZ – low level and/or low lying, but relatively well drained plateau surface areas (slopes 0-2%, 1-2e, 3w). Native vegetation typically dominated by relatively tall stringybarks and other eucalypts.</p>



		<p>Summary: areas below the level of the higher plateau surfaces. Deeper topsoils ameliorate the effect of waterlogging, especially on sloping ground. Drainage grades from the relatively well drained 'PoZ' areas, to the imperfectly drained 'PoA' areas, to the poorly drained 'PoE' areas. These areas have greater levels of fertility than those areas dominated by ironstone gravel or deep sands, have relatively deep soils, and when relatively well drained, provide conditions which can support a much more substantial native vegetation (in the form of sclerophyll forest) than elsewhere in this land system.</p>
PhZ	0.8	<p>Low lying plateau areas with deep sandy soils. Main soils: deep bleached sand, underlain by a clayey substrate at depth H3 (<i>sandy Tenosol</i>). With some highly leached sands, especially in wetter areas I2 (<i>Podosol</i>). With minor to limited areas of soils with ironstone gravel J2a (<i>Ferric Brown Kurosol-Chromosol</i>) and/or M1 (<i>Ferric Tenosol</i>). Minor areas of sandy texture contrast soil in drainage lows G5 (<i>Brown Kurosol-Sodosol-Chromosol</i>).</p> <p>PhZ – low lying plateau surface area (slopes 0-2%, 1e, 4-5w)</p> <p>Summary: infertile sandy areas. The sands are most likely derived from nearby coastal deposits and adjacent higher elevation plateau topsoils. Areas are typically dominated by banksia and low stringybark gums (2-3m).</p>
PiE PiO	0.5 0.1	<p>Depressions on the plateau surface with highly leached sandy soils. Main soils: wet highly leached loamy sands to sandy loams, underlain by a clayey substrate at moderate or deep depth I2 (<i>Podosol</i>). Some areas of thick loamy sands to sandy loams over clay may occur on the 'drier' margins G5-F1 (<i>Brown Kurosol-Chromosol-Sodosol</i>).</p> <p>PiE – depressions/headwater areas (5-7w) PiO – moderately saline drainage depression/headwater area (slopes 0-2%, 1-2e, 5-7w, 3+s)</p> <p>Summary: wet and infertile small depressions or headwater areas.</p>
HKE HKO	0.2 0.1	<p>Depressions with texture contrast soils. Main soils: loamy texture contrast soil F1 (<i>Brown Kurosol-Sodosol-Chromosol</i>) with some ironstone. Sometimes with some loamy ironstone soil J2a (<i>Ferric Brown Kurosol-Chromosol</i>).</p> <p>HKE – wet shallow depression/headwater area (slopes <0.5%, 5-7w, 1e, 1-2s) HKO – moderately saline drainage depression/headwater area (slopes 0-2%, 1-2e, 5w, 3+s)</p> <p>Summary: wet shallow depressions or headwater areas on the plateau surface, where most of the former ironstone gravel has been 'dissolved'. There are possibly some raised subsoil salinity levels. Native vegetation is dominated by reedy grass: also with banksia, bullock, and a few low mallee.</p>
MIYA	0.03	<p>Relict coastal dune core with mostly moderate to shallow depth soil on calcrete. Main soils: moderate to shallow depth sand on calcrete H2-B8 (<i>Petrocalcic Tenosol</i>); possibly with minor areas of deep sands H3 (<i>sandy Tenosol</i>), especially in hollows. Minor areas of texture contrast soil with ironstone may occur where calcarenite has been 'dissolved'.</p> <p>MIYA – small rise with low dune core topography (dune core heights <5m, slopes 0-2%, 1e, 2-1w, 2-1y)</p> <p>Summary: outlier of nearby remnant coastal dune areas. Some patches of calcarenite rock evident on landscape surface.</p>
ZP- ZQ1 ZQ2 ZU-	0.2 0.02 0.1 0.2	<p>Lagoonal depressions on the plateau surface.</p> <p>ZP- – lagoonal depression margins with melaleuca shrubs, mildly saline to non saline (slopes <0.5%, 5w, 1e, 2-1s). Including the lagoonal margins of the Larrikin Lagoon area. Main soils: sandy texture contrast soil with moderate depth loamy sand to sandy loam topsoil over grey clay N3a (<i>Grey Sodosolic-Kuorosolic Hydrosol</i>).</p> <p>ZQ1 – bare, near coastal lagoonal depression with moderate salinity or less (slopes <0.5%, 7w, 1e, 3s)</p>



	<p>Main soils: wet clay loamy calcareous gradational soil N3b (Grey Calcarosolic-Dermosolic Hydrosol).</p> <p>ZQ2 – lagoonal depression with moderate salinity or less (slopes <0.5%, 7w, 1e, 3-2s). Including a relatively low lying lagoonal margin in the Larrikin Lagoon area which may be moderately saline. Mostly covered by melaleuca (1-1.5 m high in the Larrikin Lagoon area).</p> <p>Main soils: wet loamy texture contrast soil with grey clayey subsoil N3a (Grey Sodosolic-Kurosolic Hydrosol), some profiles may contain some ironstone.</p> <p>ZU- – shallow lagoonal depression of Larrikin Lagoon: mildly saline to non saline subsoils. Seasonally flooded; water can remain all year. Covered by thick reedy grass (slopes <0.5%, 7-8w, 1e, 2-1s).</p> <p>Main soils: wet, organic-rich loamy texture contrast soil with grey clayey subsoil N3a (Grey Sodosolic-Kuorosolic Hydrosol).</p> <p>Summary: wet lagoonal depressions with marginal salinity or less. Lagoonal depressions are seasonally flooded; lagoonal margins less frequently.</p>
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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:

