



# **Land Resource Assessment of the Upper Logan and Albert Rivers Catchment**

**South-East Queensland**

**Volume 2 - Appendices**

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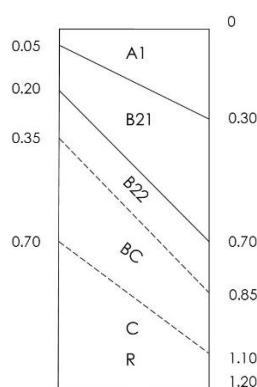
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## **Appendix 1: Soil Profile Classes**

## Conventions used in the descriptions of the morphology, landscape and SPCs

A **soil profile class** (SPC) is a group of similar soil profiles with a defined central concept and range of values. As the range of the definitive properties increase, the SPC will become more inclusive (i.e. broader). However, the variation of some key soil properties within the SPC must be less than the variation between different SPCs. Soil morphological properties and selected laboratory results are typically used to define an SPC. Also considered are parent material, landform, landscape position, vegetation and land use responses.

**SPC diagrams** provide a stylised representation of the soil horizons present (e.g. A, B21 etc.) and their range of upper and lower depths in metres. Solid lines represent definite horizon boundaries while dashed lines represent horizon boundaries that are only sometimes present e.g.:



A **soil variant** is a soil with profile attributes clearly outside the range of defined soil types but not extensive enough to warrant defining a new type e.g. Brabazon Acidic Variant (BzAv).

A **soil phase** is a subdivision of a soil profile class based on attributes that have particular significance in the use of the soil, for example, sodic phase e.g. Dulbolla Sodic Phase (DbSp).

**Australian Soil Classification** (Isbell & NCST Second Edition 2016) is listed in order of frequency of occurrence. If more than one classification applies to an SPC, the dominant soils are displayed as bold.

**Depth categories** used follow Isbell & NCST (Second Edition 2016) and are:

- Very shallow (<0.25m);
- Shallow (0.25-0.5m);
- Moderately deep (0.5-1.0m);
- Deep (1.0-1.5m);
- Very deep (1.5-5.0m); and
- Giant (>5.0m).

**Geology** as defined by the Beenleigh, Ipswich and Mount Lindesay maps sheets, 1:100,000 (2001).

**Surface characteristics** as in the *Australian Soil and Land Survey Field Handbook* or 'Yellow Book' (2009).

**Landform** as described by *Australian Soil and Land Survey Field Handbook* or 'Yellow Book' (NCST 2009).

The **pH profiles** are based on field determination (Raupach test) for each horizon.

**Horizons** are described by the Yellow Book (2009).

**Textures** are field textures as described by the Yellow Book (2009).

**Structure** as described by the Yellow Book (2009).

**Segregations** are described by the Yellow Book (2009).

**Boundary distinctness** is described by the Yellow Book (2009).

### Frequency of occurrence

- Frequently = >30% of occasions
- Occasionally = 10–30% of occasions
- Rarely = <10% of occasions.

**Colour codes** (moist) are those of Munsell soil colour charts (2000). Only the dominant Munsell colours have been listed in the descriptions. There may be some slight deviations from the range specified.

**Colour nomenclature** based on the colour classes of Isbell & NCST (Second Edition 2016) and is used in SPC concept descriptions.

**Representative site(s)** for SPCs are shown in bold.

Sites from the BOB (ZAV), LARA, MISSE, MFM, SEDG, SERES, SEQ, SPFD and SOC projects used here are described in their respective project reports or are available in the SALI database.

### References

Isbell RF and National Committee on Soil and Terrain (2016), *The Australian Soil Classification, second edition*, CSIRO, Australia.

Munsell soil colour charts (2000), Munsell Colour, Grand Rapids, USA.

National Committee on Soil and Terrain (2009), *Australian Soil and Land Survey Field Handbook* ['Yellow Book'], CSIRO Publishing, Melbourne.

## LARA soil profile classes (and abbreviations)

Barney (Ba)	Jimboomba (Jm)	Tamborine (Ta)
Basel (Bs)	Josephville (Jo)	Tartar (Tt)
Beausang (Bg)	Kagaru (Ka)	Tartar Shallow Phase (TtSp)
Bell (SEQ) (Bl)	Kilmoylar (Km)	Telemon (Tm)
Birnam (Bi)	Knapp (Kn)	Waterford (Wa)
Blenheim (Bm)	Knapp Acidic Phase (KnAp)	Woollaman (Wm)
Brabazon (Bz)	Kooralbyn (Ko)	Wonglepong (Wo)
Brabazon Acidic Variant (BzAv)	Kooralbyn Deep Phase (KoDp)	Yarrabilba (Ya)
Bremer (B)	Koukandowie (Kk)	
Bremer Buried Phase (BBp)	Laravale (Lv)	
Brennan (Be)	Lillydale (Ld)	
Bridge (Br)	Lillydale Acidic Phase (LdAp)	
Bromelton (Bn)	Lindesay (Li)	
Cainbable (Ce)	Lockrose (Ls)	
Cedar Vale (Cv)	Lockyer (Ly)	
Chinghee (Ch)	Logan (SEQ) (Lg)	
Clutha (Cl)	Lowood (Lw)	
Cooeeimbardi (Cb)	Macleay (Ma)	
Cookes (Co)	Maroon (Mr)	
Corbould (Cd)	Monsildale (Mn)	
Cressbrook (Cr)	Mundoolun (Mu)	
Drynan (Dn)	Neranleigh (Nr)	
Drynan Deep Variant (DnDv)	Neranleigh Shallow Variant (NrSv)	
Drynan Alkaline Variant (DnAv)	Nindooibah (Ni)	
Duggua (Du)	Nindooibah Deep Phase (NiDp)	
Dulbolla (Db)	Nindooibah Acidic Variant (NiAv)	
Dulbolla Sodic Phase (DbSp)	Palen (Pa)	
Dunsinane (Ds)	Payne (Pn)	
Edendale (Ed)	Philp (Pp)	
Edendale Acidic Variant (EdAv)	Pine Vale (Pv)	
Ernest (Er)	Rathdowney (Ra)	
Ferny (Fy)	Richards (Ri)	
Flanagan (Fl)	Robinson (Rs)	
Glenapp (Gp)	Sarabah (Sa)	
Glenoake (Gl)	Saville (Sv)	
Gorman (Go)	Shaws (Sh)	
Gould (Gd)	Sippel (Sl)	
Grigor (Gr)	Spencer (Sp)	
Gunyah (Gy)	Stockleigh (St)	
Hardgrave (Ha)		
Hooper (Hr)		

**BARNEY (Ba)**

VERSION 1

**Concept:**

Very shallow to moderately deep, uniformly coarse to medium textured, gravelly soils with dark sandy loam to clay loam surfaces over brown and grey sandy clay loams or clay loams, formed on rhyolite.

**Soil Classification:**

**Leptic Tenosol**, Bleached Leptic Tenosol, Leptic Rudosol.

**Landform:**

Crests and slopes of rolling to very steep rises, low hills, hills and mountains.

**Geology:**

Mount Gillies Rhyolite (Tfg/re, Tfg/ri, Tfg); Mount Barney central complex (Tbsr/Tbgr).

**Vegetation:**

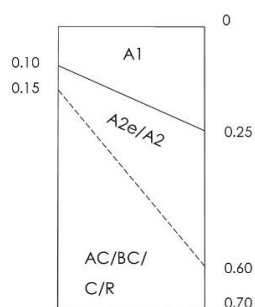
*Eucalyptus tereticornis*, *E. crebra*, *E. microcorys*, *C. citriodora*, *Corymbia* spp., *Allocasuarina torulosa*, *Ficus* spp.

**Permeability/Drainage:**

Slowly to moderately permeable / Imperfectly drained to well drained.

**Surface features:**

Loose to firm or hard setting, no microrelief, frequent sheet or rill erosion, few to many rhyolite pebbles and cobbles.



**A1** Black (10YR 2-3/2) sandy loam to sandy clay loam; single grained or weak to moderate angular/subangular blocky structure; few to common angular to subrounded rhyolite pebbles to cobbles; field pH 5.5-6.5; abrupt or clear change to

**A2e/A2** Where present, frequently bleached, grey or brown (10YR 4-5/2-3 & 10YR 6-7/1-3 dry) sandy clay loam to clay loam; weak angular/subangular blocky structure; few to common rhyolite pebbles; field pH 6.0.

**AC/BC/C/R** Weak to strong, massive rhyolite, saprolite/rock.

**Sites:** LARA: **273**, 281, 284, 286, **294**, 2003, 2004, 2006, 2012, 2056.

**Distribution:** Upper Logan River; Palen Creek; Darlington, Mount Ernest.

**BASEL (Bs)**

VERSION 1

**Concept:**

Deep to very deep grey cracking clay on alluvium. Subsoils are neutral to alkaline and may be sodic, calcic and/or saline at depth.

**Soil Classification:**

**Grey Vertosol**, Aquic (Grey) Vertosol, Redoxic Hydrosol.

**Landform:**

Drainage impaired plains, swamps, drainage depressions and backplains of floodplains and terraces.

**Geology:**

Quaternary alluvium (Qpa, Qpa/1, Qa) of mixed origin.

**Vegetation:**

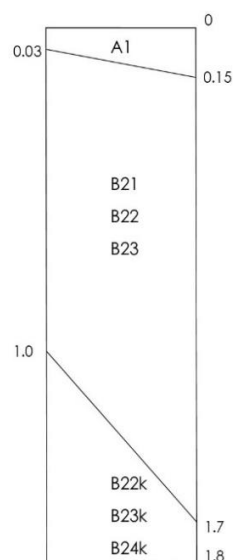
*E. tereticornis*, *E. moluccana*, *Casuarina cunninghamiana*, *Lophostemon suaveolens*.

**Permeability/Drainage:**

Very slowly to moderately permeable / Poorly to imperfectly drained.

**Surface features:**

Firm to hard setting. Periodically cracking, not self-mulching, gilgai common.



**A1/A1p/A12** Black or grey (10YR 2-6/1-2, 2.5Y 4-5/1-2) light clay to medium clay (frequently silty or fine sandy); moderate to strong angular/subangular blocky or granular structure; rarely very few to few medium manganiferous segregations; field pH 5.5-7.5.

**B21/B22/B23** Grey or brown (10YR 3/4, 4-5/1-2, 2.5Y-5Y 4-6/1-4) medium clay to heavy clay (often silty); moderate to strong lenticular structure (sometimes in conjunction with angular/subangular blocky or prismatic structure) and faint to prominent slickensides; commonly few to many distinct fine to coarse orange, grey or brown mottles; occasionally few to common fine to medium manganiferous segregations; field pH 6.0-9.0.

**B22k/B23k/B24k** Where present, grey or brown (10YR 5/1, 2.5Y-5Y 5/2-4) light medium to medium heavy clay; moderate to strong lenticular structure and prominent slickensides; few medium to coarse calcareous nodules; field pH 8.5-9.0.

**Sites:** LARA: **31**, 49, 60, **84**, 505, 538, 539, **576**, 624, 764, 2029, 2030, 2158, 2159, **9014**.  
SEQ: 94, 146, 147, 215, 223, 245, 249, 319, 320, 347, 361, 381, 390, 402; SPFD: 124.

**Distribution:** Scattered from Rathdowney to North Maclean on the Logan River and along Flagstone, Collins and Canungra Creeks from Flagstone Creek to Tambourine Village on the Albert River.

**BEAUSANG (Bg)**

VERSION 1

**Concept:**

Deep to very deep soils with a very strong texture contrast between A and B horizons formed on sandstone and siltstone influenced alluvium. Frequently bleached, grey and black sandy to clay loamy surfaces over mottled, slightly acidic to alkaline, often sandy, grey clays. Buried alluvial horizons are common.

**Soil Classification:**

**Grey Chromosol**, Grey Sodosol.

**Landform:**

Terraces, plains, fans and valley flats of level to gently undulating plains and flood plains. Slope <5%.

**Geology:**

Quaternary alluvium (Qa, Qha/2) derived from Triassic to Jurassic sediments.

**Vegetation:**

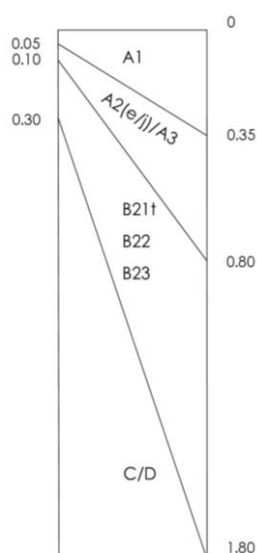
*Eucalyptus. tereticornis*, *E. melanophloia*, *Corymbia tessellaris*, *Angophora subvelutina*, *Casuarina cunninghamiana*, *Ficus* spp.

**Permeability/Drainage:**

Very slowly to moderately permeable / Poorly to imperfectly drained.

**Surface features:**

Firm to hard setting, no microrelief.



- A1** Grey or black (7.5-10YR 2-4/1-2) loamy sand to clay loam; massive to moderate granular or subangular blocky structure; field pH 4.5-7.5; abrupt to clear change to
- A2(e/f)** Frequently present and or bleached, grey, black or brown (7.5-10YR 2-6/1-3 & 10YR 7/1-2, 8/1-4 dry) loamy sand to clay loam; massive; commonly mottled; rarely few subrounded quartz pebbles; pH 4.5-7.5; sharp to clear change to
- B21t** Grey (10YR 4-6/1-2, 6/3; 2.5-10Y 5-7/1-2) light to medium heavy clay; weak to moderate prismatic, lenticular or angular/subangular blocky structure, rare slickensides; frequently few to common distinct orange mottles; occasionally few manganese segregations; gravels are rare; field pH 5.5-8.0; abrupt to gradual change to
- B22t/ B23t** Grey, brown or yellow (10YR 4-6/1-6, 2.5-10Y 5-7/1,) light to medium heavy clay; weak to strong prismatic, angular/subangular blocky or lenticular structure (occasionally massive); rare distinct slickensides; frequently few to common distinct mottles of various colour; occasionally few manganese or calcareous segregations; field pH 5.5-8.5; abrupt to gradual change to
- C/D** Where present, grey, brown or black (10YR 3-5/1-4, 2.5Y 5-7/1-3) sandy loam to medium clay (often fine sandy); massive or moderate to strong angular blocky, subangular blocky or prismatic structure; frequently common distinct mottles; rarely few medium quartz pebbles; rarely few to common manganiferous segregations; field pH 5.5-8.0.
- Sites:** LARA: 2, **149**, 213, 305, 315, 324, **346**, **571**, 776, 2008, 2197, 2234; SEQ: 61, 70, 76, 82, 86, 118, 140, 149, 263, 371, **425**.

**Distribution:** Isolated occurrences across the study area from Barney View to Jimboomba on the Logan River and in the area around Flagstone Creek and Benobble on the Albert River, in sub-catchments dominated by Jurassic sediments.

**BELL (SEQ) (BI)**

VERSION 1

**Concept:**

Deep to very deep black cracking (but not self-mulching) clays on alluvium. Subsoils are alkaline and may be calcic, mottled and/or saline or sodic at depth.

**Soil Classification:**

**Black Vertosol**

**Landform:**

Plains and terrace plains on alluvial/flood plains and terraces.

**Geology:**

Quaternary alluvium (Qa, Qha/1).

**Vegetation:**

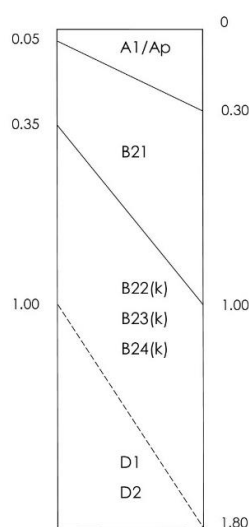
*E. tereticornis*, *E. moluccana*, *Grevillea robusta*, *Casuarina cunninghamiana*, also *Araucaria cunninghamii*, *Callistemon viminalis*.

**Permeability/Drainage:**

Slowly to moderately permeable / Poorly to moderately well drained.

**Surface features:**

Firm to hard setting. Occasional periodic cracking and/or gilgai.



- A1/A1p** Black (7.5-10YR 2-3/1-2) light to medium heavy clay (often silty or fine sandy); massive or weak to strong angular/subangular blocky, polyhedral or lenticular structure occasionally with slickensides; rarely few mottles, gravels or manganese segregations; field pH 5.5-8.5; abrupt to clear change to
- B21** Black (7.5-10YR 2-3/1-2) light to heavy clay (often silty or fine sandy); weak to strong angular/subangular blocky, polyhedral, or lenticular structure, frequent slickensides; rarely few mottles or gravels; rarely few medium or coarse calcareous or manganese segregations; field pH 6.0-9.0; gradual/diffuse change to
- B22(k)/ B23(k) B24(k)** Where present, black or brown (7.5-10YR 2-4/1-4, 2.5Y 4/3) light medium to medium heavy clay; moderate to strong prismatic and lenticular structure with slickensides; few to many fine to coarse calcareous and manganiferous nodules; field pH 8.0-9.0.
- D1/ D2** Where present, brown (10YR 3-4/3-4) fine sandy/silty light to medium clay; weak to strong polyhedral, prismatic or lenticular structure, with slickensides; rarely few calcareous nodules; very few faint mottles; field pH 7.0-9.0.
- Sites:** LARA: 11, **12**, 109, 113, **358**, 366, **464**, **470**, 475, 503, 531, 535, 536, **537**, 540, **541**, 561, 564, 567-569, 573, **574**, 578, 584, 585, **591**, 593, **594**, 598, 600, **604**, 606, 611-613, **615**, 616, 619, **630**, 631, 644, 652, **666**, 670, **677**, 689, 712, 738, 765, 2031, 2033, 2040-2043, 2047, 2048, 2065, 2080, 2105, 2114, 2129, 2130, 2146, 2152, 2156, 2165, 2176, 2221, 2224-2226, 2232, 2239, 2258, **9001**, **9006**.  
SEQ: 80, 95, 100, 104, 112, 115, 122, 134, 135, 144, 313, 314, 316, 321, 324, 334, 349, 351, 352, 354, 358, 360, 362, 363, 366, 367, 369, 377-380, 382-386, 388, 392, 393, 396, 397, 399, 406, 407, 411, 412, 414, 417, 419, 421-424.

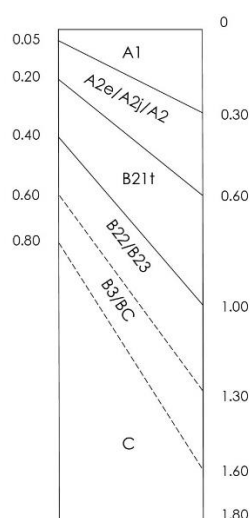
**Distribution:** Widespread on the Logan River, Running Creek, Christmas Creek and Albert River where basalt alluvial sources dominate.



**BIRNAM (Bi)**

VERSION 1

<b>Concept:</b>	Moderately deep to deep mottled and/or bleached, acidic to neutral, brown and yellow texture contrast soils on sandstone. May be saline.
<b>Soil Classification:</b>	<b>Brown or Yellow Chromosol</b>
<b>Landform:</b>	Slopes (rarely crests) of undulating to rolling rises and low hills. Slope 2-25%.
<b>Geology:</b>	Sandstones of the Koukandowie formation (Jbmk) and Gatton Sandstone (Jbmg).
<b>Vegetation:</b>	<i>E. tereticornis</i> , <i>E. melanophloia</i> , <i>E. siderophloia</i> , <i>E. crebra</i> , <i>C. citriodora</i> , <i>C. tessellaris</i> , <i>C. intermedia</i> . Also <i>Grevillea robusta</i> .
<b>Permeability/Drainage:</b>	Slowly to moderately permeable / Imperfectly to moderately well drained.
<b>Surface features:</b>	Firm to hard setting, no microrelief, common sheet erosion, occasionally few to common coarse sandstone or quartz pebbles or cobbles, rare sandstone outcrops.



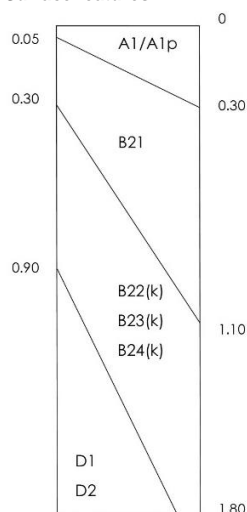
<b>A1</b>	Grey, black or brown (7.5-10YR 2-5/2-4) loamy sand to clay loam; single grained or weak to moderate angular/subangular blocky structure; occasionally few sandstone or quartz pebbles; rarely very few manganiferous nodules; field pH 5.0-6.5; abrupt to gradual change to
<b>A2e/ A2j/ A2</b>	Grey, brown or yellow (7.5-10YR 3-6/2-6 & 7.5-10YR 6-8/1-4 dry) loamy sand to clay loam; massive or weak angular/subangular blocky structure; commonly few faint to distinct mottles; commonly few sandstone or quartz pebbles; commonly few to many manganiferous segregations; field pH 5.5-6.5; abrupt or clear change to
<b>B21t</b>	Brown or yellow, rarely black (7.5-10YR 2/2, 4-6/3-8) light to medium heavy clay; massive or weak to strong prismatic, polyhedral or angular blocky structure; common to many distinct mottles; occasionally few sandstone and/or quartz pebbles; occasionally few manganiferous nodules; field pH 5.5-7.0; clear to gradual change to
<b>B22t/ B23t</b>	Where present, brown, yellow or grey (10YR 4-6/1-6) sandy light medium to medium heavy clay; massive or moderate prismatic or subangular blocky structure; common to many faint to distinct mottles; few pebbles; occasionally few manganiferous segregations; field pH 5.5-7.5; clear change to
<b>B3/ BC</b>	Where present, grey or brown (7.5YR-2.5Y 4-5/6, 6-8/1-3) sandy light to medium heavy clay; massive or weak subangular blocky structure; few quartz/sandstone pebbles; few manganiferous segregations; field pH 6.0-7.5.
<b>C</b>	Where present, massive weak to strong sandstone.
<b>Sites:</b>	LARA: 154, 157, 168, 171, 172, 173, 177, 196, 197, 208, 209, 210, 212, 214, 321, 382, 383, 390, 410, 411, 412, 414, 430, 431, 519, 526, 527, 532, 542, 543, 545, 546, 599, 746; SEQ: 158, 173, 184, 212, 242, 246.

