

# PAN Parndana Land System

A sluggishly drained plateau area. There are many low-lying areas and ill-defined drainage depressions where colluvial/alluvial deposition has occurred. The system is bordered to the south by a deeply dissected plateau area; to the west by a very wet/poorly drained plateau area; to the east by a slightly higher and better drained plateau area; and to the north by a very highly dissected area with some remnant plateau highs. This system is named after the township of Parndana which is situated toward the western end of the system, and was only settled after World War II.

**Area:** 59.3 km<sup>2</sup>

**Annual rainfall:** 625 – 710 mm average

**Geology:** The slightly higher plateau areas mostly consist of Pliocene age regolith, comprising deeply weathered clayey sediments capped with ironstone gravel (or occasionally ferricrete – sheet or boulder laterite). Other areas of Pliocene-Quaternary age colluvium occur, also consisting of deeply weathered clayey sediments usually capped with ironstone gravel and sometimes with ironstone included in the upper clayey subsoil. Areas occur where ironstone gravel has been ‘dissolved’: usually in drainage areas and on some lower slopes. Deposits of Quaternary age clayey alluvium occur in depression areas: these areas are also usually without ironstone gravel. There are a few areas with gilgai relief (flats/mounds and crabholes).

These clayey sediments are underlain by early Cambrian age Kanmantoo Group meta-sediments: Tapanappa Formation meta-sandstone, and undifferentiated Kanmantoo Group meta-sandstones. These rocks have near surface expression in places: at the sloping edge of the plateau adjacent to the steep slopes and gullies, on some crests, on lower slopes adjacent to drainage lines and in some low-lying depression areas.

**Topography:** Mostly a gently undulating plateau surface. Slopes are generally from 0-3%. The steepest reach 8% on a few slopes bordering drainage lines. The system’s main drainage is to the south via tributaries of Timber Creek; while there is a minor area which drains south into the Eleanor River. There is also some drainage to the north via the Snaky Creek Swamp into Snaky Creek, and via tributaries near Parndana into Deep Creek. Apart from the well-defined creeks, many ill-defined drainage areas occur; these eventually drain into creeks or depression areas. Some significant depression areas occur, particularly the ‘swamp’ at the head of Snaky Creek.

**Elevation:** From near 180 m in the west, to around 130 m in the south

**Relief:** Generally 10 m or less; 20 m at its greatest extent.

**Main Soils:**

<b>J2a</b>	<u>Colluvial ironstone soil</u>
<b>J2b</b>	<u>Ironstone soil</u>
<b>F1-F2a</b>	<u>Sodic texture contrast soil</u>

**Minor Soils:**

<b>K4</b>	<u>Texture contrast soil on weathered rock</u>
<b>F2b-J2c-G4</b>	<u>Cracking texture contrast soil</u>
<b>J3</b>	<u>Shallow soil on ferricrete</u>
<b>M1</b>	<u>Deep loamy soil</u>



**Main Features:** Arable plateau surfaces with some depression areas and slopes. Topsoils are loamy. Main soils are loamy with ironstone gravel over clay. Ironstone gravel reduces fertility due to its ability to 'fix' phosphorus. Soil waterholding capacity is also reduced by the gravel. The clayey subsoils are relatively impermeable, resulting in waterlogged conditions in many soils over winter and spring. Impermeable subsoils also result in increased run-off. Acidic conditions occur in most soils: some topsoils and subsoils are strongly acidic; while lower subsoils in particular are often strongly acidic. A few patches of saline seepage occur in depressions and drainage ways, however, there is less saline seepage in comparison to more easterly areas.