- J2b** Shallow ironstone soil on mottled clayey substrate (*Ferric Brown Kurosol*). Thin to medium thickness topsoil with ironstone gravel. The topsoil consists of a surface soil which is typically a sandy loam, and a subsurface layer of sandy loam to clay loam. This subsurface layer is often a transitional layer between surface soil and subsoil. The subsoil is typically a yellow brown to bright yellow clay. Red, olive brown, yellow brown, grey and/or yellow, very hard 'mottled zone' silty clay substrate occurs at around 50 cm depth, which effectively defines the lower soil boundary. The surface is typically blanketed by a pavement of ironstone. Soil pHs are strongly acidic or acidic. Found on high level plateau surfaces and upper slopes. Bushfire intensity is high in these areas. Native vegetation is often sparse and is typically dominated by low banksia, low bullock and very low mallee.
- J2a** Ironstone soil (*Ferric Brown Kurosol-Chromosol-Sodosol*). Medium thickness topsoil with ironstone gravel, overlying yellow brown clayey subsoil. There is often a clay loamy to light clayey transition layer between topsoil and subsoil which often contains ironstone gravel. Very hard 'mottled zone' clayey substrate occurs at depth to moderate depth (below 60 cm). Soil pHs are acidic to strongly acidic. Typically found on mid level plateau surfaces, and slopes. Native vegetation is typically dominated by low mallee.
- M1** Deep sandy loam with ironstone gravel (*Ferric Tenosol*). Typically deep to moderate depth sandy loam, light sandy loam or loamy sand, with thick ironstone gravel in lower layers. Bleached layers can occur above and within the ironstone gravel layer. This is underlain by often pale coloured clayey substrate, which can be sodic/dispersive in the upper layer. Found on low lying plateau surfaces and lower lying areas on slopes where ironstone gravel and topsoil material from higher levels have accumulated. Native vegetation is typically dominated by mallee.
- K4** Acid sandy loam over brown clay on rock (*stony Brown Kurosol-Chromosol-Sodosol*). Medium thickness sandy loam to loamy sand topsoil, often with a bleached subsurface layer. The topsoil typically contains some ironstone and quartz fragments, and occasionally some metasandstone



fragments. Subsoils are clayey and olive brown to yellow brown. Soil pHs are acidic to strongly acidic. Weathered rock, typically mixed with 'mottled zone' clayey substrate material occurs at moderate depth. Found on slopes where bedrock comes closest to the land surface. Native vegetation typically dominated by low mallee.

Minor soils:

- F1-G5** Sandy loam to loamy sand over acid clay (*Brown Kurosol-Chromosol-Sodosol*). Medium thickness to thick sandy loam or loamy sand topsoil, often with a bleached subsurface layer, and sometimes with some ironstone. A clay loamy to light clayey transition layer between topsoil and subsoil may occur. Subsoils are clayey and grey brown, olive brown or yellow brown. Upper subsoils are often sodic/dispersive. Lower subsoils are often grey or green grey, indicating wetness. Soil pHs are acidic to strongly acidic. Found in relatively wet depressions and low lying areas where ironstone gravel has been 'dissolved'. Where these areas are not excessively wet, quite tall eucalypts occur.
- J3** Shallow soil on ferricrete or dense ironstone gravel (*Petroferric Tenosol*). Shallow sandy loam to loamy sand on ferricrete (boulder or sheet 'laterite') or on a very dense and very thick layer of ironstone gravel. Soil pHs are acidic to strongly acidic. Found in small patches on plateau surfaces and upper slopes.
- H3** Bleached siliceous sand (*sandy Tenosol*). Deep to moderate deep bleached loamy sand to sand. The bleached layer is underlain by yellow brown to yellow sandy subsoil. This is all underlain by clayey substrate. Found in low lying situations where sandy topsoil from higher elevations has accumulated. Soil pHs are acidic to strongly acidic. These are infertile soils with native vegetation dominated by banksia and/or low stringybark gums.
- I2** Wet highly leached sand (*Podosol*). Deep to moderate depth bleached loamy sand to sand. There is a subsoil layer with dark brown accumulations of organic matter, iron and aluminium. These dark brown accumulations may occur as distinct segregations or as an entire layer. A clayey substrate occurs below this. Soil pHs are acidic to strongly acidic. Found in wet headwater/small depression areas where sand has accumulated. These highly leached, wet and infertile sands have native vegetation dominated by banksia, low mallee and/or bullock.
- N3a** Wet sandy loam to clay loam over grey clay (*Grey Sodosolic-Kurosolic Hydrosol*). Thin to medium thickness dark sandy loam, loam or clay loamy topsoil. Subsoils are clayey and grey brown, olive grey, dark grey or light grey, are usually sodic, and can be dispersive. Subsoils can have slightly raised salinity levels. Dark grey to light grey clayey substrate occurs at shallow to moderate depth: lagoonal waters 'perch' on this substrate layer. Soil pHs are acidic to strongly acidic. Found in lagoonal depressions and margins: Larrikin Lagoon being the main area.

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