**Distribution:** Throughout the western and northern portion of the study area from Rathdowney in the south to Maclean, Jimboomba, Mundoolun and Chambers Flat in the north.

**BLLENHEIM (Bm)**

VERSION 1

<b>Concept:</b>	Deep to very deep, black, cracking, self-mulching clays on alluvium. Subsoils are alkaline and calcic. May be saline or sodic at depth and may overlie buried alluvial horizons.
<b>Soil Classification:</b>	<b>Black Vertosol</b>
<b>Landform:</b>	Plains, levees and valley flats on alluvial/flood plains and terraces.
<b>Geology:</b>	Quaternary alluvium (Qa, Qha/2).
<b>Vegetation:</b>	<i>E. tereticornis</i> , <i>E. moluccana</i> , <i>Grevillea robusta</i> , <i>Casuarina cunninghamiana</i> , <i>Ficus</i> spp., <i>Angophora</i> spp.
<b>Permeability/Drainage:</b>	Moderately permeable / Imperfectly to moderately well drained.
<b>Surface features:</b>	Self-mulching, occasionally with gilgai, rare basalt pebbles or cobbles.



<b>A1/A1p</b>	Black (10YR 2-3/1-2) light to medium heavy clay (usually sandy or silty); moderate to strong granular, polyhedral or angular/subangular blocky structure (rarely lenticular), often with slickensides; rarely few medium basalt pebbles; field pH 6.0-7.5; abrupt to gradual change to
<b>B21</b>	Black (10YR 2-3/1-2) medium to heavy clay (frequently silty); moderate to strong polyhedral to lenticular structure with slickensides; rarely few to common basalt pebbles; occasionally few fine to medium calcareous or manganiferous nodules; field pH 7.0-9.0; clear to diffuse change to
<b>B22(k)/ B23(k) B24k</b>	Where present, black, brown or grey (10YR 2-4/1-4) medium to medium heavy clay; weak to strong lenticular structure with slickensides; rarely few faint brown or distinct orange mottles; rarely few basalt pebbles; few to many medium to coarse calcareous (or rarely manganiferous) nodules; field pH 7.0-9.0; abrupt to gradual change to
<b>D1/ D2</b>	Where present, brown or black (10YR 2/1, 3-4/3-4) light clay to medium clay (often silty or sandy); weak to moderate prismatic structure, occasionally breaking to lenticular, with slickensides; occasionally very few faint mottles; frequently few medium calcareous nodules; rarely fine gravelly; field pH 9.0.
<b>Sites:</b>	LARA: 356, 380, 449, 481, 488, 492, 494, 588, 589, 590, 601, 603, 622, 643, 646, 711, 717, 720, 730, 731, 737, 2089-2092, 2103, 2104, 2106-2108, 2117, 2124, 2125, 2128, 2134, 2135, 2147, 2153, 2173, 2186, 2222, 2227, 2244, 2247, 2249, 2256, 9002, 9009, 9012, 9013, 9015, 9018; SEQ: 312, 374; MFM: 183, 188.

**Distribution:** Back Creek; Palen Creek; Running Creek; Oaky Creek; Christmas Creek; Spring Creek; Laravale, Josephville and Gleneagle to Cedar Grove on the Logan River; Cainbale Creek; Biddaddaba Creek; Canungra Creek at Wonglepong; Mount Alexander, Kerry, Nindoolinbah, Tabragalba and Tamborine on the Albert River.

**BRABAZON (Bz)**

VERSION 1

**Concept:**

Moderately deep, brown texture contrast soils on siltstone and sandstone from 0.5 m. Subsoils are slightly acidic to alkaline, mottled and occasionally saline and/or vertic.

**Soil Classification:**

**Brown Chromosol, Yellow Chromosol.**

**Landform:**

Mid and lower slopes (occasionally upper slopes and ridges) of undulating to rolling rises and low hills. Slope 3-15%.

**Geology:**

Siltstones & sandstones of Walloon Coal Measures (Jw) also Tertiary Sediments (Ts-SEQ) and Beaudesert Beds (Te)

**Vegetation:**

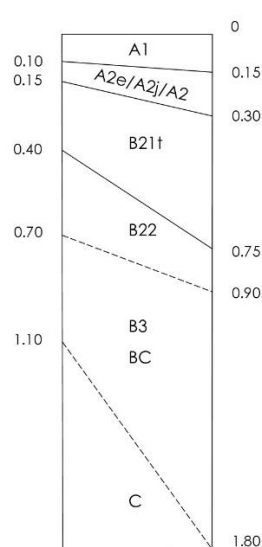
*E. tereticornis*, *E. moluccana*, *E. siderophloia*, *E. crebra*, *C. citriodora*, *C. tessellaris*, *C. intermedia*, *Ficus* spp.

**Permeability/Drainage:**

Slowly to moderately permeable / Imperfectly to moderately well drained.

**Surface features:**

Hard setting or firm, occasionally few sandstone, quartz or conglomerate pebbles to cobbles, frequent sheet erosion.



**A1** Black or brown (7.5-10YR 2-3/1-3) sandy loam to clay loam; massive or weak to moderate subangular blocky or polyhedral structure; rarely few distinct orange mottles; rarely very few quartz pebbles; field pH 5.5-6.5; abrupt or clear change to

**A2e/A2j/A2** Very frequently bleached, grey, brown or yellow (10YR 4-6/1-6 & 10YR-2.5Y 7-8/1-4 dry) sandy loam to clay loam; massive or weak to moderate subangular blocky structure; few faint or distinct mottles; rarely few quartz pebbles; rarely few to many manganiferous nodules; field pH 5.5-6.5; abrupt or clear change to

**B21t** Brown, rarely yellow (7.5-10YR 3-6/3-6) medium to heavy clay (often sandy or silty); weak to moderate polyhedral, angular/subangular blocky or lenticular structure, occasional slickensides; few to many faint, distinct or substrate mottles; few to common sandstone or siltstone pebbles; rarely very few manganiferous or calcareous segregations; field pH 6.0-7.5; clear or gradual change to

**B22t** Where present, yellow, grey or brown (10YR-2.5Y 5-7/1-6) sandy/silty medium to medium heavy clay; massive or weak to moderate angular/subangular blocky or lenticular structure, rare slickensides; few to many distinct or substrate mottles; rarely few manganiferous segregations; field pH 7.0-9.0; clear to diffuse change to

**B3/BC** Where present, grey or yellow (10YR-2.5Y5-6/2-6) sandy light medium to medium clay; massive or weak to moderate angular blocky structure; common to many mottles; common sandstone pebbles; rarely few manganiferous segregations; field pH 6.5-8.0; clear change to

**C** Where present, massive, weak sandstone/siltstone.

**Sites:** LARA: 497, 627, 723, 727, 734, 801, 2066, 2071, 2083; SEQ: 119, 310; MFM: 185, 200.

**Distribution:** Oaky Creek, Christmas Creek, Teviot, Kagaru, Cedar Grove, Woodhill, Veresdale, Kerry, Cryna.

**Brabazon Acidic Phase (BzAp)** – as above with B horizon pH <5.5 (KUAB). Sites – LARA: 98, 123, 732; SEQ: 133; MFM: 190, 191, 192, 212, 323.

**BREMER (B)**

VERSION 2

**Concept:**

Deep to giant, uniformly fine textured, non-cracking, black, brown and grey soils. Subsoils are neutral to alkaline, non-calcic, occasionally mottled, saline and/or vertic. Buried horizons are not encountered within 1.8 m.

**Soil Classification:**

**Black, Brown or Grey Dermosol**

**Landform:**

Plains, terrace plains, levees and fans on alluvial plains, plains, flood plains and terraces.

**Geology:**

Quaternary alluvium (Qa, Qha/2, Qhac).

**Vegetation:**

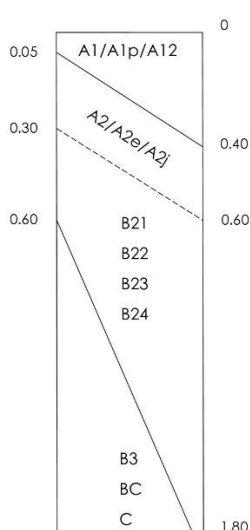
*E. tereticornis*, *E. moluccana*, *E. grandis*, *Casuarina cunninghamiana*, *C. glauca*, *Grevillea robusta*, *Ficus* spp., *Angophora* spp.

**Permeability/Drainage:**

Slowly to moderately permeable / Imperfectly to moderately well drained.

**Surface features:**

Firm or hard setting, occasionally with periodic cracking, rare gilgai microrelief, rare basalt cobbles.



**A1/A1p/A12** Black, brown or grey (5-10YR 2-4/1-3) clay loam to medium clay; massive or weak to strong angular/subangular blocky or polyhedral structure; rarely few fine basalt or sandstone gravels; rarely very few fine manganiferous nodules; field pH 5.5-8.0; abrupt to gradual change to

**A2/A2e/A2j** Rarely present, frequently bleached, grey or brown (10YR 5/2-4 & 10YR 7/2 dry) light to medium clay; massive or weak to moderate angular/subangular blocky structure; very few to common fine mottles; very few fine to medium gravels; field pH 6.5-7.0; clear change to

**B21/B22/B23/B24** Black, brown or grey (7.5-10YR 2-5/1-4, 6/1-2, 2.5Y 5-6/1-3, 5/4) light to heavy clay; massive or weak to strong polyhedral, angular/subangular blocky, prismatic or lenticular structure rarely with slickensides; commonly very few to common fine to medium faint to distinct mottles (often substrate derived); commonly very few to few fine to medium manganiferous segregations; occasionally very few or few fine to medium gravels; field pH 6.0-8.0; abrupt to clear change to

**B3/BC** Rarely present, brown (10YR 4/3-4) sandy light medium clay; weak to moderate angular/subangular blocky structure; few substrate mottles; very few medium gravels; field pH 7.0-8.0.

**C** Rarely present, massive weathering sandstone.

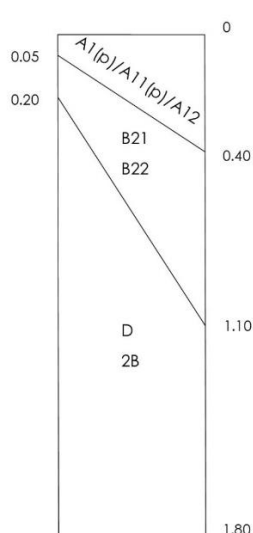
**Sites:** LARA: 50, 81, 86, 107, 117, 119, 184, 230, 259, 276, 348, 375, 433, 621, 696, 786, 787, 2014, 2016, 2032, 2160, 2180, 2215, 2220, 2231, 2263; SEQ: 92, 139, 145, 181, 248, 265, 365, 416; MISSE: 531-2, 535, 536; SPFD: 123.

**Distribution:** Common soil, widespread along Logan River, Palen Creek, Albert River, Canungra Creek; also Widgee Creek.

**BREMER BURIED PHASE (BBp)**

VERSION 1

<b>Concept:</b>	Deep to giant, uniformly fine textured, non-cracking, black, brown and grey soils. Subsoils are neutral to alkaline, non-calci, non-sodic, occasionally mottled, saline and/or vertic. Various buried alluvial horizons occur within 1.8 m.
<b>Soil Classification:</b>	<b>Black Dermosol</b> , Brown Dermosol, Grey Dermosol.
<b>Landform:</b>	Plains, terrace plains, levees and valley flats on flood plains, alluvial plains and terraces.
<b>Geology:</b>	Quaternary alluvium (Qa).
<b>Vegetation:</b>	<i>E. tereticornis</i> , <i>Allocasuarina torulosa</i> , <i>Melaleuca</i> spp., <i>Casuarina cunninghamiana</i> , <i>Grevillea robusta</i> ; also <i>Araucaria cunninghamii</i> , <i>Lophostemon suaveolens</i> , <i>Acacia</i> spp.
<b>Permeability/Drainage:</b>	Slowly to moderately permeable / Moderately well drained or imperfectly drained.
<b>Surface features:</b>	Firm or hard setting, occasionally with periodic cracking, rare gilgai microrelief.



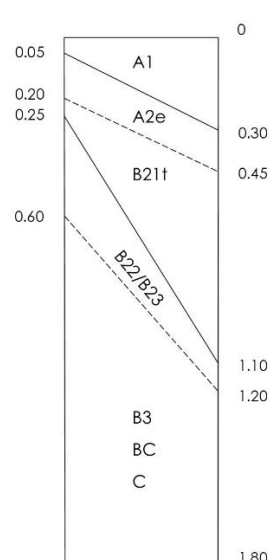
<b>A1(p)/A11(p)/A12(p)</b>	Black or grey (10YR 2-5/1-2) clay loam to medium clay (often sandy); massive or weak to strong polyhedral or angular/subangular blocky structure rarely with slickensides; rarely few fine distinct orange mottles; field pH 5.5-7.5; abrupt to diffuse change to
<b>B21/B22/B23</b>	Black, brown or grey (7.5-10YR 2-5/1-4) light to medium heavy clay (may be silty or sandy); weak to strong angular/subangular blocky, polyhedral or prismatic (rarely lenticular) structure, occasionally with slickensides; occasionally very few to common faint to distinct fine red/orange/brown mottles; rarely very few fine gravels; field pH 6.0-9.0; clear or gradual change to
<b>D/2B</b>	Highly variable, older alluvial deposition. Black, brown, yellow or grey (7.5-10YR 2-6/1-6); loamy sand to medium heavy clay (frequently sandy); single grained, massive or weak to strong angular/subangular blocky, polyhedral or prismatic (rarely lenticular) structure, occasionally with slickensides; occasionally very few to common distinct fine mottles; rarely few fine or medium manganiferous nodules; occasionally very few to many fine to coarse gravels; field pH 6.5-9.0; clear or gradual change to
<b>Sites:</b>	LARA: <b>106, 115, 254, 260, 265, 278, 302, 359, 363, 379, 419, 426, 443, 455, 456, 463, 476, 501, 530, 572, 623, 637, 650, 674, 676, 701, 707, 708, 804, 2034, 2046, 2111, 2155, 2166, 2228, 9003.</b> SEQ: 85, 99, 103, 264, 364, 395, 400.

**Distribution:** Common soil, widespread along Logan River, Palen Creek, Albert River, Canungra Creek; also Cainbale Creek and Christmas Creek.

**BRENNAN (Be)**

VERSION 1

<b>Concept:</b>	Moderately deep to very deep, grey, frequently bleached, mottled, strongly acidic to neutral, texture contrast soils overlying grey, brown or yellow subsoils on sandstone or siltstone. Subsoils may be sodic and/or saline.
<b>Soil Classification:</b>	<b>Grey Chromosol or Grey Kurosol</b>
<b>Landform:</b>	Mid and upper slopes (also lower slopes and crests) of undulating to steep rises and low hills. Slope 1-30%.
<b>Geology:</b>	Sandstones and siltstones of Walloon Coal Measures (Jw) and Beaudesert Beds (Te).
<b>Vegetation:</b>	<i>Eucalyptus moluccana</i> , <i>E. crebra</i> , <i>E. tereticornis</i> , <i>Corymbia citriodora</i> , <i>C. tessellaris</i> .
<b>Permeability/Drainage:</b>	Slowly to moderately permeable / Imperfectly drained.
<b>Surface features:</b>	Firm or hard setting, no microrelief, occasional sheet, rill or gully erosion, occasionally few sandstone or siltstone pebbles or cobbles.



<b>A1</b>	Black, rarely grey or brown (7.5-10YR 2-4/1-3) sandy loam to clay loam; massive or weak to moderate angular/subangular blocky, granular or polyhedral structure; occasionally few siltstone pebbles; field pH 5.0-7.5; abrupt or clear change to
<b>A2e</b>	Frequently present, grey or brown (10YR 3/6, 4-6/1-3, 7/1 & 10YR 7-8/1-2 dry) loamy sandy to clay loam; massive or weak angular blocky structure; rarely few faint or distinct mottles; occasionally few to common pebbles; field pH 5.0-6.5; abrupt or clear change to
<b>B21t</b>	Grey (7.5-10YR 4-6/1-2) light to medium heavy clay; massive or weak to strong angular/subangular blocky, lenticular or prismatic structure; few to many distinct red or orange mottles; occasionally few sandstone or quartz pebbles; very rarely few manganiferous segregations; field pH 4.5-6.5; abrupt to gradual change to
<b>B22t/B23t</b>	Where present, grey, brown or yellow (7.5-10YR 4-7/2-6); medium to heavy clay; massive or moderate polyhedral, subangular blocky or prismatic structure; frequently few to many mottles; very rarely few manganiferous segregations; field pH 4.5-6.5; diffuse change to
<b>B3/BC</b>	Where present, grey or brown (10YR 4-7/1-3) sandy medium to medium heavy clay; massive or weak to moderate angular/subangular blocky or prismatic structure; occasionally few to common distinct mottles; commonly few sandstone or siltstone pebbles; field pH 4.5-6.0; clear to diffuse change to
<b>C</b>	Where present, massive, weak to very weak sandstone and siltstone; field pH 6.0.

**Sites:** LARA: 116, 132, 252, 255, 261, 268, 269, 275, 309, 314, 728, 736, 780, 783, 2067, 2271; SEQ: 300. SEDG: 12.

**Distribution:** Upper Logan River, Josephville, Kagaru, Woollaman Creek, Kerry, Nindooibah, Veresdale, Woodhill.

**BRIDGE (Br)**

VERSION 2

**Concept:**

Deep to very deep, brown, sporadically or conspicuously bleached, cracking (not self-mulching) clay soils on alluvium. Subsoils are acidic and frequently mottled.

**Soil Classification:**

**Grey Vertosol or Brown Vertosol**

**Landform:**

Plains and terrace plains on flood plains and terraces. Slope 0-2.5%.

**Geology:**

Quaternary alluvium (Qa, Qpa).

**Vegetation**

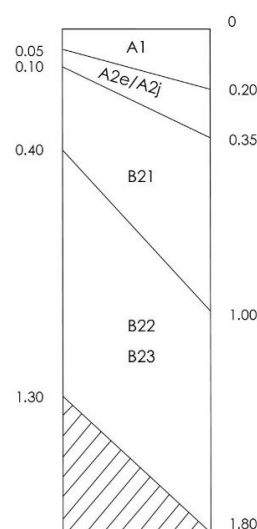
*Eucalyptus tereticornis*, *E. moluccana*, *Lophostemon suaveolens*

**Permeability/Drainage:**

Slowly permeable / Poorly drained.

**Surface features:**

Firm or hard setting, frequent normal gilgai.



**A1** Black or grey (10YR 3-5/2) light to light medium clay; weak to moderate granular structure; commonly very few distinct fine to medium mottles; rarely few medium manganiferous nodules; field pH 5.5-6.0, clear change to

**A2e/A2j** Grey, rarely brown or black, (10YR 3-5/2 & 10YR 7/2 dry) light to light medium clay; weak to moderate granular structure; frequently very few fine to medium distinct mottles; occasionally few to many medium manganiferous nodules; rarely few large pebbles; field pH 5.5-6.0, clear or gradual change to

**B21** Brown or grey (10YR-2.5Y 4-5/2-3) medium to medium heavy clay; moderate subangular to lenticular structure; commonly few to many distinct medium mottles; occasionally few medium manganiferous nodules; field pH 4.5-5.5; clear or gradual change to

**B22/B23** Where present, grey (10YR-2.5Y 5/1-2) medium to medium heavy clay; moderate lenticular structure; commonly few to many distinct medium to coarse mottles; rarely very few fine manganiferous segregations; field pH 4.5-5.5.

**Sites:** SEQ: 78, **98**, 131, 302, 307, 338, 345.

**Distribution:** Minor distribution on Teviot Brook downstream of Wyaralong Dam and on the Logan River downstream of Teviot Brook at Cedar Grove, Jimboomba and North Maclean.

**BROMELTON (Bn)**

VERSION 1

**Concept:**

Very deep, grey and brown, non-cracking, gradational soils. Subsoils are acidic and mottled, and may be vertic and saline.