**Soil Landscape Unit summary:** Parndana Land System (PAN)

SLU	% of area	Main features #
XI-	0.3	<b>XI-</b> – a dam and two short drainage lines.
LOT	0.5	<p>Non-arable to semi-arable depression at the head of Snaky Creek: with sodic soil, some soil formed over weathering rock, some podsolized soil, and areas of gilgai microrelief in the centre of the swamp. [Description mostly taken from Northcote, CSIR Bulletin No.233, 1948.]</p> <p>Main soils: <u>cracking texture contrast soil</u> - bleached sandy soil over sodic clay with cracking subsoil and some ironstone nodules throughout <b>G4</b> (<i>Vertic Brown Sodosol</i>). With <u>texture contrast soil on weathered rock</u> - bleached sandy soil with some quartz fragments and ironstone nodules, over sodic clay, overlying weathering sandstone, found at swamp margins <b>K4</b> (<i>Brown Sodosol</i>). With areas of bleached podsolized sandy soil with soft 'coffee-rock' accumulations in the subsoil, overlying clayey sediments <b>I2</b> (<i>Podosol</i>). And with limited areas of gilgai relief in the centre of the swamp: with cracking clay soil, with some fine lime throughout the profile on gilgai mounds <b>E3</b> (<i>Vertosol</i>); and bleached loamy soil over sodic and cracking clay with fine lime in the lower subsoil in gilgai depressions <b>F2</b> (<i>Vertic Grey Sodosol</i>).</p> <p><b>LOT</b> – alluvial depression with 10-50% saline seepage (slopes 0-1%, 1e, 4-3*s, 5-4w)</p> <p>Summary: this depression is characterised by wetness and saline seepage.</p>
HCE HCT	0.1 5.4	<p>Non-arable drainage depressions: with sodic soil, and some soil over weathering rock.</p> <p>Main soils: loamy <u>sodic texture contrast soil</u> <b>F1-F2a</b> (<i>Brown Sodosol</i>). With 10-40% loamy <u>texture contrast soil on weathered rock</u> <b>K4</b> (<i>Brown Chromosol-Sodosol</i>). With 0-10% loamy <u>ironstone soils</u> <b>J2a-J2b</b> (<i>Ferric Brown Chromosol</i>).</p> <p><b>HCE</b> – drainage depression: very upper reaches of creek/drainage lines (slopes 2-4%, 2-3e)  <b>HCT</b> – drainage depression and lower slopes with 10-50% saline seepage (slopes 1-5%, 2-3e, 4-3*s)</p> <p>Summary: characterised by wetness, risk of flooding, some saline seepage, and acidic to strongly acidic soils.</p>
HKA HKE HKO	2.6 1.0 0.8	<p>Non-arable, semi-arable or arable drainage depressions and low-lying plains: with sodic soil, and some ironstone soil.</p> <p>Main soils: loamy <u>sodic texture contrast soil</u>, a few with weathered rock within 1m <b>F1-F2a</b> (<i>Brown Sodosol</i>). With 10-40% loamy <u>ironstone soils</u> <b>J2a-J2b</b> (<i>Ferric Brown Chromosol</i>).</p> <p><b>HKA</b> – low-lying plain/plateau surface (slopes 0-1.5%, 1e)  <b>HKE</b> – lower slopes and drainage depression (slopes 1-3%, 2e)  <b>HKO</b> – lower slopes and drainage depression with &lt;10% saline seepage (slopes 2-8%, 3e, 3-2°s-3-2*s)</p> <p>Summary: these areas are characterised by waterlogging/wetness, many sodic subsoils, acidic to strongly acidic soils, reduced fertility where ironstone gravel occurs due to phosphorous fixation, and saline seepage in a few areas.</p>