**Soil Classification:**

**Grey Dermosol, Brown Dermosol.**

**Landform:**

Plains and terrace plains on plains and terraces.

**Geology:**

Quaternary alluvium (Qa).

**Vegetation:**

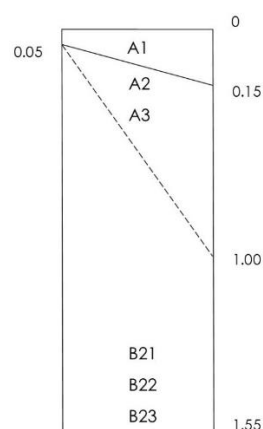
*Eucalyptus tereticornis*.

**Permeability/Drainage:**

Slowly to moderately permeable / Imperfectly drained.

**Surface features:**

Firm.



**A1** Black or grey (10YR 3-4/1-2) clay loam; weak to moderate angular blocky structure; field pH 5.5-7.5; clear to gradual change to

**A2/A3** Where present, grey (10YR 5/1-2) fine sandy clay loam to clay loam; massive or moderate angular blocky structure; few to common fine distinct mottles; field pH 5.0-6.0; clear change to

**B21/B22/B23** Grey or brown (2.5Y 5-6/1-3) sandy light medium clay to medium clay; moderate to strong angular blocky or lenticular structure; few to many fine to medium distinct red or orange mottles; field pH 4.0-5.5.

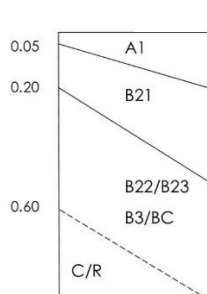
**Sites:** LARA: **249**; SEQ: 227. (Very limited occurrence in this study area – not well described – see BNH report for further detail).

**Distribution:** Two isolated pockets at Veresdale Scrub and Stockleigh.

**CAINBABLE (Ce)**

VERSION 1

<b>Concept:</b>	Very shallow to moderately deep, black and red (rarely brown), non-cracking, uniformly fine soils over basalt from 0.2 m. Subsoils range from acidic to neutral.
<b>Soil Classification:</b>	<b>Black Dermosol, Red Dermosol, Brown Dermosol.</b>
<b>Landform:</b>	Crests and ridges of rolling to steep hills and mountains. Slope 3 to >50%.
<b>Geology:</b>	Beechmont basalt (Tlb) and intrusive basalts (Tid).
<b>Vegetation:</b>	<i>Eucalyptus tereticornis</i> , <i>E. siderophloia</i> , <i>E. moluccana</i> , <i>E. crebra</i> , <i>E. microcorys</i> , <i>Toona australis</i> , <i>Corymbia citriodora</i> , <i>Araucaria cunninghamii</i> , <i>Lophostemon confertus</i> , <i>Xanthorrhoea</i> spp.
<b>Permeability/Drainage:</b>	Moderately to highly permeable / Moderately well drained.
<b>Surface features:</b>	Firm with periodic cracking, no microrelief, basalt cobbles to boulders.



<b>A1</b>	Black or brown (5-10YR 2-3/1-2, 4/3) light to medium clay, moderate to strong angular/subangular blocky or polyhedral structure; frequently many to abundant basalt pebbles; field pH 5.5-7.5; clear change to
<b>B21</b>	Black or red, rarely brown (2.5-10YR 2-3/2, 4/3) light to medium clay; moderate to strong polyhedral, angular/subangular blocky or prismatic structure, common slickensides; frequently few to abundant basalt pebbles to cobbles; field pH 4.5-7.0; abrupt or clear change to
<b>B22/B23</b>	Where present, red or brown (2.5-10YR 4/3-4) light to light medium clay; moderately structured; few to common basalt pebbles; field pH 5.0; gradual to diffuse change to
<b>B3/B3k/BC</b>	Where present, red or brown (5-10YR 3-4/3-4) light to medium heavy clay; weak to moderate subangular blocky structure; common to many basalt pebbles; field pH 5.0-7.0; gradual change to
<b>C/R</b>	Very weak to strong, massive, basalt rock.

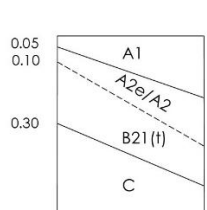
**Sites:** LARA: 87, 93, 437, 695, 698, 2039, 2053, 2208; SERES: 1.

**Distribution:** Generally in the south-east and east of the study area from Witheren to the QLD/NSW border. One small occurrence at Bromelton.

**CEDAR VALE (Cv)**

VERSION 1

<b>Concept:</b>	Very shallow to shallow, red, strongly acidic to neutral texture contrast, gradational or uniformly fine soils over sandstone or siltstone from 0.3 m.
<b>Soil Classification:</b>	<b>Red Chromosol or Red Dermosol</b>
<b>Landform:</b>	Crests and upper slopes of rolling to steep rises, low hills and hills. Slope up to 40%.
<b>Geology:</b>	Koukandowie Formation (Jbmk), Gatton Sandstone (Jbmg), Marburg Subgroup (Jbm).
<b>Vegetation:</b>	<i>Eucalyptus tereticornis</i> , <i>E. moluccana</i> , <i>E. siderophloia</i> , <i>E. crebra</i> , <i>E. fibrosa</i> , <i>Corymbia tessellaris</i> .
<b>Permeability/Drainage:</b>	Moderately permeable / moderately well to well drained.
<b>Surface features:</b>	Hard setting or firm, no microrelief, frequent sheet or rill erosion, frequent sandstone or siltstone pebbles to stones.



<b>A1</b>	Black or brown (10YR 2/2, 3-4/3) sandy clay loam to light clay; weak to moderate polyhedral or angular/subangular blocky structure; rarely very few distinct red mottles; frequently very few sandstone or siltstone pebbles; field pH 5.5-6.0; clear change to
<b>A2(e)</b>	Where present, frequently bleached, brown or red (5-10YR 4-5/6 & 10YR 6-8/3 dry) sandy loam; massive or weak angular blocky structure; rarely few faint mottles; commonly few sandstone or quartz pebbles; field pH 5.5-6.0; abrupt change to
<b>B21(t)</b>	Red (2.5-5YR 3-5/4-8) sandy light clay to medium clay; moderate to strong subangular blocky or prismatic structure; commonly few distinct grey or orange mottles; commonly few to many angular sandstone or siltstone pebbles; field pH 5.5-6.0; abrupt to clear change to
<b>C</b>	Sandstone or siltstone saprolite.

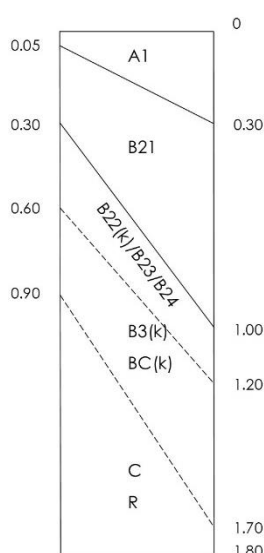
**Sites:** LARA: 99, 134, 298, 397, **528, 769**, 2001, 2021, 2112.

**Distribution:** Throughout the western and northern portions of the study area from Mount Barney to Mundoolun and Jimboomba. Also at Biddaddaba Creek and Tabragalba.

**CHINGHEE (Ch)**

VERSION 1

<b>Concept:</b>	Moderately deep to deep, black or brown, cracking (not self-mulching) soils over basalt. Subsoils are neutral to strongly alkaline and often calcic and/or saline.
<b>Soil Classification:</b>	<b>Black Vertosol</b> , Brown Vertosol, rarely Grey Vertosol.
<b>Landform:</b>	Slopes of rolling low hills to steep mountains. Slope 0.5-30%.
<b>Geology:</b>	Albert basalt (Tfa) and basalt flows (Tv).
<b>Vegetation:</b>	<i>Eucalyptus tereticornis</i> , <i>E. moluccana</i> , <i>E. siderophloia</i> , <i>E. melanophloia</i> , <i>E. melliodora</i> , <i>E. eugenioides</i> , <i>Corymbia citriodora</i> , <i>C. tessellaris</i> , <i>Araucaria cunninghamii</i> , <i>Grevillea robusta</i> , <i>Lephostemon confertus</i> .
<b>Permeability/Drainage:</b>	Slowly to moderately permeable / Imperfectly to moderately well drained.
<b>Surface features:</b>	Firm to hard-setting with periodic cracking, frequent basalt pebbles to stones/boulders, occasional erosion.

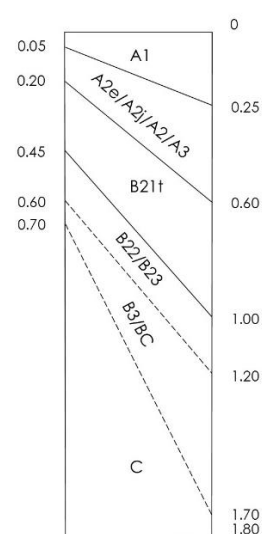


<b>A1</b>	Black (7.5-10YR 2-3/1-2) light to medium heavy clay (may be silty or fine sandy); moderate to strong angular/subangular blocky or polyhedral structure; occasionally few basalt/quartz pebbles; field pH 6.0-7.5; abrupt to gradual change to
<b>B21</b>	Black or brown (rarely grey) (7.5-10YR 2-4/1-3) medium to medium heavy clay (often silty); moderate to strong lenticular, polyhedral, prismatic or angular/subangular blocky structure, with slickensides; rarely few faint mottles; frequently few to many basalt pebbles; occasionally few medium calcareous nodules; field pH 6.0-9.0; abrupt to gradual change to
<b>B22(k)/B23/B24</b>	Where present, brown or black (7.5-10YR 2-3/1-2, 2-4/3-4) light medium to medium heavy clay; moderate to strong lenticular, polyhedral or angular/subangular blocky structure, with slickensides; frequent few to many basalt pebbles; frequently few medium calcareous and/or manganiferous segregations; field pH 7.0-9.0; abrupt to gradual change to
<b>B3(k)/BC(k)</b>	Where present, brown or grey (7.5-10YR 3-5/1-4) light to medium heavy clay; massive or weak to moderate angular/subangular blocky, polyhedral, prismatic or lenticular structure, frequent slickensides; frequently few to many basalt pebbles; occasionally few to many fine to coarse calcareous nodules; field pH 6.5-9.0; clear to diffuse change to
<b>C/R</b>	Very weak to strong, massive, basalt rock, occasionally with few calcareous segregations where saprolite; field pH 6.5-9.0.
<b>Sites:</b>	LARA: 56, 103-5, 436, <b>442</b> , 446, <b>493</b> , 607, <b>625</b> , 633, <b>634</b> , 638, 640, 655, 665, 667, <b>672</b> , 680, 682, 700, 710, 718, 722, 724, <b>725</b> , <b>735</b> , 762, 800, 2013, 2058, 2068, 2077-8, 2142, 2145, 2157, 2163.
<b>Distribution:</b>	Chinghee Creek, Running Creek, Christmas Creek, Kerry, Tabragalba; Canungra Creek.

**CLUTHA (CI)**

VERSION 1

<b>Concept:</b>	Moderately deep to deep strongly acidic to neutral, grey and yellow, mottled and frequently bleached, texture contrast soils formed on quartzose sandstone (rarely siltstone or shale). Subsoils may be saline and/or sodic.
<b>Soil Classification:</b>	<b>Grey or Yellow Kurosol or Chromosol</b> , Grey Kandosol or Grey Dermosol.
<b>Landform:</b>	Slopes (predominately mid and lower) of undulating to rolling rises, also low hills. Slope generally <10%.
<b>Geology:</b>	Sandstones (rarely siltstones or shale) of Woogaroo Subgroup (RJbw), Ipswich Coal Measures (Ri), Tingalpa Formation (Rin) and Mount Barney beds (Cy).
<b>Vegetation:</b>	<i>E. tereticornis</i> , <i>E. crebra</i> , <i>E. fibrosa</i> , <i>Corymbia citriodora</i> , <i>C. intermedia</i> , <i>Melaleuca</i> spp., <i>Acacia</i> spp.
<b>Permeability/Drainage:</b>	Slowly to moderately permeable / Poorly to imperfectly drained.
<b>Surface features:</b>	Firm to hard setting (rarely soft), no microrelief, occasionally few sandstone cobbles, occasional sheet or rill erosion.



<b>A1</b>	Black, brown or grey (10YR-2.5Y 2-5/1-3) loamy sand to sandy clay loam; single grained, massive or weakly structured; rarely few fine pebbles; field pH 5.5-7.0; abrupt to gradual change to
<b>A2(e/j)/A3</b>	Very frequently present and/or bleached, grey, brown or yellow (10YR-2.5Y 4-7/2-4 & 10YR7-8/1-2 dry) loamy sand to sandy loam; single grained, massive or weakly structured; rarely few sandstone or quartz pebbles; field pH 5.0-6.5; abrupt or clear change to
<b>B21t</b>	Grey or yellow (10YR-2.5Y 4-6/1-6) clay loam to heavy clay (often sandy); frequently massive but also weak to strong prismatic, angular/subangular blocky or lenticular structure; common to many distinct mottles; occasionally few to common pebbles; field pH 4.5-6.5; abrupt or clear change to
<b>B22/B23</b>	Where present, grey or brown (10YR-5Y 5/4-6, 4-7/1-3) sandy clay loam to medium heavy clay; massive or weak to moderate angular blocky structure; few to many distinct mottles; field pH 4.5-6.5; abrupt or clear change to
<b>B3/BC</b>	Where present, grey (2.5Y 7-8/1 & 10YR6/6) sandy clay loam to sandy medium heavy clay; massive; common to many distinct mottles; field pH 4.5-6.0.
<b>C</b>	Where present, massive, weak, weathered sandstone (rarely siltstone or shale).
<b>Sites:</b>	LARA: 120, 198, 201-204, 234, 236, 239, 246, 297, 425, 427, 550, 771, 772, 790, 792. SEQ: 193, 199, 201, 221, 254, 257, 260, 261, 262, 357.
<b>Distribution:</b>	Throughout the areas of these geologies.

**Clutha Deep Variant (CIDv)** – As above with depth >1.5m and no C horizon encountered. Sites – LARA: 200, 773; SEQ: 413.

**COOEEIMBARDI (Cb)**

VERSION 2

**Concept:**

Deep to very deep self-mulching, neutral to alkaline, black cracking clay soils on alluvium. Subsoils are not calcic, rarely mottled and may be slightly or moderately saline.

**Soil Classification:****Black Vertosol****Landform:**

Plains, terrace plains and backplains on alluvial/flood plains and terraces.

**Geology:**

Quaternary alluvium (Qa).

**Vegetation:**

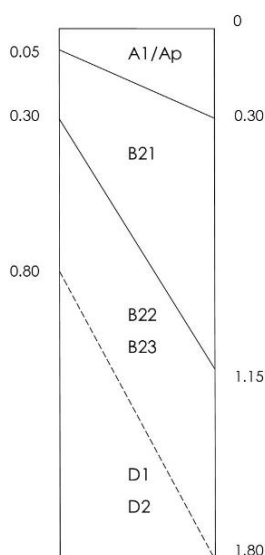
*E. tereticornis*, *E. moluccana*, *Grevillea robusta*, *Casuarina cunninghamiana*, *Callistemon* spp.

**Permeability/Drainage:**

Slowly to moderately permeable / Moderately well drained, occasionally imperfectly drained.

**Surface features:**

Cracking, self-mulching, with common gilgai.



**A1/ Ap** Black (7.5-10YR 2-3/1-2) light to medium heavy clay (often silty); weak to strong polyhedral or subangular blocky grading to lenticular structure with faint slickensides; rarely fine distinct mottles; rarely very few rounded gravels; field pH 6.0-7.5; abrupt to gradual change to

**B21** Black or brown (7.5-10YR 2-5/1-3, 2.5Y4/3) light to medium heavy clay; moderate to strong subangular blocky or lenticular structure with slickensides; rare distinct mottles; rarely very few rounded fine gravels; rarely few manganiferous segregations; field pH 6.5-9.0; clear to gradual change to

**B22/ B23** Where present, black, brown or grey (7.5-10YR 2-5/1-4, 2.5-5Y3-6/2) light to medium heavy clay; moderate to strong lenticular structure with slickensides; occasionally few fine to medium distinct mottles; occasionally few to common fine to coarse manganiferous segregations; field pH 6.0-8.5; clear change to

**D1/ D2** Where present, black or brown (10YR 2-3/1-2, 3-4/3) fine sandy clay loam to medium clay (often sandy or silty); weak to strong angular/subangular blocky, prismatic or lenticular (with slickensides) structure; rarely very few fine gravels; field pH 7.0-8.5.

**Sites:** LARA: 54, **85**, 562, **563**, 609, 645, 683, **716**, 2075, 2136, 2178, 2254, 3005; SEQ: 376, 394, 398.

**Distribution:** Christmas Creek at Lamington; Running Creek near Rathdowney; On the Logan River from Tamrookum to Beaudesert; Albert River at Darlington, Kerry Creek, Tabragalba, Mundoolun and Tamborine; Canungra Creek at Wonglepong and Boyland.

**COOKES (Co)**

VERSION 1

**Concept:**

Moderately deep to very deep, acidic to neutral, texture contrast soils formed on sandstone and siltstone influenced alluvium. Frequently bleached clay loam over acidic, frequently mottled brown and grey clays. May be sodic or saline at depth.

**Soil Classification:****Brown Chromosol, Brown Kurosol.****Landform:**

Plains on alluvial and flood plains.

**Geology:**

Quaternary alluvium (Qa, Qha/2).

**Vegetation:**

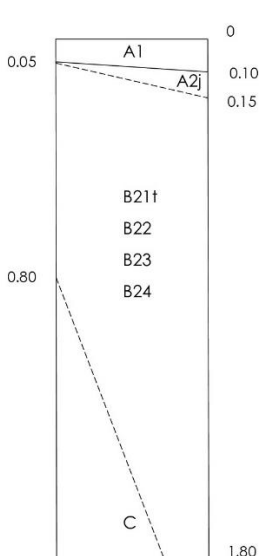
*Corymbia tessellaris*, *Melaleuca* spp., *Acacia* spp.

**Permeability/Drainage:**

Slowly to moderately permeable / Imperfectly to moderately well drained.

**Surface features:**

Hard setting, no microrelief, no surface coarse fragments.



**A1** Black or brown (10YR 3/2-3) clay loam; massive to weakly structured; field pH 5.5-6.0; clear change to

**A2j** Where present. Grey (10YR 4/2 & 10YR7/2 dry) clay loam; massive to weakly structured; field pH 5.0-5.5.

**B21t/ B22/ B23/ B24** Brown or grey (10YR 4-5/3-4, 2.5Y 4-6/2-3, 5/4) light medium to heavy clay; moderate to strong angular blocky or lenticular structure; frequent common to many distinct mottles; common medium manganiferous segregations at depth; field pH 5.0-6.5; clear to gradual.

**Sites:** SEQ: 2, **4** (very limited occurrence in this study area – not well described).

**Distribution:** Very limited area around Logan Village /Buccan/Quinzech Creek, adjacent to the Logan River in an area dominated by Devonian to Triassic sediments.

**CORBOULD (Cd)**

VERSION 1

**Concept:** Shallow to moderately deep, strongly acidic, commonly bleached and mottled, grey and brown (rarely yellow) gradational and texture contrast soils formed on Devonian arenite/sandstone, chert and greywacke. May be saline.

**Soil Classification:** **Grey or Brown Kandosol**, Brown Kurosol, Yellow Kurosol.

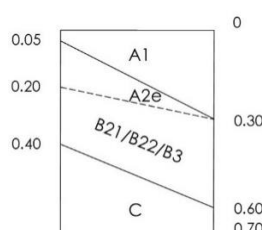
**Landform:** Slopes of undulating rises to steep hills. Various slopes, many >40%.

**Geology:** Arenite/sandstone, chert and greywacke of the Neranleigh-Fernvale beds (DCf, DCf/w, DCf/c).

**Vegetation:** *Corymbia intermedia*, *C. citriodora*. Also *E. melanophloia*, *Acacia* spp., *Ficus* spp., *Grevillea robusta*.

**Permeability/Drainage:** Slowly to moderately permeable / Imperfectly drained.

**Surface features:** Firm, no microrelief, occasional sheet erosion, occasionally few large sandstone/arenite pebbles.



**A1** Grey, brown or black (10YR 2-4/1-3) sandy loam to sandy light clay; weak to moderate structure; few to common pebbles; field pH 4.5-6.0; clear to gradual change to

**A2e** Where present, grey or brown (10YR 5-6/3 & 10YR7-8/1-2 dry) sandy loam to light clay; massive or weakly structured; field pH 4.5-5.0, clear or gradual change to

**B21/B22/B3** Brown, grey or yellow (10YR-2.5Y 5-6/2-4) light clay to light medium clay; massive but also weak to strong angular blocky structure; few to common distinct mottles; few to many pebbles; field pH 4.5-5.0; clear change to

**C** Massive, moderate to strong sandstone/arenite/chert/greywacke.

**Sites:** LARA: 216, 218, 241, 243, 793.

**Distribution:** Small area at Shaws Pocket/Cedar Creek.

**CRESSBROOK (Cr)**

VERSION 1

**Concept:** Very deep to giant, acid to neutral, coarse textured soils on alluvium over buried alluvial horizons and/or bedload.

**Soil Classification:** **Stratic or Arenic Rudosol**

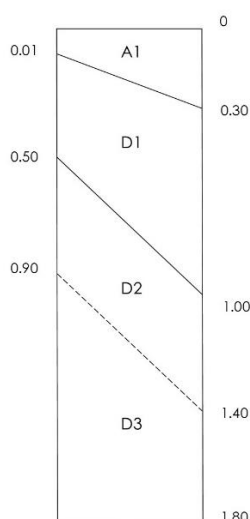
**Landform:** Stream channels and stream banks on flood plains.

**Geology:** Quaternary Alluvium (Qa, Qha/1).

**Vegetation:** *Eucalyptus tereticornis*, *Casuarina cunninghamiana* and *Callistemon* spp.

**Permeability/Drainage:** Highly permeable / Well drained to rapidly drained.

**Surface features:** Loose or hard setting, no microrelief, frequent large pebbles to cobbles & erosion.



**A1** Black, brown or grey (10YR 3-4/1-3); loamy sand to sandy loam; single grained, massive to weak angular/subangular blocky structure; field pH 5.5-7.0, clear change to

**D1** Grey or brown (10YR 4-6/3); loamy sand to sandy loam; massive to weak subangular blocky structure; field pH 6.0 to 7.0, clear change to

**D2** Brown (10YR 4-5/3-4 moist); loamy sand to sandy light clay; massive or weak subangular blocky structure; field pH 6.0-7.0, clear change to

**D3** Where present, brown (10YR 4-5/3-6) loamy sand to sandy light clay; massive; frequently few to many sub-angular to sub-rounded 2-20 mm pebbles; field pH 5.5-7.5.

**Sites:** LARA: 2009, 2164 (very limited occurrence in this study area – observation sites only).

**Distribution:** Very limited distribution in the Upper Logan and at Il-Bogan. Described further in the BNH report.



**DRYNAN (Dn)**

VERSION 1

**Concept:** Shallow to moderately deep, red, texture contrast soil on siltstone and sandstone, underlain by grey clays. Subsoils are acidic or strongly acidic but may be alkaline and calcic at depth in siltstone saprolite. Subsoils are frequently mottled, rarely sodic and may be saline.

**Soil Classification:** **Red Chromosol or Red Kurosol**

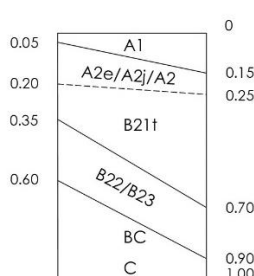
**Landform:** Crests and slopes of undulating to rolling rises or low hills. Slope 0-15%.

**Geology:** Walloon Coal Measures (Jw) and Beaudesert Beds (Te).

**Vegetation:** *Eucalyptus moluccana*, *Corymbia citriodora*, *C. tessellaris*.

**Permeability/Drainage:** Moderately to highly permeable / Poorly to imperfectly drained.

**Surface features:** Hard setting or firm, occasional sheet erosion or siltstone/sandstone cobbles, rare sandstone outcropping.



- A1** Black or brown (7.5-10YR 2-3/1-3) sandy loam to clay loam; massive or weak to moderate angular/subangular blocky structure; field pH 5.5-7.0; abrupt or clear change to
- A2e/A2j/A2** Frequently present, brown or grey (10YR 3-5/3-4, 4/2 & 10YR6-8/2-3 dry) sandy loam to clay loam; massive or weak angular/subangular blocky structure; rarely few faint mottles, fine gravels or manganiferous nodules; field pH 5.5-6.5; abrupt change to
- B21t** Red (2.5-5YR 3-5/6-8) light medium to heavy clay; moderate subangular blocky or polyhedral structure; frequently common to many distinct brown, orange or grey mottles; occasionally few sandstone pebbles; field pH 5.0-7.5; clear change to
- B22t/B23t** Grey or red (2.5-5YR 3-5/6-8; 10YR6-7/2-3) light medium to medium heavy clay; weak to strong polyhedral or subangular blocky structure; frequently few to many faint or distinct mottles; occasionally few manganiferous or calcareous nodules; field pH 5.0-9.0; clear change to
- C** Grey or brown, weak to very weak, massive siltstone or sandstone saprolite; occasionally few calcareous nodules; field pH 5.5-9.0.

**Sites:** LARA: 20, 133, **318, 678**, 2064, 2148, 2200, 2217; SEQ: 137, 148; MFM: 210, 330; BOB (ZAV): B494.

**Distribution:** Upper Logan, Barney View, Laravale, Echo Hills, Bromelton, Undullah, Woodhill, Kerry, Tabragalba.

**Drynan Deep Phase (DnDp)** – As above with depth >1.0m and without alkaline saprolite. Imperfectly drained. Sites – LARA: 29, 264, 317; MFM: 324, 331.

**Drynan Alkaline Phase (DnAp)** – As above with strongly alkaline B22/B23/B3 with calcareous segregations. Moderately well drained. Sites – LARA: 313, 316, 2201.

**DUGGUA (Du)**

VERSION 1

**Concept:** Deep to very deep, brown, cracking (but not self-mulching) clay soil on alluvium. Subsoils are alkaline or occasionally neutral. They are also commonly mottled, calcic and/or sodic and may be saline.

**Soil Classification:** **Brown Vertosol**

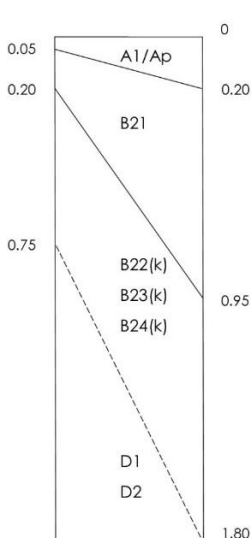
**Landform:** Plains, terrace plains, backplains and levees on flood plains and terraces.

**Geology:** Quaternary alluvium (Qa).

**Vegetation:** *Eucalyptus tereticornis*.

**Permeability/Drainage:** Slowly to moderately permeable / Imperfectly to moderately well drained.

**Surface features:** Firm to hard setting with frequent periodic cracking, not-self-mulching, rarely with microrelief.



- A1/Ap** Black (10YR 3/1-2) light to medium heavy clay; moderate to strong angular/subangular blocky or polyhedral structure; rarely very few fine to medium manganiferous segregations; field pH 5.5-7.0; clear change to
- B21** Brown or grey (10YR 4-5/2-4; 2.5Y4-5/3) medium to heavy clay; moderate to strong subangular blocky to lenticular structure often with slickensides; common fine to medium faint or distinct mottles; rarely few fine manganiferous segregations; rarely very few medium pebbles; field pH 6.0 to 9.0; gradual or diffuse change to
- B22(k)/B23(k)/B24(k)** Brown or grey (7.5-10YR 5/1-4; 2.5Y 4-6/2-3) medium to heavy clay; moderate to strong lenticular (rarely angular/subangular blocky or prismatic) structure with slickensides; commonly few distinct mottles; occasionally few fine manganiferous segregations; frequently few to common fine to coarse calcareous segregations; field pH 6.0-9.0.
- D1/D2** Very rarely within 1.8m. Yellow or brown (10YR 6/3-4) clay loam fine sandy to sandy light clay; massive or weak angular/subangular blocky structure; field pH 8.0-9.0.

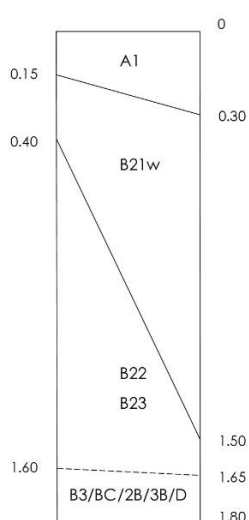
**Sites:** LARA: 10, 82, 575, **742**; SEQ: 128, 196, 232, 401, 409.

**Distribution:** Occurs in various locations along the Logan River from downstream of Christmas Creek to Beaudesert to Chambers flat. Also occurs on the Albert River at the junction of Kerry and Cainbale Creeks and along its Flagstone Creek tributary.

**DULBOLLA (Db)**

VERSION 1

<b>Concept:</b>	Deep to very deep, neutral to alkaline, frequently mottled, brown and yellow gradational and uniformly fine soils formed on siltstone, occasionally over buried horizons from 0.6 m.
<b>Soil Classification:</b>	<b>Brown or Yellow Dermosol</b>
<b>Landform:</b>	Mid and lower slopes and flats of rolling low hills, hills and plains. Slope 1-15%.
<b>Lithology and geology:</b>	Siltstones of Koukandowie Formation (Jbmk) and Gatton Sandstones (Jbmg).
<b>Vegetation:</b>	<i>Eucalyptus tereticornis</i> , <i>E. moluccana</i> , <i>Corymbia citriodora</i> , <i>Araucaria cunninghamii</i> .
<b>Permeability/Drainage:</b>	Slowly to moderately permeable / Imperfectly to moderately well drained.
<b>Surface features:</b>	Firm or hard setting with rare periodic cracking, no microrelief.



- A1** Black (10YR 2-3/1-2) heavy clay loam to medium clay; moderate to strong polyhedral or weak to moderate subangular blocky structure; occasionally few fine pebbles; rarely few manganiferous nodules; field pH 6.0-7.0; clear change to
- B21w** Brown or yellow (7.5-10YR 3-5/3-6) medium to medium heavy clay; moderate to strong polyhedral or subangular blocky structure, frequently with slickensides; common distinct mottles; occasionally few medium pebbles; rarely few manganiferous nodules; field pH 5.5-8.0; abrupt to gradual change to
- B22/ B23** Where present, brown, yellow or grey (10YR-2.5Y 4-6/1-4) medium to medium heavy clay; moderate to strong polyhedral or angular/subangular blocky structure, frequently with slickensides; few to common distinct mottles; frequently few siltstone pebbles; occasionally few to common manganiferous or calcareous segregations; field pH 6.0-9.0.
- BC** Rarely present, grey (10YR 4/1) sandy medium clay; weak subangular blocky structure; few distinct red and orange mottles.
- 2B/ 3B/ D** Occasionally present, brown or black (10YR 2-3/2-4) sandy/silty light medium to medium clay; weak to moderate subangular blocky structure; field pH 7.0-8.0.

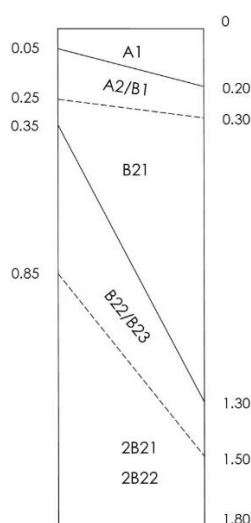
**Sites:** LARA: 345, 509, 533, 534, 2269; SEQ: 124.

**Distribution:** Limited occurrence - Rathdowney to Tamrookum, also Canungra Creek at Sarabah.

**DULBOLLA SODIC PHASE (DbSp)**

VERSION 1

<b>Concept:</b>	Deep to very deep, sodic, neutral to alkaline, frequently mottled, brown gradational and uniformly fine soils on siltstone and sandstone, occasionally over buried horizons. Subsoils become strongly alkaline and are frequently calcic and saline.
<b>Soil Classification:</b>	<b>Brown Dermosol</b>
<b>Landform:</b>	Crests and slopes (rarely flats) of rolling hills. Slope 1-10%.
<b>Lithology and geology:</b>	Siltstones and sandstones of Koukandowie Formation (Jbmk) and Gatton Sandstones (Jbmg).
<b>Vegetation:</b>	<i>Eucalyptus tereticornis</i> , <i>E. moluccana</i> .
<b>Permeability/Drainage:</b>	Slowly to moderately permeable / Imperfectly drained.
<b>Surface features:</b>	Firm, no microrelief.



- A1** Black or brown (10YR 2-3/1-3) light to medium clay; moderate to strong angular/subangular blocky or granular structure; rarely few faint orange mottles; few siltstone pebbles; field pH 6.0-7.5; abrupt to gradual change to
- A2/ B1** Where present, grey or brown (10YR 4/1-3); sandy light clay to medium heavy clay; weak to strong subangular blocky structure; occasionally few distinct mottles; few sandstone or siltstone pebbles; field pH 6.0-7.5; clear to gradual change to
- B21** Brown (7.5-10YR 4-5/3) light medium to medium clay; moderate to strong angular/subangular blocky or polyhedral structure, rare slickensides; occasionally few to common distinct mottles and/or few siltstone, sandstone or quartz pebbles; rarely few to common ferromanganiferous nodules; field pH 5.5-8.5; clear to diffuse change to
- B22/ B23** Brown, yellow or grey (10YR-2.5Y 4-6/1-6) light medium to medium heavy clay; moderate structure, rare slickensides; few to many faint to distinct mottles; rarely few pebbles; rarely few calcareous nodules, field pH 6.0-8.5; gradual change to
- 2B21/ 2B22/** Occasionally present, grey (10YR-2.5Y 4-5/2) medium heavy clay; strong lenticular or subangular blocky structure; occasionally few calcareous nodules; field pH 8.5.

**Sites:** LARA: 126, 127, 169, 389.

**Distribution:** Limited occurrence – Burnett Creek, Rathdowney, also Undullah.

**DUNSINANE (Ds)**

VERSION 1

**Concept:**

Shallow to moderately deep, neutral, occasionally mottled, brown and red gradational and uniformly fine soils on siltstone, mudstone and sandstone from 0.3 m. Subsoils may be sodic.

**Soil Classification:**

**Brown or Red Dermosol**, Brown Kandosol.

**Landform:**

Slopes of undulating to rolling rises and low hills. Slopes generally <20% but maybe up to 30%.

**Lithology and geology:**

Siltstones, mudstones and conglomerates of Tertiary Sediments (Ts-SEQ) and Walloon Coal Measures (Jw).

**Vegetation:**

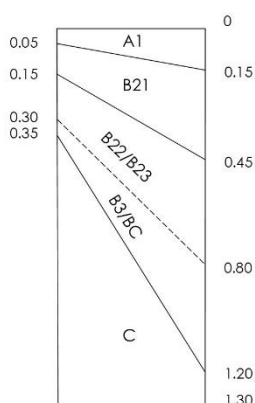
*Corymbia citriodora*, *Eucalyptus melanophloia*.

**Permeability/Drainage:**

Slowly to moderately permeable / Moderately well drained to well drained.

**Surface features:**

Hard setting or firm, no microrelief, common to many siltstone, shale or conglomerate pebbles to stones.



- A1** Black (5-10YR 3/1-2) clay loam to light medium clay; weak to strong angular blocky, polyhedral or prismatic structure; occasionally few siltstone pebbles; field pH 6.0-7.0; clear to diffuse change to
- B21** Brown or red (5-10YR 3-5/3-6) light to medium clay; weak to strong angular/subangular blocky or prismatic structure; rarely few faint mottles; frequently few siltstone or conglomerate pebbles; field pH 6.0-6.5.
- B22/ B23** Where present, brown, red or yellow (5-10YR 3-6/4-6) medium clay; weak to strong subangular blocky structure; rarely few distinct mottles; occasionally few pebbles; field pH 5.5-6.0.
- B3/ BC** Brown, red or grey (2.5YR7/4, 7.5-10YR 4-5/2-5) light to light medium clay; massive or weakly structured; occasionally few large siltstone pebbles; rarely few manganese or calcareous segregations; field pH 6.0-8.5.
- C** Massive weathered rock.

**Sites:** LARA: 41, 42, 43, **262**; SEQ: 308; MFM: 320.

**Distribution:** Limited extent - Kerry, Beaudesert, Kagaru, Mount Dunsinane.

**EDENDALE (Ed)**

VERSION 1

**Concept:**

Moderately deep to very deep, neutral to strongly alkaline, black, uniformly fine soils over sandstone or siltstone. Black clay over brown, black or grey, frequently calcic subsoils. May be saline.

**Soil Classification:**

**Black Dermosol**

**Landform:**

Lower slopes and flats (rarely mid slopes) of undulating to rolling rises and low hills. Slope <15%.

**Lithology and geology:**

Sandstones and siltstones of Walloon Coal Measures (Jw).

**Vegetation:**

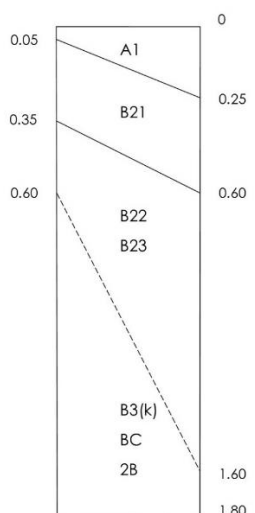
*Eucalyptus tereticornis*, *E. crebra*, *Corymbia citriodora*, *C. tessellaris*.

**Permeability/Drainage:**

Slowly to moderately permeable / Imperfectly to moderately well drained.

**Surface features:**

Firm or hard setting with occasional periodic cracking, no microrelief, occasionally few pebbles to stones, common, rill or gully erosion.



- A1** Black (10YR 2-3/1-2) light to light medium clay; moderate angular/subangular blocky or polyhedral structure; rarely few pebbles or manganiferous nodules; field pH 6.0-6.5; abrupt or clear change to
- B21** Black (10YR 2-3/1-2) light medium to medium heavy clay; moderate to strong angular blocky, polyhedral or lenticular structure, frequent slickensides; rarely few faint mottles; rarely few manganiferous nodules or pebbles; field pH 6.0-8.0; clear or gradual change to
- B22/ B23** Frequently present, grey, brown or black (10YR 2-5/1-4) light medium to medium heavy clay; weak to strong angular/subangular blocky, polyhedral or lenticular structure, common slickensides; frequently few to common faint or distinct mottles; frequently few to common pebbles; common very few to few manganiferous nodules; field pH 6.0-9.0; clear to diffuse change to
- 2B/ B3(k)/ BC** Where present, grey, brown or black (10YR-2.5Y 3-5/1-4) light medium to medium heavy clay; weak to strong angular/subangular blocky, polyhedral or lenticular structure, with slickensides; few substrate mottles; few to many pebbles; few to common calcareous or manganiferous segregations; field pH 8.0-9.0.
- C** Where present, weak, massive, sandstone or siltstone saprolite.

**Sites:** LARA: 19, 319, 340, 355, 605, 743, 753, 2079, 2095, 2245; SEQ: 305.

**Distribution:** Back Creek, Barney View, Laravale, Nindooibah, Tabragalba and Biddaddaba. Also at Kagaru.

**Edendale Acidic Phase (EdAp)** – As above, on crests of low hills and with a pH <=5.0 in B21 and below. Sites - LARA: 16, 2132.

**ERNEST (Er)**

VERSION 1

**Concept:**

Moderately deep to deep, acidic to neutral, frequently bleached, grey gradational and uniformly fine soils. Subsoils are commonly mottled, slightly gravelly and may be alkaline at depth. Sandstone or rhyolite present from 0.9 m.

**Soil Classification:****Grey Dermosol****Landform:**

Mid and lower slopes and fans on rolling to steep low hills, hills and mountains. Slope 3-20%.

**Lithology and geology:**

Tertiary/Quaternary rhyolite or sandstone colluvium (TQr) also Chillingham Volcanics (Rch).

**Vegetation:**

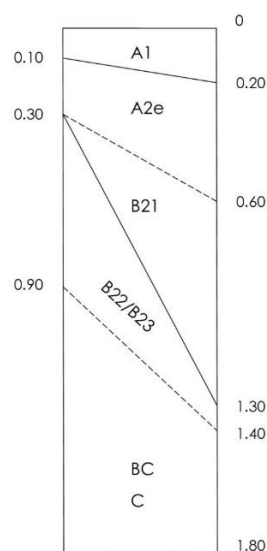
*Eucalyptus moluccana*, *E. microcorys*.

**Permeability/Drainage:**

Moderately permeable / Imperfectly drained.

**Surface features:**

Firm or hard setting, no microrelief, frequently few to common rhyolite or sandstone cobbles or stones, gully or sheet erosion common.



**A1** Black (10YR 2/1-2) clay loam fine sandy to silty light medium clay; weak to moderate angular/subangular blocky or polyhedral structure; rarely few fine quartz pebbles; field pH 6.0; clear change to

**A2e** Frequently present in rhyolite derived soils, grey (10YR 6-7/1-2; 10YR8/1-2 dry) clay loam fine sandy; weak angular/subangular blocky structure; frequently few distinct orange mottles; few angular pebbles; field pH 5.0-6.0; clear change to

**B21t** Grey or black (10YR 2-5/1-2) light medium to medium heavy clay; moderate to strong subangular, polyhedral or lenticular structure; few to common faint or distinct orange mottles; few to common fine rhyolite, quartz or sandstone pebbles; field pH 5.0-6.5; abrupt to gradual change to

**B22t/ B23t** Where present, grey (10YR 4-5/1) sandy medium heavy clay; weak to moderate prismatic or angular blocky structure; common distinct orange or red mottles; few quartz pebbles; field pH 7.5-8.0.