FBE	2.1	<p>Arable low-lying plain: with sodic ironstone soils usually with cracking clay subsoils. Main soils: loamy <u>cracking texture contrast soil</u> with ironstone gravel over cracking and sodic clay, in areas of gilgai or slight gilgai relief <b>J2c</b> (<i>Vertic Ferric Brown Sodosol</i>). With 10-40% loamy <u>cracking texture contrast soil</u> over sodic and cracking clay, often on mounds/flats in areas of gilgai relief <b>F2b</b> (<i>Vertic Brown Sodosol</i>) and loamy <u>ironstone soils J2a-J2b</u> (<i>Ferric Chromosol-Sodosol</i>). A few soils have weathering rock within 1m (<b>K4</b>).</p> <p><b>FBE</b> – low-lying plain/depression (slopes 0-1%, 1e)</p> <p>Summary: the main issues are waterlogging, subsoil physical condition, reduced fertility where ironstone gravel occurs due to phosphorous fixation, and acidic to strongly acidic soils.</p>
FWZ	15.4	<p>Mostly arable summit/plateau surfaces: with ironstone soil, some soil over weathering rock, and some shallow soil on ferricrete. Mains soils: loamy <u>ironstone soils J2a-J2b</u> (<i>Ferric Brown Chromosol</i>). With 10-40% loamy <u>texture contrast soil on weathered rock K4</u> (<i>Brown Chromosol-Sodosol</i>) and loamy <u>shallow soil on ferricrete J3</u> (<i>Petroferric Tenosol</i>).</p> <p><b>FWZ</b> – summit/plateau surfaces (slopes 0-2%, 1-2e)</p> <p>Summary: the main issues are reduced fertility where ironstone gravel occurs due to phosphorous fixation, acidic to strongly acidic soils, low water holding capacity and stoniness (ferricrete fragments) where shallow soils occur, and some waterlogging.</p>
FUA FUB FUE FUK FUO	2.4 3.4 1.1 0.2 0.4	<p>Mostly arable plains, slopes and drainage areas: with ironstone soil, and some sodic soil. Main soils: loamy <u>ironstone soils J2a-J2b</u> (<i>Ferric Brown Chromosol</i>). With 10-40% loamy <u>sodic texture contrast soil</u> usually in ill-defined drainage areas <b>F1-F2a</b> (<i>Brown Sodosol</i>). With 0-10% loamy <u>shallow soil on ferricrete J3</u> (<i>Petroferric Tenosol</i>). With 0-10% loamy <u>texture contrast soil on weathered rock K4</u> (<i>Brown Chromosol-Sodosol</i>).</p> <p><b>FUA</b> – mid-level plateau area (slopes 0-2%, 1-2e)  <b>FUB</b> – slopes (1-3%, 2e)  <b>FUE</b> – depression (slopes 0-1%, 1e)  <b>FUK</b> – low-lying plain with &lt;10% saline seepage (slopes 0-1%, 1e 2-3s)  <b>FUO</b> – depression with &lt;10% saline seepage (slopes 0-1%, 1e, 2-3s)</p> <p>Summary: the main issues are waterlogging, reduced fertility where ironstone gravel occurs due to phosphorous fixation, and acidic to strongly acidic soils.</p>
FRA FRB FRE FRZ	13.5 10.8 2.8 23.6	<p>Mostly arable summit/plateau surfaces, plains, slopes and depressions: with ironstone soils. Main soils: loamy <u>ironstone soils J2a-J2b</u> (<i>Ferric Brown Chromosol</i>). With 0-10% loamy <u>shallow soil on ferricrete J3</u> (<i>Petroferric Tenosol</i>). With 0-10% loamy <u>texture contrast soil on weathered rock K4</u> (<i>Brown Chromosol-Sodosol</i>) and 0-10% loamy <u>sodic texture contrast soil F1-F2a</u> (<i>Brown Sodosol</i>).</p> <p><b>FRA</b> – mid-level plateau area (slopes 0-2%, 1-2e)  <b>FRB</b> – slopes (1-4%, 2e)  <b>FRE</b> – slight depression (slopes 0-2%, 1-2e)  <b>FRZ</b> – summit/plateau surfaces (slopes 0-2%, 1-2e). Often with thick ironstone gravel.</p> <p>Summary: the main issues are waterlogging, reduced fertility with ironstone gravel due to phosphorous fixation, and acidic to strongly acidic soils.</p>
FVB FVZ	3.2 2.7	<p>Mostly arable summit/plateau surfaces and slopes: with ironstone soil, and some soil over weathering rock.</p> <p>Main soils: loamy <u>ironstone soils J2a-J2b</u> (<i>Ferric Brown Chromosol</i>). With 10-40% loamy <u>texture contrast soil on weathered rock K4</u> (<i>Brown Chromosol-Sodosol</i>). With 0-10% loamy <u>shallow soil on ferricrete J3</u> (<i>Petroferric Tenosol</i>).</p> <p><b>FVB</b> – slopes (1-4%, 2e)  <b>FVZ</b> – summit/plateau surfaces (slopes 0-2%, 1-2e)</p> <p>Summary: the main issues are reduced fertility where ironstone gravel occurs due to phosphorous fixation, acidic to strongly acidic soils, some waterlogging, and some stoniness.</p>



FXB FXZ	1.5 5.7	<p>Arable to semi-arable summit/plateau surfaces: with ironstone soil, and some shallow soil on ferricrete.</p> <p>Main soils: loamy <u>ironstone soils J2a-J2b</u> (<i>Ferric Brown Chromosol</i>). With 10-40% loamy <u>shallow soil on ferricrete J3</u> (<i>Petroferric Tenosol</i>). With 0-10% loamy <u>texture contrast soil on weathered rock K4</u> (<i>Brown Chromosol-Sodosol</i>).</p> <p><b>FXB</b> – slopes (1-3%, 2-1e) <b>FXZ</b> – summit/plateau surfaces (slopes 0-2%, 1-2e)</p> <p>Summary: the main issues are waterlogging, reduced fertility with ironstone gravel due to phosphorous fixation, low water holding capacity and stoniness (ferricrete fragments) where shallow soils occur, and acidic to strongly acidic soils.</p>
FxZ	0.3	<p>Semi-arable summit/plateau area: with shallow soil on ferricrete, and some ironstone soils.</p> <p>Main soils: loamy <u>shallow soil on ferricrete J3</u> (<i>Petroferric Tenosol</i>). With 10-40% loamy <u>ironstone soils J2a-J2b</u> (<i>Ferric Brown Chromosol</i>).</p> <p><b>FxZ</b> – summit/plateau surface (slopes 0-1%, 1e)</p> <p>Summary: the main issues are low water holding capacity and stoniness (ferricrete fragments) where shallow soils occur, waterlogging, reduced fertility with ironstone gravel due to phosphorous fixation, and acidic to strongly acidic soils.</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:

**J2a** Colluvial ironstone soil (*Ferric Brown Chromosol*). Very thick to thick, with some medium thickness, sandy loam to loam (a few almost peaty), with a sub-surface layer of sandy loam to silty clay loam which is very occasionally bleached and includes ironstone gravel; on or grading into yellow-brown, olive-brown, brown or yellow-red clay with ironstone nodules or occasionally ironstone gravel. The clay usually has red and olive mottles. The subsoil often has subangular blocky or polyhedral structure which usually breaks down to <2 mm or 2 - 5 mm lenticular peds. The clay is usually a 'short' clay, ribboning as for a light clay, clay loam or less but obviously being more clayey than that. (These soils result from colluvial/alluvial deposition processes as evidenced by the presence of ironstone nodules in the upper clayey subsoil layers.) Note: a few Ferric Dermosols occur. Found on plateau surfaces: slopes and flats.

**J2b** Ironstone soil (*Ferric Brown Chromosol*). Thick to medium thickness sandy loam to loam, with a sub-surface layer of sandy loam to light clay loam which is occasionally bleached and includes ironstone gravel; on or sometimes grading into yellow-brown to olive-brown clay which usually has some red and olive mottles. The subsoil usually has weak to moderate subangular blocky or polyhedral primary structure which breaks down to <2 mm or 2 - 5 mm lenticular secondary structure. The clay usually textures as a 'short' clay, that is, it ribbons as would a light clay or clay loam or less but is obviously more clayey. The few soils with bleached layers occur in drainage areas and are probably sodic. Note: a few Ferric Dermosols occur. Found on plateau surfaces: especially crests, slopes, flats and depressions. [The unbleached versions equate to the 'Seddon Gravelly Soil' of Northcote.]

*Note:* the above soils are very similar, except that the former has been affected by colluvial/alluvial processes, having ironstone nodules or ironstone gravel in the upper layers of the clayey subsoil, as well as in the topsoil layers, and is usually found in lower-level situations.



**F1-F2a** Sodic texture contrast soil (*Brown Sodosol*). Thick, with some medium thickness, light sandy loam, sandy loam or loam, with a sub-surface layer of clayey sand to clay loam which is often bleached and often includes some ironstone nodules; on or grading into yellow-brown, olive-brown or even olive mottled clay which is usually sodic. Some soils have some quartz fragments in the subsoil or lower subsoil. Sometimes weathering rock occurs just at or below 1m. Note: some soils would be classified as Chromosols or Dermosols. Found on flats, drainage flats, depressions, lower slopes and in ill-defined drainage areas.

**Minor Soils:**

**K4** Texture contrast soil on weathered rock (*Brown Chromosol-Sodosol*). Very thick to medium thickness sandy loam to loam, with a sub-surface layer of sandy loam to clay loam which is sometimes bleached, often has some ironstone gravel (nodules or highly ferruginized rock fragments), usually has some quartz fragments and sometimes some meta-sandstone fragments; over yellow-brown, olive-brown or brown clay with mottles; on weathering rock material. The clayey subsoil is sometimes sodic. Found on crests, slopes and in drainage areas.

**F2b-J2c-G4** Cracking texture contrast soil (*Vertic Ferric Brown Sodosol* and *Vertic Brown Sodosol*). Medium to thin sandy loam to loam, with a sub-surface layer of light sandy loam to clay loam which is sometimes bleached and usually includes ironstone gravel; on olive-brown 'sticky' cracking and sodic clay, often including some ironstone nodules. Found on flats and in areas with gilgai microrelief (flats/mounds and crabhole depressions). Crabhole soils usually have a bleached layer with ironstone gravel; while those on flats/mounds are usually not bleached and often have some ironstone nodules but not ironstone gravel.

**J3** Shallow soil on ferricrete (*Petroferric Tenosol*). Sandy loam to loam, over a layer of light sandy loam or sandy loam which is sometimes bleached and includes ironstone gravel; overlying ferricrete (boulder or sheet laterite). A substrate of mottled clay underlies the ferricrete layer. Found on plateau surfaces.

**M1** Deep loamy soil (*loamy Tenosol*). Loamy to light clayey soil, over alternate layers of lighter texture and heavier texture (these consist of clayey sand and light sandy clay loam). The lighter textured layers are often bleached. Underlain by rock, weathering rock or clay. Found in creek beds. [Also found in creek beds: bare rock and ironstone gravel piles overlying rock.]

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