**BC/ C** Where present, very weak to strong rhyolite or ferruginised sandstone, massive.

**Sites:** LARA: 219, 282, 283, 304, 756.

**Distribution:** Upper Logan river, Upper Palen Creek and Cedar Creek (Albert River).

**FERNY (Fy)**

VERSION 1

**Concept:**

Very shallow to shallow, acidic to neutral, grey, black and brown, loamy to clay loamy soils over chert and sandstone/arenite from 0.1 m.

**Soil Classification:**

**Leptic/Bleached-Leptic Tenosol**, Clastic/Leptic Rudosol.

**Landform:**

Hillslopes and hillcrests of low hills and hills.

**Geology:**

Chert, sandstone/arenite and mudstone/siltstone of the Neranleigh-Fernvale beds (DCf, DCf/c, DCf/w, DCf/g) and also Mount Barney Beds (Cy).

**Vegetation:**

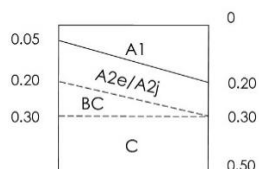
*Eucalyptus melanophloia*, *E. tereticornis*, *Corymbia intermedia*, *C. citriodora* also *E. fibrosa*, *E. crebra* and *E. fusiformis*.

**Permeability/Drainage:**

Slowly to moderately permeable / Moderately drained to well drained.

**Surface features:**

Firm, no microrelief, occasional sheet erosion, frequent chert and sandstone/arenite pebbles and cobbles, rare sandstone/arenite outcropping.



**A1** Grey, brown or black (10YR 3-5/1-3) sandy loam to light clay; weakly structured; few to many chert, sandstone/arenite or siltstone pebbles; field pH 5.0-6.5; clear to gradual change to

**A2e/ A2j** Where present, grey (10YR 5-7/2-3 & 10YR7/2 dry) sandy loam to clay loam; massive or weakly structured; rarely few to common distinct mottles; few to many siltstone or sandstone/arenite pebbles; field pH 5.5-6.0; clear change to

**BC** Frequently present, brown, grey or yellow (7.5-10YR 4-6/3-4) clay loam to light clay; massive or weakly structured; rarely common distinct mottles; many to abundant large chert or sandstone/arenite pebbles; field pH 4.5-6.5; clear change to

**C/R** Massive chert, sandstone/arenite or mudstone/siltstone.

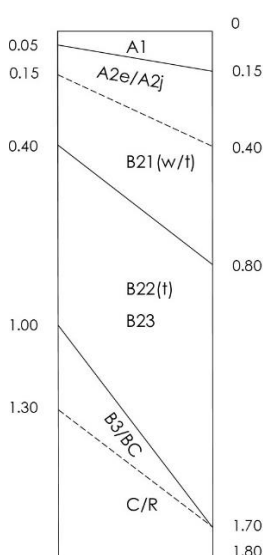
**Sites:** LARA: 217, 220, 221, 225, 231, 238, 242, 295, 296, 796.

**Distribution:** Located in the north-east and south-west portions of the survey area.

**FLANAGAN (FI)**

VERSION 1

<b>Concept:</b>	Deep to very deep, acidic, frequently bleached, red, uniform, gradational or texture contrast soils formed on siltstone and sandstone. Subsoils are strongly acidic and frequently mottled.
<b>Soil Classification:</b>	<b>Red Dermosol</b> , Red Kurosol, Red Kandosol.
<b>Landform:</b>	Crests, ridges, mid and upper slopes of undulating to rolling rises to steep hills. Slope 5-35%.
<b>Lithology and geology:</b>	Siltstones and sandstones of Koukandowie Formation (Jbmk), Gatton Sandstone (Jbmg), Heifer Creek Sandstone (Jbmh), Marburg Subgroup (Jbm).
<b>Vegetation:</b>	<i>Eucalyptus tereticornis</i> , <i>E. eugenioides</i> , <i>E. crebra</i> , <i>E. moluccana</i> , <i>Corymbia</i> spp., <i>Acacia</i> spp., <i>Lophostemon confertus</i> , <i>Xanthorrhoea johnsonii</i> .
<b>Permeability/Drainage:</b>	Slowly to moderately permeable / Moderately well drained to well drained.
<b>Surface features:</b>	Loose to hard setting, no microrelief, occasionally few to many sandstone cobbles or boulders and sandstone outcropping, frequent sheet, rill or gully erosion.



<b>A1</b>	Black, brown (rarely red) (5-10YR 3-4/1-4, 4/3-6) sandy loam to light medium clay; massive, weak angular/subangular blocky or moderate polyhedral structure; rarely few faint or distinct orange and red mottles; frequently few medium to large gravels; field pH 5.5-7.0; abrupt or clear change to
<b>A2e/A2j</b>	Where present, black, red or brown (5-10YR 3/2-3, 4-5/3-6 & 10YR7-8/2-3 dry) sandy loam to sandy light clay; massive or weak angular blocky structure; few sandstone/quartz pebbles to cobbles; rarely few faint red mottles; field pH 5.0-6.0; clear or abrupt change to
<b>B21w/B21t</b>	Red (2.5-5YR 3-5/4-8) light medium to medium heavy clay; moderate to strong subangular blocky or polyhedral structure; few to common faint or distinct grey, brown or orange mottles; few sandstone pebbles to cobbles; field pH 5.0-5.5; clear to gradual change to
<b>B22(t)/B23</b>	Red or grey (2.5-5YR 3-5/4-8, 10YR4-6/1-2) medium to medium heavy clay; moderate to strong polyhedral or subangular blocky structure; commonly few distinct grey or orange mottles few to many siltstone or sandstone pebbles to cobbles; field pH 4.5-5.0; clear, gradual or diffuse change to
<b>B3/BC</b>	Occasionally present, yellow, grey or red (2.5-7.5YR 5-6/1-8) medium to medium heavy clay; moderate to strong subangular blocky or polyhedral structure; few distinct red mottles; field pH 4.5-6.0.
<b>C/R</b>	Where present, red/yellow weathering sandstone; weak to very weak; field pH 4.5-5.5.

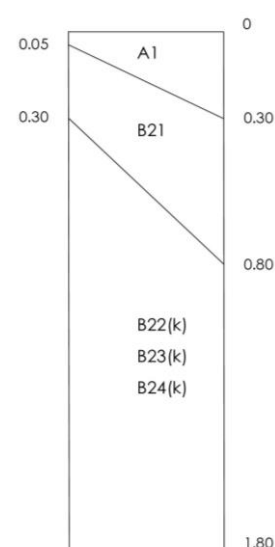
**Sites:** LARA: 301, 326, 384, 521, 750, 2116; SEQ: 60, 110, 125.

**Distribution:** Widely distributed from the QLD/NSW border in the south to Flagstone in the north.

**GLENAPP (Gp)**

VERSION 1

<b>Concept:</b>	Very deep, neutral to alkaline, black, self-mulching, cracking clays and calcic subsoils on basalt and basalt colluvium.
<b>Soil Classification:</b>	<b>Black Vertosol</b>
<b>Landform:</b>	Lower slopes, fans and footslopes of undulating and rolling low hills and hills. Slope <15%.
<b>Lithology and geology:</b>	Albert Basalt (Tfa) and Tertiary/Quaternary basalt colluvium (TQr/Qr).
<b>Vegetation:</b>	<i>Eucalyptus tereticornis</i> , <i>E. siderophloia</i> , <i>E. melliodora</i> , <i>Corymbia tessellaris</i> , <i>Ficus</i> spp.
<b>Permeability/Drainage:</b>	Moderately permeable / Moderately well drained.
<b>Surface features:</b>	Self-mulching, rare microrelief, occasionally basalt pebbles, occasional sheet erosion.



<b>A1</b>	Black (5-10YR 2-3/1-2) medium to medium heavy clay; moderate to strong angular/subangular blocky, polyhedral or lenticular structure, may have slickensides; rarely few basalt pebbles; field pH 6.0-7.5; abrupt to clear change to
<b>B21</b>	Black, rarely brown (5-10YR 2-3/1-3) medium to heavy clay; moderate to strong lenticular, polyhedral or subangular blocky structure, with slickensides; rarely few faint mottles; rarely few basalt pebbles; occasionally few calcareous or manganiferous segregations; field pH 7.0-9.0; clear to gradual change to
<b>B22(k)/B23(k)/B24(k)</b>	Black, brown or grey (7.5-10YR 2-5/1-4, 4/3) light medium to medium heavy clay; moderate to strong lenticular or prismatic structure; occasionally few faint mottles; occasionally few basalt pebbles; few to many fine to coarse calcareous segregations; field pH 7.0-9.0.

**Sites:** LARA: 13, 55, 129, 130, 465, 477, 489, 512, 513, 514, 632, 651, 654, 662, 663, 675, 709, 713, 2027, 2044, 2045, 2061, 2062, 2063, 2074, 2076, 2119, 2137, 2138, 2140, 2170, 2185, 2240, 2251, 3001, 9004, 9007, 9008, 9016.

**Distribution:** Running Creek, Innisplain, Oak Creek, Christmas Creek, Josephville, Bromelton, Nindooibah, Kerry Creek, Spring Creek, Cavell Creek, Biddaddaba.

**GLENOAKE (GI)**

VERSION 1

**Concept:**

Moderately deep, acidic to neutral, brown and yellow, occasionally mottled, gradational and uniformly fine textured soils. Subsoils are frequently alkaline and calcic below 0.6 m.

**Soil Classification:**

**Brown Dermosol**, Yellow Dermosol

**Landform:**

Crests and slopes of rolling to steep low hills and hills. Slope 1-25%.

**Lithology and geology:**

Siltstones and sandstones of Koukandowie Formation (Jbmk) and Gatton Sandstone (Jbmg)

**Vegetation:**

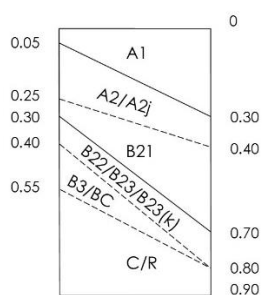
*Eucalyptus tereticornis*, *E. melanophloia*, *E. moluccana*, *E. crebra*, *Corymbia*, *Citriodora*

**Permeability/Drainage:**

Moderately to highly permeable / Moderately well drained to well drained

**Surface features:**

Hard setting or firm, rare periodic cracking, no microrelief, occasionally few sandstone or siltstone pebbles or cobbles, common sheet erosion



- A1** Black or brown (5-10YR 3/1-3, 4/2-3) sandy loam to light clay; weak to moderate angular/subangular blocky or polyhedral structure; rarely few distinct mottles; rarely few sandstone pebbles; field pH 4.5-6.5; abrupt to gradual change to
- A2/ A2j** Rarely present, grey or brown (10YR 4-5/2-3 & 10YR72 dry) sandy clay loam; weak to moderate angular blocky structure; few distinct mottles; few quartz pebbles; field pH 5.5-6.0; clear or gradual change to
- B21(t)** Brown or yellow (7.5-10YR 4-5/3-6, 6/4) sandy clay loam to medium clay; moderate to strong angular/subangular blocky or polyhedral structure; frequently few to many faint to distinct mottles; occasionally few sandstone or siltstone pebbles; field pH 4.5-7.5; clear change to
- B22/ B23/ B23k** Where present, brown, yellow or grey (7.5-10YR 5-6/1-6) clay loam sandy to medium clay; weak to moderate polyhedral or angular/subangular blocky structure, rarely with slickensides; few to common faint or distinct mottles; occasionally few sandstone or siltstone pebbles; few to many manganiferous or calcareous segregations; field pH 6.0-8.5; clear change to
- B3/ BC** Where present, brown, yellow or grey (10YR 5-6/2-6) sandy loam to light clay; massive or moderate angular blocky structure; few faint or distinct mottles; frequently few to common sandstone or siltstone pebbles; rarely few calcareous segregations; field pH 6.0-8.5.
- C/R** Massive siltstone or sandstone; rare calcareous segregations; field pH 6.0-9.0.

**Sites:** LARA: 138, 139, 190, 207, 247, 335, 401, 402, 421, 453, 2266, 2267.

**Distribution:** Scattered throughout the Marburg group geologies at Rathdowney, Tamrookum, Maclean, Mundoolun, Boyland and Canungra.

**GORMAN (Go)**

VERSION 1

**Concept:**

Shallow, neutral to alkaline, black and brown cracking clay soils over hard or weathered basalt from 0.3 m. Rarely self-mulching or calcic.

**Soil Classification:**

**Black Vertosol**, Brown Vertosol.

**Landform:**

Upper slopes of undulating and rolling low hills; mid slopes of rolling to steep rises to hills. Slope 3-40%.

**Lithology and geology:**

Albert Basalt (Tfa).

**Vegetation:**

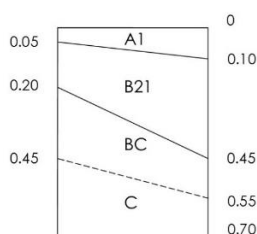
*Eucalyptus siderophloia*, *E. crebra*, *Corymbia tessellaris*. Also *Araucaria cunninghamii*, *Ficus* spp.

**Permeability/Drainage:**

Moderately permeable / Moderately well drained.

**Surface features:**

Firm with frequent periodic cracking, no microrelief, rarely self-mulching, frequent basalt pebbles or stones, frequent sheet erosion.



- A1** Black (10YR 1-2/1-2) light to medium clay; moderate to strong polyhedral or subangular blocky structure; field pH 6.0-7.0; clear change to
- B21** Black or brown (10YR 2-3/1-4) medium to medium heavy clay; moderate lenticular structure with slickensides; common faint orange mottles; rarely few calcareous nodules; field pH 6.5-8.5; abrupt to gradual change to
- BC** Where present, brown (10YR 3-4/3-4) sandy light clay; weak angular/subangular blocky or prismatic structure; frequent basalt pebbles; field pH 7.5-8.5.
- C/R** Very weak, massive basalt saprolite.

**Sites:** LARA: 639, 2054, 2073, 2093, 2121, 2188, 2242.

**Distribution:** Christmas Creek, Sandy Creek, Nindooibah and Biddaddaba.

**GOULD (Gd)**

VERSION 1

**Concept:**

Moderately deep to very deep, strongly acidic to neutral, brown, black and grey cracking clay soils on siltstone that are occasionally sodic.

**Soil Classification:**

**Brown Vertosol**, Black Vertosol, Grey Vertosol.

**Landform:**

Slopes (rarely broad crests) of undulating and rolling rises and low hills. Slope 2-15%.

**Lithology and geology:**

Siltstones of Walloon Coal Measures (Jw), Koukandowie Formation (Jbmk), Gatton Sandstones (Jbmg), Heifer Creek Sandstone (Jbmh) and Beaudesert Beds (Te).

**Vegetation:**

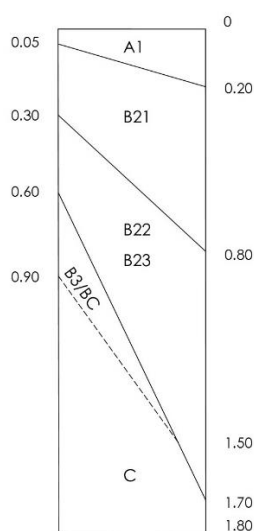
*Eucalyptus moluccana*, *E. tereticornis*, *Corymbia citriodora*.

**Permeability/Drainage:**

Slowly to moderately permeable / Poorly to moderately well drained.

**Surface features:**

Firm or hard setting (rarely self-mulching) with frequent periodic cracking, gilgai rare.



**A1(p)** Black (5-10YR 2-3/1-2) light to medium clay; massive or weak to strong angular/subangular blocky or granular structure; rare distinct mottles; occasionally few manganiferous nodules; field pH 5.5-6.5; abrupt to gradual change to

**B21** Brown, black or grey (7.5YR-2.5Y 3-5/1-4) light medium clay to heavy clay; moderate to strong lenticular or angular/subangular blocky structure, frequent slickensides; frequently few to common faint or distinct mottles; commonly few manganiferous segregations; field pH 5.5-7.0; gradual or diffuse change to

**B22/ B23** Grey or brown (7.5YR-2.5Y 4-5/1-4, 6/3) light medium to heavy clay; moderate to strong lenticular, angular blocky or prismatic structure, with slickensides; few to many faint to prominent mottles; occasionally few manganiferous segregations; field pH 4.0-7.0; gradual or diffuse change to

**B3/ BC** Where present, grey, brown or yellow (7.5-10YR 5-6/1-4) light medium to medium clay; massive or moderate lenticular or subangular blocky structure, with slickensides; common siltstone pebbles; field pH 4.0-5.5.

**C** Present in moderately deep soils only. Weak, massive, siltstone saprolite; field pH 4.5-5.0.

**Sites:** LARA: 37, 38, 39, 40, 73, 618, 2223, 3007; SEQ: 88, 89, 190, 191, 309, 318, 331, 333; MFM: 425.

**Distribution:** Mount Ernest, Laravale, Gleneagle, Teviot to Jimboomba and Woodhill.

**GRIGOR (Gr)**

VERSION 1

**Concept:**

Moderately deep to very deep, neutral, black texture-contrast soils with sandy surfaces on Quaternary alluvium. Subsoils overlie buried alluvial horizons.

**Soil Classification:**

**Black Chromosol**

**Landform:**

Plains and levees on alluvial plains and terraces.

**Lithology and geology:**

Quaternary alluvium (Qa) influenced by Triassic and Jurassic sediments.

**Vegetation:**

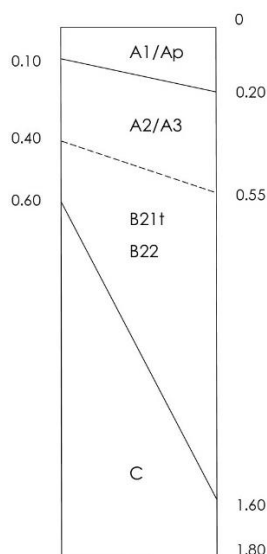
*Eucalyptus tereticornis*, *Casuarina cunninghamiana*.

**Permeability/Drainage:**

Slowly to moderately permeable / Imperfectly to moderately well drained.

**Surface features:**

Loose to firm, no microrelief.



**A1/ Ap** Black or brown (10YR 2-3/2-3, 4/3) loamy sand to sandy loam; massive or weak to moderate angular blocky structure; field pH 6.0-7.0; abrupt or clear change to

**A2/ A3** Where present, black or brown (10YR 3/2-3, 4/3 & 10YR5/3, 6/4 dry) loamy sand to sandy loam; massive or weak angular blocky structure; occasionally few medium faint brown mottles; field pH 6.0-6.5; abrupt change to

**B21t/ B22** Black or grey (10YR 2-6/1-2) fine sandy light clay to medium clay; weak prismatic or weak to moderate angular/subangular blocky structure rarely with faint slickensides; occasionally few fine to medium red or orange mottles; frequently very few fine to medium manganiferous segregations; field pH 6.5-7.0.

**C** Where present, black or brown, massive, loamy sands to sandy loams in downstream areas. In upper catchment areas it is very weak weathered sandstone with a sandy loam texture weathering insitu; field pH 6.5-7.0.

**Sites:** LARA: 311, 554, 559; MISSE: 534.

**Distribution:** Isolated pockets in the Upper Logan near Rocky Creek; also adjacent to Knapp Creek downstream of Cannon Creek and on the Logan River at Veresdale downstream of Allan Creek.

**GUNYAH (Gy)**

VERSION 1

**Concept:**

Deep to very deep, alkaline, black texture-contrast soils on Quaternary alluvium. Loamy to clay loamy surfaces over black clays. Subsoils may be calcic and/or vertic.

**Soil Classification:****Black Chromosol****Landform:**

Plains and levees on flood plains and terraces.

**Lithology and geology:**

Quaternary alluvium (Qa).

**Vegetation:**

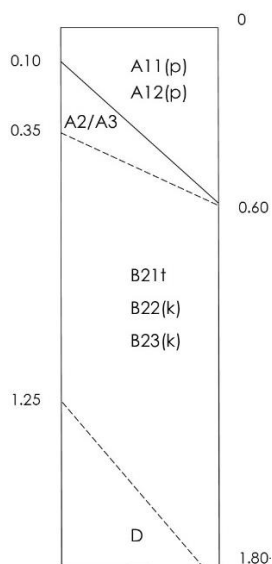
*Eucalyptus tereticornis*, *Casuarina cunninghamiana*, *Grevillia robusta*, *Ficus* spp.

**Permeability/Drainage:**

Slowly to moderately permeable / Moderately well drained to well drained.

**Surface features:**

Firm to hard setting, no microrelief.



**A11(p)/A12(p)** Black or brown (10YR 2-3/1-3) sandy loam to clay loam sandy; massive or weak to moderate angular/subangular blocky or polyhedral structure; field pH 6.0-8.0; abrupt or clear change to

**A2/A3** Where present, brown (10YR 3-4/3) clayey sand to clay loam fine sandy; massive or weak subangular blocky structure; occasionally very few medium faint orange mottles; field pH 6.0-7.5; abrupt or clear change to

**B21t/B22(k)/B23(k)** Black or brown (10YR 2-3/1-4) fine sandy clay loam to medium clay; massive or weak to moderate (rarely strong) subangular blocky, polyhedral, lenticular or prismatic structure, occasionally with faint to distinct slickensides; rarely few medium faint to distinct orange or brown mottles; occasionally few to common medium to coarse manganiferous or calcareous nodules; rarely very few medium coarse fragments of various origins; field pH 6.5-9.0; abrupt change to

**D** Where present, brown, massive, loamy sands to sandy clay loams; field pH 7.0-7.5.

**Sites:** LARA: 376, 508, 570, 610, 642, 2167, 9005; SEQ: 355, 368.

**Distribution:** Knapp Creek and Logan River at Laravale; Logan River and Palen Creek at Rathdowney; Christmas Creek; Logan River at Il-Bogan; Collins Creek to Yarrabilba on the Albert River.

**HARDGRAVE (Ha)**

VERSION 1

**Concept:**

Deep to very deep, brown, neutral to alkaline, frequently mottled, texture contrast soils on sandstone (rarely siltstone or coal). Black loams overlying brown medium clays, over brown and grey medium to heavy clays. Subsoils are frequently strongly alkaline and calcic.

**Soil Classification:****Brown Chromosol****Landform:**

Mid and lower slopes of undulating rises to rolling low hills. Slope up to 20%.

**Geology:**

Sandstones (rarely siltstones) of Koukandowie Formation (Jbmk), Gatton Sandstones (Jbmg) and Heifer Creek Sandstone (Jbmh).

**Vegetation:**

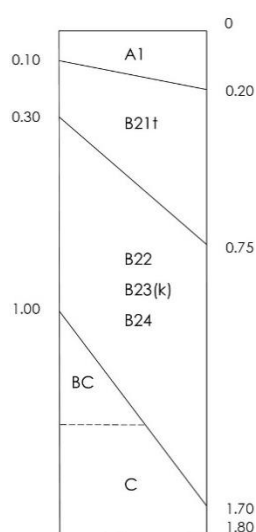
*Eucalyptus tereticornis*, *E. moluccana*.

**Permeability/Drainage:**

Slowly to moderately permeable / Imperfectly to moderately well drained.

**Surface features:**

Hard setting or firm, occasionally sheet or gully erosion, occasionally few sandstone and siltstone pebbles.



**A1** Black (10YR 2-3/1-2) sandy loam to clay loam; massive or weak to moderate angular/subangular blocky or polyhedral structure; rarely very few small sandstone or siltstone pebbles; rarely very few manganiferous segregations; field pH 6.0-6.5; abrupt or clear change to

**B21t** Brown (7.5YR-2.5Y 3-5/3-4) medium to medium heavy clay; moderate to strong polyhedral or subangular blocky structure; frequently few distinct mottles; rarely very few small sandstone or siltstone pebbles; frequently few manganiferous nodules; field pH 6.0-7.5; abrupt or clear change to

**B22(k)/B23(k)/B24** Brown or grey (10YR-2.5Y 4-5/1-6) sandy light clay to heavy clay; moderate to strong polyhedral or angular/subangular blocky structure; few to common faint to distinct mottles; few fine to coarse gravels; very few to few calcareous or manganiferous segregations; field pH 6.5-8.5.

**BC** Where present, brown (10YR4/4) sandy medium clay; massive to weak angular blocky structure; field pH 8.5.

**C** Where present, massive, weak sandstone (rarely siltstone or coal); field pH 8.5.

**Sites:** LARA: 320, 322, 323, 2209; SEQ: 189, 225, 226.

**Distribution:** Barney View, Bromelton, Jimboomba, Stockleigh/North Maclean.



**HOOPER (Hr)**

VERSION 2

**Concept:**

Deep to very deep, black, non-cracking uniformly fine clay soils on alluvium. Subsoils are strongly alkaline and calcic at depth overlying alkaline, calcic buried alluvial horizons.

**Soil Classification:****Black Dermosol****Landform:**

Plains and terrace plains on flood plains and terraces.

**Geology:**

Quaternary alluvium (Qa).

**Vegetation:**

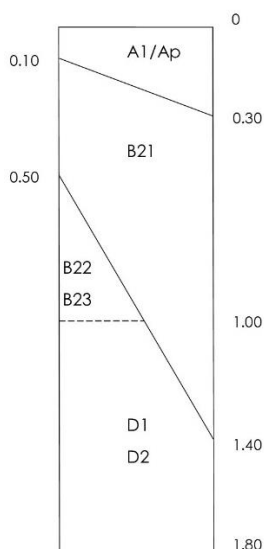
*Eucalyptus tereticornis*, *Casuarina cunninghamiana*, *Corymbia tessellaris*.

**Permeability/Drainage:**

Moderately permeable / Moderately well drained.

**Surface features:**

Firm or hardsetting, with periodic cracking, no microrelief, rare basalt gravels.



**A1/ A1p** Black (10YR 2-3/1) silty light to medium clay; weak to moderate angular/subangular blocky or polyhedral structure; field pH 6.0-7.0; abrupt or clear change to

**B21** Black (10YR 2/1) light medium to medium clay (often silty); weak to strong angular/subangular blocky polyhedral or lenticular structure often with slickensides; field pH 6.5-8.5; gradual change to

**B22/ B23** Where present, black or brown (10YR 3/2-3) medium clay; strong prismatic or subangular blocky structure, frequently with slickensides; frequently few medium manganiferous segregations; field pH 7.5-8.5; gradual change to

**D1/ D2** Black or brown (10YR 3/2-4) sandy/silty light to light medium clay or medium heavy clay; massive or weakly to moderately structured; few substrate mottles; few medium calcareous nodules; field pH 8.5-9.0.

**Sites:** LARA: 483, 485, 729, **9011**; SEQ: 415.

**Distribution:** Very limited and isolated occurrence. New Year Creek at Glenapp; Oaky Creek at Innisplain; Albert River at Kerry; Sandy Creek at Tamborine.

**JIMBOOMBA (Jm)**

VERSION 1

**Concept:**

Moderately deep to deep, brown, poorly structured, acidic to neutral, uniformly coarse soils formed on alluvium from a range of sources, often with buried horizons below. May be bleached.

**Soil Classification:****Orthic Tenosol****Landform:**

Plains and terrace plains on flood plains and terraces.

**Geology:**

Quaternary alluvium (Qa).

**Vegetation:**

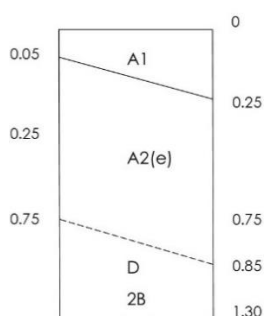
*Eucalyptus tereticornis*, *E. microcorys*, *Casuarina* spp., *Angophora* spp.

**Permeability/Drainage:**

Moderately permeable / Well drained.

**Surface features:**

Loose or hard setting; no microrelief; frequent sub-rounded/rounded stones.



**A1** Brown or grey (10YR 3/2, 4/2) loamy sand to sandy clay loam; massive or weakly structured; field pH 5.5-6.5; clear or abrupt change to

**A2(e)** Where present, brown or grey (10YR 5-6/2-3 & 10YR6-7/2-3 dry); loamy sand; massive or weakly structured; field pH 5.5-6.5; abrupt, clear or gradual change to

**D/ 2B** Frequently present, grey or brown (10YR 5-6/3-6); sand; massive; field pH 5.5-6.5.

**Sites:** LARA: 777, 2010; SEQ: 67 (very limited sites in this study area – not well described).

**Distribution:** Limited occurrence in the Upper Logan, Allen Creek near Bromelton and near Jimboomba.

**JOSEPHVILLE (Jo)**

VERSION 1

**Concept:**

Shallow to moderately deep, red and brown, non-cracking, uniformly fine clay soils. Dark surfaces over occasionally mottled red and brown clays on sandstone and siltstone from 0.4 m. Subsoils are neutral to alkaline and may be saline.

**Soil Classification:****Red or Brown Dermosol****Landform:**

Crests, ridges, upper and mid slopes of undulating to rolling rises and low hills. Slope 1-15%.

**Geology:**

Siltstones and sandstones of Walloon Coal Measures (Jw) and Beaudesert Beds (Te).

**Vegetation:**

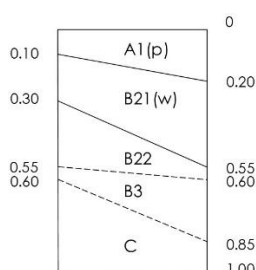
*E. moluccana*, *E. siderophloia*, *Corymbia tessellaris*, *C. citriodora*.

**Permeability/Drainage:**

Moderately permeable / Moderately well drained to well drained.

**Surface features:**

Firm or hard setting, no microrelief or cracking, occasionally few siltstone or sandstone pebbles to stones, common sheet or rill erosion.



**A1(p)** Black or brown (7.5-10YR 2-3/1-2, 3-4/3) light clay to medium clay; moderate to strong angular/subangular blocky, polyhedral or granular structure; rarely few small sandstone/siltstone pebbles; rarely few manganiferous segregations; field pH 5.5-6.5; abrupt to gradual change to

**B21(w)** Red, brown or black (2.5-10YR 2-3/2, 3-5/3-6) light medium to heavy clay; moderate to strong subangular polyhedral or lenticular structure, occasional slickensides; occasionally few to common distinct red, orange or grey mottles; rarely few siltstone pebbles; rarely few manganiferous nodules; field pH 6.0-8.0; clear to diffuse change to

**B22** Occasionally present, brown (7.5-10YR 3-4/3) medium to heavy clay; moderate lenticular structure, with slickensides; occasionally few faint orange mottles; few to common manganiferous segregations; field pH 7.0-9.0; abrupt or clear change to

**B3** Occasionally present, red or brown (5-10YR 5/4-6) medium heavy clay; moderate to strong subangular blocky or lenticular structure; common to many siltstone pebbles; occasionally few manganiferous nodules; field pH 5.5-8.5; gradual change to

**C** Weak or very weak, massive sandy light clay, siltstone or sandstone saprolite; field pH 8.0-8.5.

**Sites:** LARA: 4, 5, 79, 124, 579, 597, 745, 754, 2035; SEQ: 311; SEDG: 4.

**Distribution:** Darlington, Christmas Creek, Oaky Creek, Josephville, Bromelton, Kagaru, Woodhill, Veresdale, Tabragalba.

**KAGARU (Ka)**

VERSION 1

**Concept:**

Deep to very deep, brown and black, cracking clay soils on siltstone. Subsoils are alkaline, calcic, commonly mottled, and may be saline.

**Soil Classification:****Black or Brown Vertosol****Landform:**

Lower slopes and flats of undulating to rolling rises and low hills. Slope 0-15%.

**Geology:**

Siltstones of Koukandowie Formation (Jbmk), Gatton Sandstone (Jbmg) Walloon Coal Measures (Jw), and Beaudesert Beds (Te).

**Vegetation:**

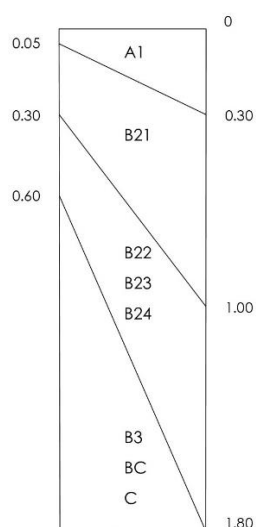
*Eucalyptus tereticornis*, *E. moluccana*, *Corymbia tessellaris*, *Araucaria cunninghamii*.

**Permeability/Drainage:**

Moderately permeable/ Imperfectly drained to well drained.

**Surface features:**

Firm with periodic cracking, rarely self-mulching, rare gilgai.



**A1(p)** Black (10YR 2-3/1-2) light to medium clay; moderate polyhedral, granular or angular/subangular blocky structure; rarely few gravels; occasionally very few manganiferous or ferromanganiferous segregations; field pH 6.0-7.5; abrupt to clear change to

**B21** Black or brown (7.5YR-2.5Y 3-5/1-4) medium to medium heavy clay (often silty); moderate to strong lenticular or subangular blocky structure, with slickensides; common few to many faint or distinct mottles; frequently few to common ferromanganiferous, calcareous, or manganiferous segregations; field pH 6.5-9.0; abrupt to gradual change to

**B22/ B23/ B24** Black, brown or grey (7.5-2.5Y 3-5/1-4) medium to medium heavy clay (often silty or fine sandy); weak to moderate lenticular structure, with slickensides; occasionally few to common faint or distinct mottles; occasionally very few siltstone pebbles; few to many calcareous or manganiferous nodules; field pH 6.5-9.0; clear to diffuse change to

**B3/ BC** Where present, grey (10YR 5-7/1-2) silty/sandy light to medium heavy clay; strong subangular blocky structure, or weak to moderate lenticular structure with slickensides; many distinct substrate mottles; common siltstone pebbles or cobbles; few calcareous and manganiferous segregations; field pH 8.5-9.0.

**C** Where present, weak to very weak, massive, siltstone; field pH 8.5-9.0.

**Sites:** LARA: 3, 373, 565, 587, 595, 690, 759, 760; SEQ: 87, 90, 107, 116, 315, 329; MFM: 67, 205, 328.

**Distribution:** Upper Logan River, Palen, Tamrookum, Bromelton, Beaudesert, Cryna, Veresdale, Woodhill, Teviot, Cedar Grove, Kagaru.

**KILMOYLAR (Km)**

VERSION 1

**Concept:**

Deep to very deep, brown, neutral texture contrast soils formed on alluvium. Commonly bleached loamy surfaces over neutral, frequently mottled brown and grey clays.

**Soil Classification:**

**Brown Chromosol**, **Yellow Chromosol**.

**Landform:**

Plains and terrace plains on level to undulating alluvial and flood plains and terraces.

**Geology:**

Quaternary alluvium (Qa, Qpa/1) derived from Jurassic sediments.

**Vegetation:**

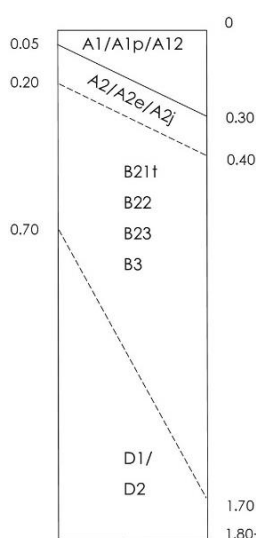
*Eucalyptus tereticornis*, *E. moluccana*, *Casuarina* spp., *Grevillia robusta*.

**Permeability/Drainage:**

Slowly to moderately permeable/ Imperfectly to moderately well drained.

**Surface features:**

Firm to hard setting, no microrelief.



**A1(p)/A12** Black, brown or grey (7.5-10YR 2-5/1-3) sandy loam to clay loam; massive or weak to moderate angular/subangular blocky structure; field pH 5.5-6.5; abrupt or clear change to

**A2(e/j)** Where present, brown or grey (10YR 3-4/2-3, 6/1-2 & 10YR6/3, 7-8/1 dry) sandy loam to clay loam; massive or weak angular/subangular blocky; frequently few to many medium manganiferous concretions where bleached; rarely very slightly gravelly; field pH 5.5-6.5; abrupt or clear change to

**B21t/B22/B23** Brown or yellow (7.5-10YR 3-6/3-6, 2.5Y5/1-4) fine sandy light clay to medium heavy clay; massive or weak to strong angular/subangular blocky, lenticular or prismatic structure, sometimes with faint slickensides; frequently very few to many distinct or prominent mottles; frequently few to many fine to medium manganiferous segregations; field pH 6.0-7.5; clear change to

**B3** Where present, brown (10YR 3-5/4) sandy light medium to medium clay; massive or weak subangular blocky structure sometimes with faint slickensides; few to many fine to medium manganiferous segregations; field pH 6.0-6.5.

**D1/D2** Where present, brown or yellow (7.5-10YR 3-6/3-6) loamy sand to sandy medium clay; massive or weakly structured; occasionally few to many distinct or prominent medium to very coarse grey mottles; field pH 6.0-7.5.

**Sites:** LARA: 83, 277, 392, 406, 555, **770, 9000**; SEQ: 71, 160, 162, 203; MFM: 180, 181.

**Distribution:** Scattered in areas dominated by Jurassic sediments, from the Upper Logan to Jimboomba/North Maclean along the Logan River. Also found along Allen Creek and also Knapp Creek below Cannon Creek.

**KNAPP (Kn)**

VERSION 1

**Concept:**

Deep to very deep, brown, neutral to alkaline texture contrast soils formed on sandstone (rarely siltstone). Bleached surfaces over frequently mottled brown clays over mottled brown, yellow and grey clays at depth.

**Soil Classification:**

**Brown Chromosol**

**Landform:**

Mid and lower slopes of undulating rises to rolling low hills. Slope 2-20%.

**Geology:**

Sandstones (rarely siltstones) of Koukandowie Formation (Jbmk) and Gatton Sandstone (Jbmg).

**Vegetation:**

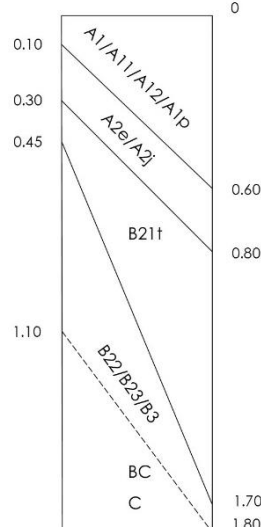
*Eucalyptus tereticornis*, *E. siderophloia*, *Casuarina cunninghamiana*, *Grevillia robusta*, *Corymbia citriodora*, *C. intermedia*, *C. tessellaris*, *Ficus* spp.

**Permeability/Drainage:**

Slowly to moderately permeable / Imperfectly to moderately well drained.

**Surface features:**

Firm or hard setting, no microrelief, commonly few sandstone cobbles, stones or boulders, rare sheet erosion.



**A1(p)/A11/A12** Black or grey (7.5-10YR 2-5/2-3) sandy loam to clay loam; massive or weak to moderate angular or subangular blocky structure; occasionally few faint mottles; field pH 6.0-7.5; clear to gradual change to

**A2e/A2j** Grey, brown or black (7.5-10YR 2-6/2-4 & 10YR7/1-3 dry); loamy sand to sandy clay loam; massive or weak angular blocky structure; rarely few quartz pebbles; frequently few faint mottles; rarely few manganiferous nodules; field pH 6.0-7.5; sharp to clear change to

**B21t** Brown (7.5-10YR 3-5/3-8) sandy light to medium clay; massive or weak to moderate angular blocky, subangular blocky or prismatic structure; common distinct mottles; occasionally few sandstone, quartz or siltstone pebbles; occasionally few manganiferous or ferromanganiferous segregations; field pH 6.0-7.5; clear to diffuse change to

**B22t/B23t** Where present, brown, yellow or grey (10YR 3-6/2-6) sandy light to medium heavy clay; massive or weak to moderate angular/subangular blocky or prismatic structure; occasionally few to common faint or distinct mottles; occasionally few sandstone or quartz pebbles; rarely common manganiferous or calcareous segregations; field pH 6.0-8.5.

**B3** Where present, grey (10YR 5/1-2) sandy light medium to medium heavy clay; massive; few distinct orange or red mottles; few sandstone or siltstone pebbles; field pH 5.5-6.0.

**BC/C** Massive, weak sandstone or siltstone.

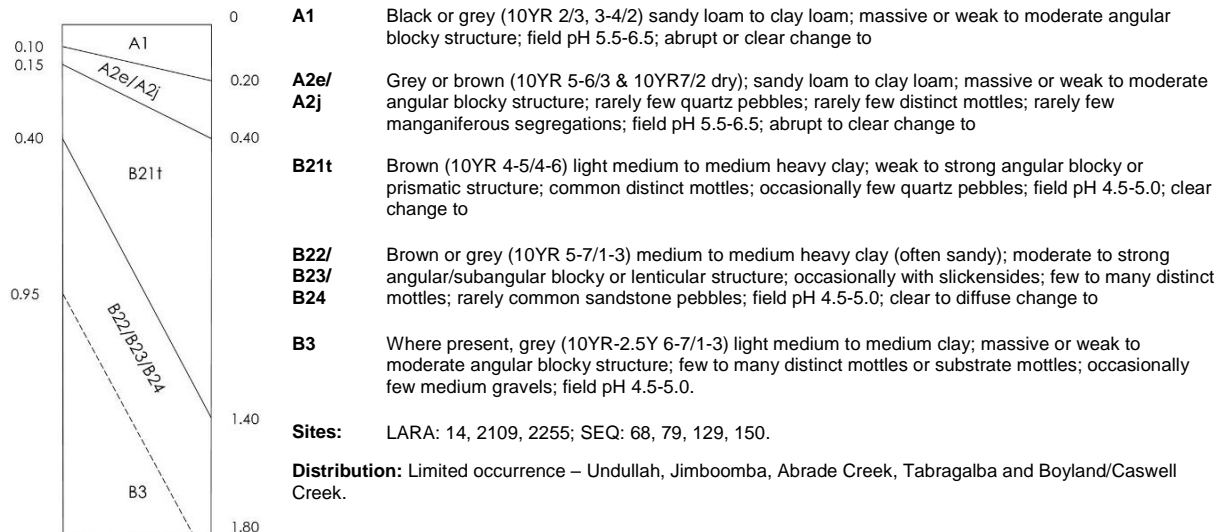
**Sites:** LARA: 143, 144, 175, 506, 507, 524, 552, 747; SEQ: 108, 420.

**Distribution:** Rathdowney, Tamrookum, Tamrookum Creek, Oaky Creek, Undullah, Jimboomba, Mundoolun, Birnam.

## KNAPP ACIDIC PHASE (KnAp)

VERSION 1

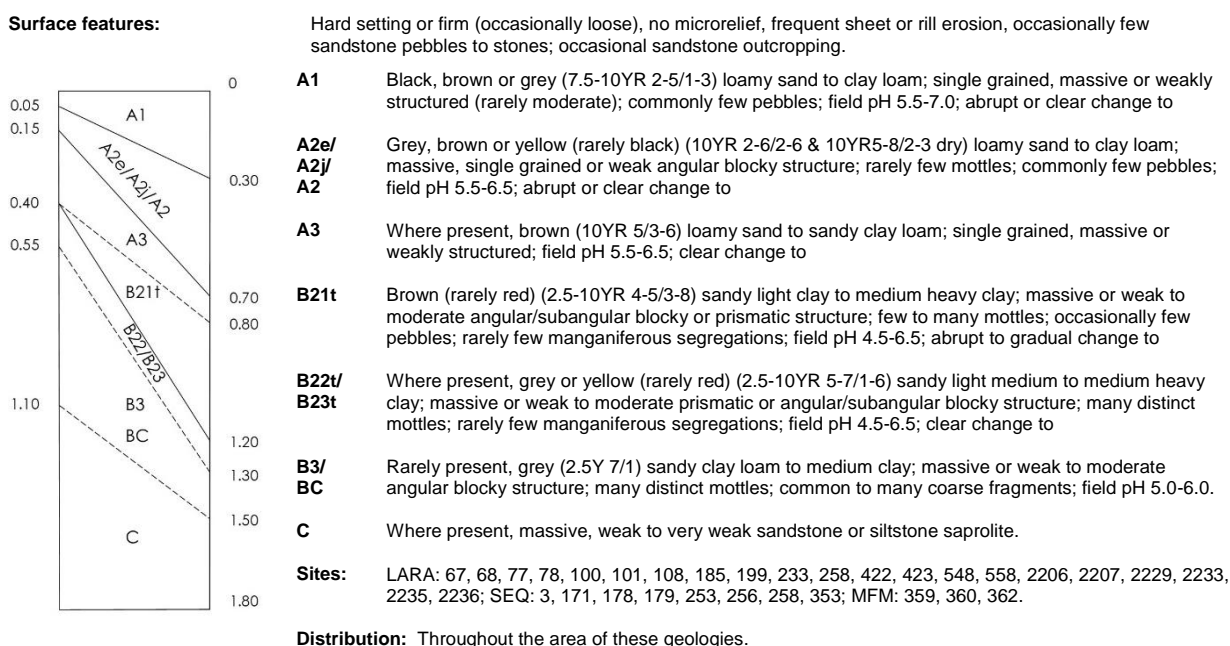
<b>Concept:</b>	Deep to very deep, brown, strongly acidic, texture contrast soils formed on sandstone (rarely siltstone). Bleached surfaces over mottled brown and grey clays (rarely sodic).
<b>Soil Classification:</b>	<b>Brown Kurosol</b>
<b>Landform:</b>	Slopes of undulating rises to rolling low hills. Slope <10%.
<b>Geology:</b>	Sandstones (rarely siltstones) of Koukandowie Formation (Jbmk), Gatton and Heifer Creek Sandstone (Jbmg & Jbmh).
<b>Vegetation:</b>	<i>Eucalyptus tereticornis</i> , <i>E. moluccana</i> , <i>Corymbia citriodora</i> , <i>Angophora</i> spp.
<b>Permeability/Drainage:</b>	Slowly permeable / Imperfectly drained.
<b>Surface features:</b>	Hard setting, no microrelief, rarely few sandstone cobbles.



## KOORALBYN (Ko)

VERSION 1

<b>Concept:</b>	Moderately deep to deep, frequently bleached, brown (rarely red) texture contrast soils on siltstone and sandstone. Subsoils are strongly acidic to neutral, frequently mottled and may be saline or sodic.
<b>Soil Classification:</b>	<b>Brown Chromosol or Kurosol</b> , Red Chromosol or Kurosol.
<b>Landform:</b>	Slopes and crests on undulating to rolling rises and low hills. Slope up to 30%.
<b>Geology:</b>	Siltstones and sandstones of Woogaroo Subgroup (RJbw), Ipswich Coal Measures (Ri).
<b>Vegetation:</b>	<i>E. Eucalyptus tereticornis</i> , <i>E. moluccana</i> , <i>E. crebra</i> , <i>E. siderophloia</i> , <i>Corymbia citriodora</i> , <i>C. tessellaris</i> , <i>C. intermedia</i> , <i>Acacia</i> spp.
<b>Permeability/Drainage:</b>	Slowly to moderately permeable / Imperfectly drained to well drained.



**KOORALBYN DEEP PHASE (KoDp)**

VERSION 1

**Concept:** Very deep, bleached, brown, mottled, strongly acidic texture contrast soils on sandstone. May be saline.

**Soil Classification:** **Brown Kurosol**

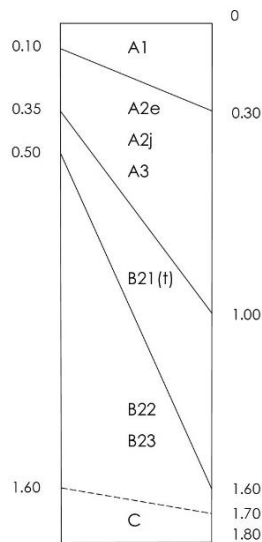
**Landform:** Hillslopes on undulating rises. Slope <5%.

**Geology:** Sandstones of Woogaroo Subgroup (RJbw).

**Vegetation:** *Corymbia citriodora*, *C. intermedia*, *Acacia* spp.

**Permeability/Drainage:** Slowly to moderately permeable / Imperfectly drained to well drained.

**Surface features:** Loose or firm, no microrelief.



**A1** Black or grey (7.5-10YR 3-5/1) loamy sand to sandy loam; single grained, massive or weakly structured; field pH 5.0-6.5; clear or gradual change to

**A2e/ A2j** Grey, brown or yellow (7.5-10YR 5-6/2-4 & 10YR7/1-2 dry) sand to sandy loam; massive, single grained or weakly structured; rarely few mottles; rarely few pebbles; field pH 5.0-6.5; abrupt or clear change to

**A3** Rarely present, brown (10YR 5/4) sandy loam; weakly structured; few distinct orange mottles; field pH 4.5-5.0; clear change to

**B21(t)** Brown (7.5-10YR 5/3-6) sandy clay loam to medium clay; massive or weak to moderate prismatic or angular blocky structure; few to many distinct mottles; field pH 4.5-5.5; clear change to

**B22(t)/ B23(t)** Where present, grey or yellow (10YR 6-8/1-8) sandy light to light medium clay; massive or weak to moderate prismatic or angular/subangular blocky structure; few to many distinct mottles; rarely few sandstone pebbles; field pH 4.5-5.5.

**C** Where present, massive sandstone saprolite.

**Sites:** LARA: 65, 102; SEQ: 194, 195, 252.

**Distribution:** Yarrabilba to Stockleigh.

**KOUKANDOWIE (Kk)**

VERSION 1

**Concept:** Moderately deep to very deep, sodic, bleached, brown and yellow texture contrast soils on siltstone and sandstone. Subsoils are neutral to strongly alkaline, mottled, occasionally calcic and/or saline.

**Soil Classification:** **Brown Sodosol**, Sodic Brown or Yellow Chromosol.

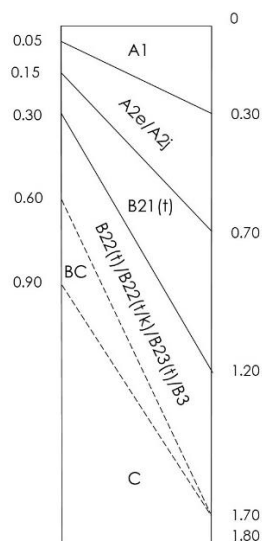
**Landform:** Hillslopes, crests and ridges on undulating and rolling rises and low hills. Slope <25%.

**Geology:** Koukandowie Formation (Jbmk), Gatton and Heifer Creek Sandstones (Jbmg/Jbmh), Woogaroo Subgroup (RJbw).

**Vegetation:** *Eucalyptus tereticornis*, *E. moluccana*, *E. Crebra*, *Corymbia citriodora*, *C. tessellaris*, *C. intermedia*, *Casuarina cunninghamiana*, *Ficus* spp., *Acacia* spp., *Petalostigma pubescens*, *Angophora floribunda*.

**Permeability/Drainage:** Very slowly to slowly permeable / Imperfectly drained.

**Surface features:** Hard setting or firm, occasional gully or sheet erosion; common sandstone pebbles to boulders; rare outcropping.



**A1** Black, brown or grey (7.5-10YR 2-6/1-4) sandy loam to clay loam; massive or weak to moderate granular or angular/subangular blocky structure; rare mottles, gravels or manganiferous segregations; field pH 5.5-7.0; abrupt to gradual change to

**A2(e/j)** Frequently bleached, grey, brown or yellow (10YR-2.5Y 3/3, 4-7/2-4 & 10YR6-8/1-4 dry) loamy sand to clay loam; massive or weak angular blocky structure; occasionally few faint or distinct mottles; occasionally few to many sandstone or quartz pebbles; rarely few manganiferous segregations; field pH 6.0-7.0; sharp to clear change to

**B21(t)** Brown or yellow (10YR 3-5/3-8, 6/4-8) light medium to heavy clay (frequently sandy); massive or weak to strong prismatic or angular/subangular blocky structure; common to many faint to prominent mottles; rarely few small siltstone or sandstone pebbles; commonly few to many manganiferous segregations; field pH 6.0-7.5; clear to diffuse change to

**B22(t)/ B23(t/k)** Where present, brown, yellow or grey (10YR-2.5Y 4-7/1-6) light medium to medium heavy clay (frequently sandy); weak to strong prismatic, polyhedral or angular/subangular blocky structure, occasional slickensides; few to many faint to prominent mottles; occasionally few to many manganiferous or calcareous segregations; field pH 6.0-9.0; sharp to gradual change to

**B3/ BC** Where present, grey, brown or yellow (10YR 4-7/1-6) sandy light to medium heavy clay; massive or weak to moderate prismatic or subangular blocky structure; few to many distinct mottles; few sandstone or quartz pebbles; field pH 6.0-8.5.

**C** Where present, massive, weak sandstone or siltstone; rarely few calcareous segregations.

**Sites:** LARA: 6, 9, 15, 25, 27, 34, 35, 46, 47, 48, 51, 53, 64, 69, 179, 299, 395, 396, 407, 408, 415, 424, 523, 547, 768, 785, 803, 2102, 2198, 3004, 3006; SEQ: 152.

**Distribution:** Throughout Marburg group geologies from Knapp Creek to Undullah, Mundoolun, Tabragalba and Canungra.

**LARAVALE (Lv)**

VERSION 1

**Concept:** Moderately deep to deep, brown, black or grey, neutral to strongly alkaline, texture contrast soils over sandstone and siltstone from 1.0 m. Subsoils are frequently mottled and subsoils may also be saline or sodic.

**Soil Classification:** **Brown or Grey Chromosol**, Black Chromosol.

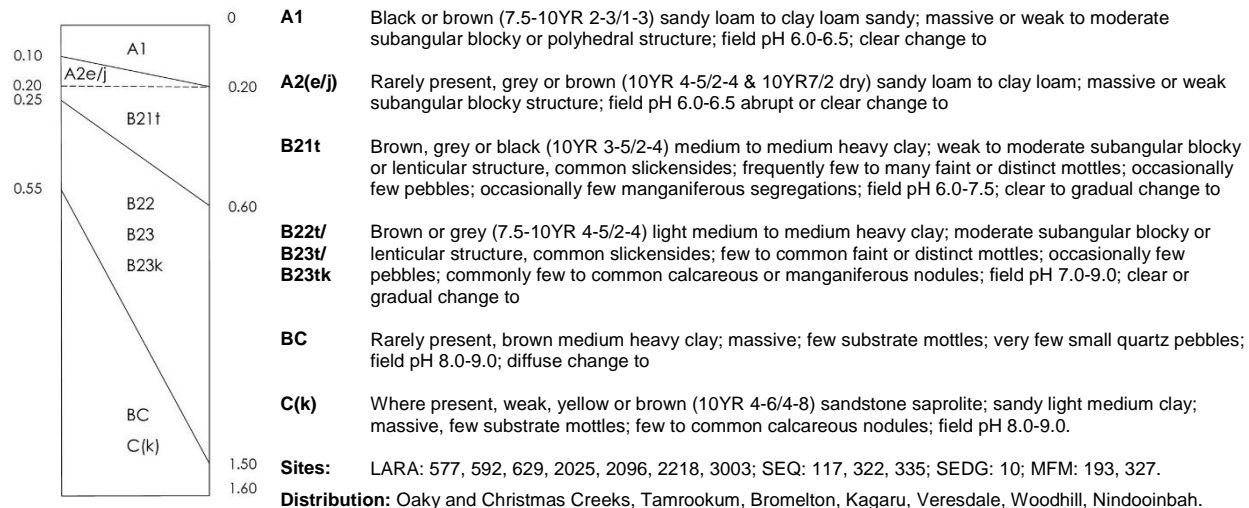
**Landform:** Mid and lower slopes and flats of undulating to rolling rises, low hills and terraces. Slope <20%.

**Geology:** Siltstones and sandstones of Walloon Coal Measures (Jw) and Beaudesert Beds (Te).

**Vegetation:** *Eucalyptus moluccana*, *E. siderophloia*, *Corymbia citriodora*, *C. intermedia*.

**Permeability/Drainage:** Slowly to moderately permeable / Imperfectly to moderately well drained.

**Surface features:** Hard setting or firm, occasional sheet erosion, occasionally very few-few sandstone pebbles or cobbles.

**LILLYDALE (Ld)**

VERSION 1

**Concept:** Moderately deep to very deep, grey, non-cracking, neutral to alkaline uniformly fine (rarely gradational) clay soils over sandstone and siltstone from 0.9 m. Subsoils are frequently mottled and neutral to strongly alkaline. Subsoils may also be occasionally calcic, saline or sodic.

**Soil Classification:** **Grey Dermosol**

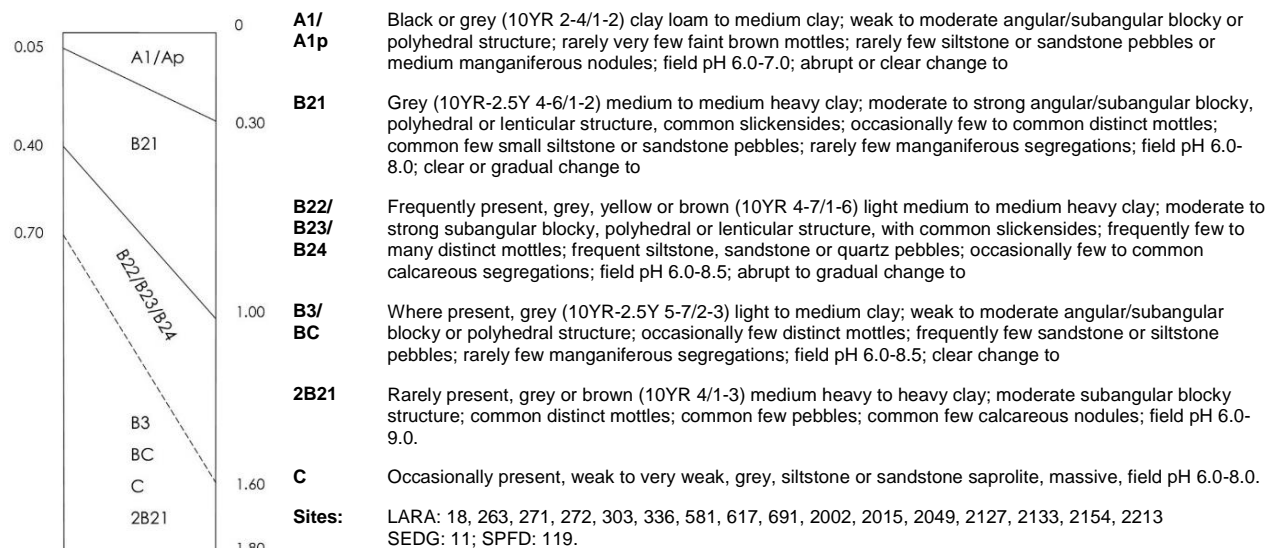
**Landform:** Slopes (occasionally crests) of undulating to rolling rises to hills. Slope 1-20%.

**Geology:** Siltstones and sandstones of Walloon Coal Measures (Jw).

**Vegetation:** *Eucalyptus tereticornis*, *E. moluccana*, *Corymbia citriodora*. Also *Araucaria cunninghamii*, *Ficus* spp. and *Casuarina cunninghamiana*.

**Permeability/Drainage:** Slowly to moderately permeable / Poorly to imperfectly drained.

**Surface features:** Firm or hard setting, no microrelief, occasionally sheet, rill or gully erosion, occasionally very few to common surface gravels of various origins.



## LILLYDALE ACIDIC PHASE (LdAp)

VERSION 1

### Concept:

Moderately deep to very deep, grey, non-cracking, bleached, strongly acidic, uniformly fine and gradational soils over sandstone and siltstone from 0.6 m. Subsoils are frequently mottled. Subsoils may also be saline.

### Soil Classification:

#### Grey Dermosol

### Landform:

Slopes (very rarely crests) of undulating to rolling rises to hills. Slope 1-15%.

### Geology:

Siltstones of Walloon Coal Measures (Jw).

### Vegetation:

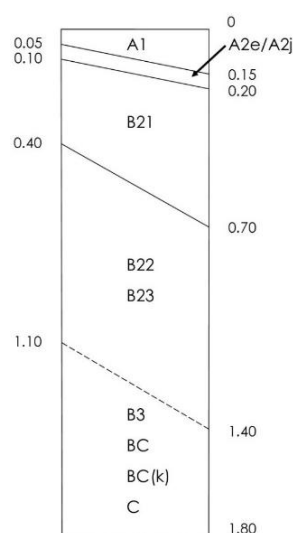
*Eucalyptus tereticornis*, *E. moluccana*, *E. crebra*, *Corymbia tessellaris*. Also *Casuarina cunninghamiana*.

### Permeability/Drainage:

Slowly to moderately permeable / Poorly to imperfectly drained.

### Surface features:

Hard setting, rare normal gilgai, occasionally sheet erosion, rarely few to common sandstone cobbles, very rare sandstone outcropping.



- A1** Grey or black (7.5-10YR 3-4/1-2) clay loam to light medium clay; weak to moderate cast, angular blocky or polyhedral structure; rarely few sandstone pebbles; field pH 5.5-6.0; sharp to clear change to
- A2e/ A2j** Very thin, grey (7.5-10YR 4-6/1-3 & 7.5-10YR7/1-2 dry) light to light medium clay; weak to moderate angular/subangular blocky or polyhedral structure; rarely few distinct mottles; rarely few siltstone pebbles; field pH 5.5-6.0; sharp or clear change to
- B21** Grey (10YR 4-6/1-2) medium to medium heavy clay; moderate to strong subangular blocky, polyhedral or lenticular structure, commonly few faint or distinct orange mottles; rarely few small gravels; rarely very few ferruginous nodules; field pH 5.0-6.0; abrupt to gradual change to
- B22/ B23** Where present, grey (10YR 4-6/2-3); medium to medium heavy clay; moderate to strong subangular blocky, polyhedral or lenticular structure, common slickensides; commonly few to many faint or distinct mottles; commonly few siltstone pebbles; rarely very few ferruginous nodules; field pH 5.0-5.5; clear to diffuse change to
- B3/ BC/ BC(k)** Where present, grey or brown (10YR-2.5Y 5-6/2-4) silty/sandy light to light medium clay; massive or weak to moderate lenticular or subangular blocky structure; occasionally common faint yellow mottles; frequently few to common siltstone pebbles; rarely few to many calcareous segregations; field pH 5.0-5.5.
- C** Occasionally present, weak to very weak, yellow or grey, siltstone saprolite, massive, field pH 4.5-5.0.

**Sites:** LARA: 28, 72, 274, 289, 365.

**Distribution:** Predominately in the Upper Logan River area but also at Kagaru.

## LINDESAY (Li)

VERSION 1

### Concept:

Deep to very deep, black (also brown or rarely grey) self-mulching, cracking clay soils over basalt from 1.2 m. Subsoils are neutral to strongly alkaline, very frequently calcic and may be mottled and/or saline.

### Soil Classification:

**Black Vertosol**, **Brown Vertosol**, **Grey Vertosol**.

### Landform:

Mid and lower slopes of rolling to steep low hills and hills. Slope 2-25%.

### Geology:

Albert basalt (Tfa).

### Vegetation:

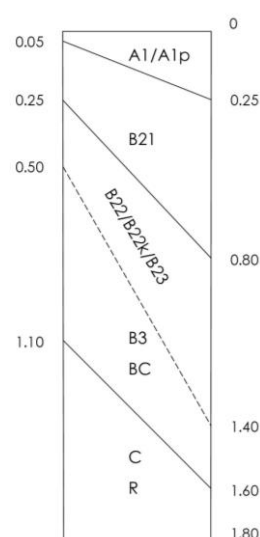
*Eucalyptus tereticornis*, *E. siderophloia*, *E. moluccana*, *E. crebra*, *Corymbia tessellaris*, *Araucaria cunninghamii*.

### Permeability/Drainage:

Slowly to moderately permeable / Imperfectly to moderately well drained.

### Surface features:

Self-mulching, cracking, occasional gilgai or erosion, occasionally basalt pebbles, cobbles or boulders.



- A1/ A1p** Black (7.5-10YR 2-3/1-2) light to medium heavy clay; moderate to strong polyhedral, angular/subangular blocky or lenticular structure, rare slickensides; rarely few basalt pebbles; field pH 6.0-7.0; abrupt to gradual change to
- B21** Black or brown, rarely grey (7.5-10YR 2-4/1-3) light medium to medium heavy clay; moderate to strong lenticular, polyhedral or angular/subangular blocky structure, often with slickensides; field pH 6.5-9.0; clear to gradual change to
- B22/ B22k B23** Black, brown or grey (7.5-10YR 3-4/2-4, 2.5Y5/1-2) light medium to medium heavy clay; moderate or strong lenticular structure often with faint to prominent slickensides; rarely fine distinct mottles; rarely few basalt pebbles; occasionally very few to many fine to medium calcareous or manganiferous segregations; field pH 7.0-9.0; clear to gradual change to
- B3/ BC** Where present, black or brown (7.5-10YR 3-4/2-4) light to medium heavy clay; weak to strong lenticular or angular/subangular blocky or prismatic structure, often with slickensides; few to many faint or distinct mottles; common basalt pebbles; few calcareous or manganiferous segregations; field pH 7.0-9.0.
- C/R** Where present, weak to strong basalt rock, massive.

**Sites:** LARA: 75, 128, 466, 648, 661, 669, 799, 2143, 2265, 3009, 3010; MFM: 80.

**Distribution:** Mt Lindsay, Mount Gipps, Screw Gully, Glenapp, Upper Running Creek, Innisplain, Chinghee Creek, Widgee Creek, Cryna, Canungra Creek and Tabragalba.

**LOCKROSE (Ls)**

VERSION 1

**Concept:**

Deep to very deep, black or grey (also brown) uniformly fine, non-cracking clay soil. Light clay to light medium clay over medium to medium heavy clay. Subsoils are neutral to alkaline and occasionally mottled, saline or calcareous.

**Soil Classification:**

**Black Dermosol, Grey Dermosol, Brown Dermosol.**

**Landform:**

Plains, terrace plains and terrace flats on flood plains and terraces.

**Geology:**

Quaternary alluvium (Qa, Qha/2).

**Vegetation:**

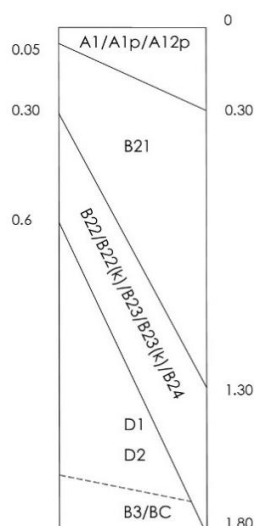
*Eucalyptus tereticornis*.

**Permeability/Drainage:**

Slowly to moderately permeable / Poorly to moderately well drained.

**Surface features:**

Firm to hard setting.



**A1/A1p/A12p** Black or grey (2.5YR 3/2, 10YR 2-4/1-2, 2.5Y3/1) light to light medium clay; weak to moderate angular/subangular blocky or granular structure or strong polyhedral structure; field pH 5.5-7.5; abrupt to gradual change to

**B21/B22(k)/B23(k)/B24** Black, grey or brown (7.5YR-10YR 2-6/1-4, 2.5Y5-6/1-4) light medium clay to medium heavy clay; moderate to strong prismatic, lenticular or angular/subangular blocky structure occasionally with distinct or prominent slickensides; frequently few to many fine to medium orange yellow or grey faint to distinct mottles; very few to few fine to medium calcareous and/or manganiferous segregations; field pH 6.0-8.5; clear, gradual or diffuse change to

**D1/D2** Where present, grey or brown (10YR 4/1-3) light clay to medium clay; moderate to strong lenticular or prismatic structure often with faint to prominent slickensides; occasionally few to common fine distinct orange mottles; frequently very few to few medium calcareous and or manganiferous nodules; field pH 8.0-8.5.

**B3/BC** Where present, grey (10YR 5/1) sandy light medium clay to medium clay; weak to moderate prismatic structure; common orange, red and pale fine to medium substrate mottles; occasionally few medium calcareous nodules; few to abundant weak sandstone coarse fragments; field pH 8.5.

**Sites:** LARA: 32, **145**, 148, 253, **306**, 308, 354, 486, **487**, 2168, 2169, 2202.  
SEQ: 101, 102, 114, 372, 403, 405.

**Distribution:** Sporadically spread along the Logan River and the mid Albert River.

**LOCKYER (Ly)**

VERSION 2

**Concept:**

Deep to very deep, black or brown, non-cracking gradational soils on mixed source alluvium. Clay loam or sandy clay loam surfaces over neutral to alkaline (often silty or sandy) clays. Occasionally faintly mottled, sodic or saline subsoils overly older horizons.

**Soil Classification:**

**Black or Brown Dermosol or Kandosol**

**Landform:**

Plains, terrace plains and levees on plains, flood plains and terraces.

**Geology:**

Quaternary alluvium (Qa).

**Vegetation:**

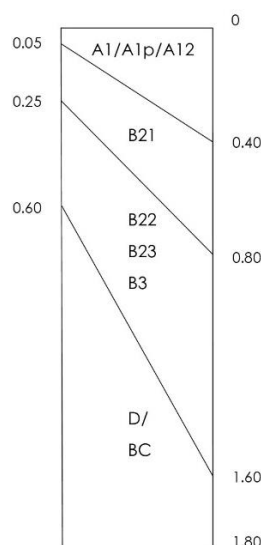
*Eucalyptus tereticornis*, *Grevillea robusta*, *Casuarina cunninghamiana*, *Ficus* spp.

**Permeability/Drainage:**

Slowly to moderately permeable / Moderately well drained.

**Surface features:**

Firm to hard setting, occasionally few basalt or quartz large pebbles or cobbles.



**A1/A1p/A12** Black or brown (10YR 2-4/1-3) sandy clay loam to light clay; weak to moderate angular/subangular blocky or polyhedral structure; rarely few coarse pebbles; field pH 6.0-7.5; abrupt to gradual change to

**B21** Black or brown (10YR 2-3/1-3, 3-5/3-4) light clay to medium heavy clay (often silty or sandy); weak to strong prismatic, polyhedral or angular/subangular blocky structure, rarely with slickensides; occasionally few orange or brown mottles; occasionally few fine gravels; field pH 6.0-8.0; clear to diffuse change to

**B22/B23/B3** Black, brown or grey (7.5-10YR 2-5/2-6) light to medium clay (frequently sandy or silty); massive or weak to moderate prismatic or angular/subangular blocky structure often with slickensides; field pH 6.5-8.5

**D/BC** Brown (10YR 3-5/3-4) sandy clay loam to sandy light medium clay; massive or moderate to strong angular blocky or prismatic structure; occasionally few faint orange mottles; rarely few to many medium calcareous or ferromanganiferous nodules; rarely few to many fine to medium pebbles; field pH 6.0-9.0.

**Sites:** LARA: **251**, 266, **267**, 353, **448**, **515**, 553, 721, 767, 788, **802**, 809, 2179, 2191, **2219**; MFM: 187; MISSE: 533.

**Distribution:** Logan River - Mount Barney, upper Running Creek, Innisplain, Sandy Creek at Josephville, Il-Bogan, Veresdale and Gleneagle. Albert River - Back Creek and Kerry Creek. Also at Chamber Flat and on Canungra Creek at Benobble.



## LOGAN (SEQ) (Lg)

VERSION 2

### Concept:

Deep to very deep, brown and black, neutral, uniformly medium to fine textured soils on alluvium. Subsoils are massive or weakly structured, rarely mottled and not gravelly. Buried alluvial horizons at depth.

### Soil Classification:

**Brown Kandosol**, Black Kandosol

### Landform:

Levees, plains and stream channels on alluvial and flood plains and terraces.

### Geology:

Quaternary alluvium (Qa, Qha/1, Qha/2).

### Vegetation:

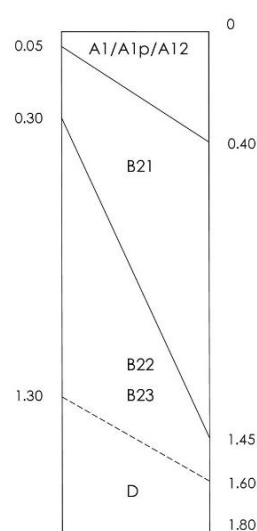
*Eucalyptus tereticornis*, *Grevillea robusta*, *Ficus* spp.

### Permeability/Drainage:

Moderately permeable / Moderately well drained or well drained.

### Surface features:

Soft to firm, no microrelief.



**A1(p)/A12** Black, brown or grey (7.5-10YR 2-4/1-4) sandy clay loam to light clay (often sandy or silty); massive or weak to moderate angular/subangular blocky structure; field pH 6.0-7.5; clear to gradual change to

**B21** Black or brown (7.5-10YR 2-3/1-4, 4-5/3-4) sandy clay loam to fine sandy light clay; massive or weak angular/subangular blocky or prismatic structure; rarely very few faint to distinct medium brown or orange mottles; rarely few medium manganiferous nodules; field pH 6.0-7.5; abrupt to gradual change to

**B22/B23** Where present, brown (7.5YR 4/3) silty/sandy light clay to sandy light medium clay; weak prismatic or angular/subangular blocky structure; occasionally common distinct medium or coarse mottles; frequently few fine to medium manganiferous or ferromanganiferous segregations; field pH 6.5-7.5; clear to gradual change to

**D** Black, brown or grey (10YR 2-5/2-6, 6/2) loamy sand to fine sandy light clay; massive, single grain or weak angular/subangular blocky structure; very rarely many coarse distinct mottles; field pH 6.5-7.0.

**Sites:** LARA: 44, 310, **387**, 388, 399, 400, **429**, 763, 766; SEQ: 123, 143 MFM: 182.

**Distribution:** On the Logan River west of Rathdowney; On the Logan river at Round Mountain and Il-Bogan; also on Sandy Creek at Josephville and Teviot Brook downstream of Woollaman Creek.

## LOWOOD (Lw)

VERSION 1

### Concept:

Moderately deep to very deep, bleached, mottled, acidic to neutral, grey, sodic texture contrast soils formed on sandstone (rarely siltstone). May be saline.

### Soil Classification:

**Grey Sodosol**, Grey Chromosol, Grey Kurosol.

### Landform:

Mid and lower slopes of undulating to rolling rises and low hills. Slope <20%.

### Geology:

Sandstones (rarely siltstones) of Koukandowie Formation (Jbmk) and Gatton Sandstones (Jbmg), also Woogaroo Subgroup (Rjbw).

### Vegetation:

*Eucalyptus siderophloia*, *E. tereticornis*, *E. moluccana*, *E. crebra*, *Corymbia tessellaris*, *C. citriodora*, *C. intermedia*, *Casuarina cunninghamiana*, *Araucaria cunninghamii*, *Grevillea robusta*, *Angophora subvelutina*, *Acacia* spp.

### Permeability/Drainage:

Very slowly to slowly permeable / Poorly to imperfectly drained.

### Surface features:

Hard setting or firm, occasional sandstone cobbles to boulders or sandstone outcropping; frequent sheet, rill or gully erosion.



**A1** Black, brown or grey (7.5-10YR 2-5/1-4) loamy sand to clay loam; massive, single grained or weak to moderate angular/subangular blocky or granular structure; rarely few quartz pebbles; rarely few mottles or manganiferous segregations; field pH 5.5-6.5; sharp to gradual change to

**A2e/A2j/A2** Frequently bleached, grey, brown or yellow (7.5-10YR 3-7/1-6 & 7.5-10YR6-8/1-3 dry) loamy sand to clay loam; massive, single grained or weak to moderate angular/subangular blocky or granular structure; occasionally few to common faint or distinct mottles; occasionally few to many quartz pebbles; rarely few to common manganiferous segregations; field pH 5.0-7.5; sharp, abrupt or clear change to

**B21t/B22t/B23t** Grey or brown (10YR-5Y 4-7/1-3) sandy light clay to medium heavy clay; massive or weak to strong prismatic, angular/subangular blocky, polyhedral or lenticular structure; common to many distinct mottles; occasionally few sandstone or quartz (rarely siltstone) pebbles; rarely few manganiferous nodules; field pH 5.0-7.5; clear, gradual or diffuse change to

**B3/BC** Where present, grey, brown or yellow (10YR-5Y 5-7/1-8) sandy clay loam to sandy medium heavy clay; massive or weak to moderate structure; many distinct mottles or substrate mottles; frequent sandstone coarse fragments; field pH 4.5-7.5.

**C** Where present, grey, brown or yellow, massive sandstone or siltstone weathering in situ.

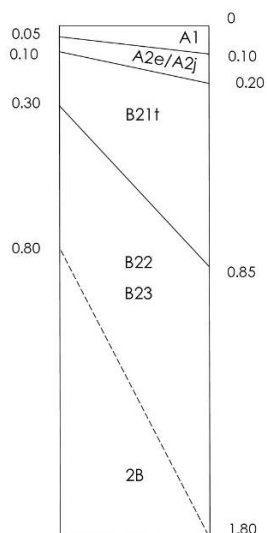
**Sites:** LARA: 7, 8, 24, 26, 52, 62, 63, 66, 76, 91, 92, 97, 159, 164, 300, 357, 371, 405, 409, 413, 418, 529, 549, 556, 557, 749, 2195, 2210, 2237, 2238, 2246, 2262, 3008; SEQ: 58, 59, 62, 63, 72, 73, 74, 77, 109, 111, 126, 141, 142, 151, 153, 154, 155, 156, 159, 163, 164, 166, 213, 214, 218, 219, 222, 233, 234, 235, 244, 336, 339, 341, 373, 375, 387, 389, 391, 418.

**Distribution:** Throughout the above geologies from Palen Creek to Maclean and Boyland.

## MACLEAN (Ma)

VERSION 1

<b>Concept:</b>	Deep to very deep, bleached, acidic, grey texture contrast soils formed on alluvium. Grey or black sandy and clayey loams over frequently mottled and vertic grey clays.
<b>Soil Classification:</b>	<b>Grey Kurosol</b> , Grey Chromosol.
<b>Landform:</b>	Plains and terrace flats on Alluvial plains and terraces.
<b>Geology:</b>	Quaternary alluvium (Qa, Qpa/1).
<b>Vegetation:</b>	<i>Eucalyptus siderophloia</i> , <i>Melaleuca</i> spp.
<b>Permeability/Drainage:</b>	Slowly to moderately permeable / Poorly to moderately well drained.
<b>Surface features:</b>	Firm to hard setting, no microrelief.



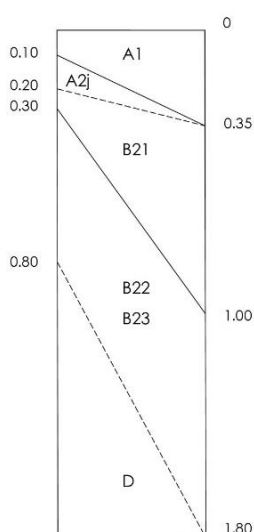
<b>A1</b>	Grey or black (10YR 4/1-2, 2.5Y3/1) sandy loam to clay loam; weak angular blocky or granular structure; field pH 5.5-6.0; clear change to
<b>A2e/A2j</b>	Grey (10YR 5-6/2 & 10YR7-8/1 dry); sandy loam to clay loam; massive or weak angular blocky structure; rarely few distinct mottles; field pH 4.5-6.5
<b>B21t</b>	Grey (10YR 5-6/1-2, 2.5Y5/2) medium clay to medium heavy clay (may be fine sandy); moderate angular/subangular blocky to strong lenticular structure; frequently common to many medium distinct mottles; field pH 4.5-7.0; gradual change to
<b>B22t/B23t</b>	Grey (10YR 5-6/1-2, 5Y6/2) light medium clay to medium heavy clay (may be fine sandy); massive or moderate angular/subangular blocky to lenticular structure; frequently few to common medium to coarse distinct mottles; field pH 4.0-5.5.
<b>2B</b>	Where present, grey (2.5Y 6/2) sandy clay loam; massive; field pH 5.0-5.5.
<b>Sites:</b>	SEQ: 66, 69, <b>84</b> , 240.

**Distribution:** Isolated occurrences in Gatton Sandstone dominated alluvium at Jimboomba.

## MAROON (Mr)

VERSION 1

<b>Concept:</b>	Deep to very deep, uniformly fine, grey and brown, non-cracking clay soils formed on alluvium. Black, brown and grey light to light medium clays overlying brown, grey and yellow medium to medium heavy clays. Subsoils are acidic, mottled and frequently sodic and saline.
<b>Soil Classification:</b>	<b>Grey Dermosol</b> , Brown Dermosol.
<b>Landform:</b>	Plains, terrace plains and valley flats on plains and terraces.
<b>Geology:</b>	Quaternary alluvium (Qa).
<b>Vegetation:</b>	<i>Eucalyptus tereticornis</i> , <i>Corymbia tessellaris</i> .
<b>Permeability/Drainage:</b>	Slowly to moderately permeable / Imperfectly drained.
<b>Surface features:</b>	Firm to hard setting, no microrelief.



<b>A1</b>	Black, brown or grey (10YR 3-4/2) light to light medium clay; massive or moderate angular/subangular blocky structure; occasionally very few to few medium manganiferous segregations; field pH 5.0-7.0; gradual change to
<b>A2j</b>	Rarely present, Grey (10YR 6/2) silty light clay; moderate angular blocky structure; field pH 5.0.
<b>B21</b>	Grey or brown (10YR 4-6/1-3) medium to medium heavy clay; moderate angular/subangular blocky, prismatic or lenticular structure occasionally with distinct slickensides; few to many distinct fine to medium orange and/or red mottles; occasionally very few fine to medium manganiferous nodules; rarely very slightly fine gravelly; field pH 4.0-5.5; clear to gradual change to
<b>B22/B23</b>	Grey or yellow (10YR 5/1-2, 6/6) medium to medium heavy clay; massive or moderate angular blocky or prismatic structure occasionally with faint slickensides; commonly few to common fine distinct orange or pale mottles; field pH 4.0-5.5.
<b>D1/D2</b>	Where present, brown (10YR 4-5/4-6) fine sandy light to light medium clay; massive; common to many medium distinct orange and pale mottles; few to common medium manganiferous segregations; field pH 5.5-6.5.

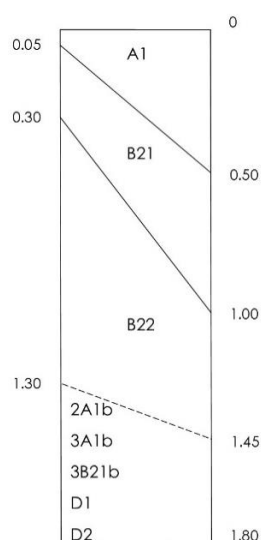
**Sites:** LARA: 141, **150**, 153, **789**.

**Distribution:** Isolated occurrences in Triassic/Jurassic sediment dominated alluvium at Undullah/Flagstone, Chambers Flat and Mundoolun.

**MONSILDALE (Mn)**

VERSION 3

<b>Concept:</b>	Deep to very deep, neutral black or brown gradational soils on alluvium. Black clay loams over black and brown clays. Subsoils are neutral, weakly to moderately structured clays over buried horizons.
<b>Soil Classification:</b>	<b>Black Dermosol</b> , Brown Dermosol.
<b>Landform:</b>	Plains on flood plains.
<b>Lithology and geology:</b>	Quaternary alluvium (Qa).
<b>Vegetation:</b>	<i>Eucalyptus tereticornis</i> <i>Casuarina cunninghamiana</i> , <i>Lophostemon confertus</i> also <i>Araucaria cunninghamii</i> and <i>Angophora subvelutina</i> .
<b>Permeability/Drainage:</b>	Slowly permeable / Moderately well drained.
<b>Surface features:</b>	Firm, no microrelief.



- A1** Black (10YR 2-3/1-2) silty loam to clay loam, silty or sandy; moderate angular/subangular blocky or polyhedral structure; field pH 6.0; clear change to
- B21** Black or brown (10YR 2-3/1-4) light to medium clay, silty or sandy; moderate angular/subangular blocky or prismatic structure; frequently faint orange or brown mottles; field pH 6.0-7.0; clear change to
- B22** Where present, black or brown (10YR 2/1, 3/4) light medium to medium clay, silty or sandy; massive or moderate prismatic structure or lenticular structure with faint slickensides; often few faint dark mottles; field pH 6.5-7.0; abrupt or clear change to
- 2A1b/3A1b/3B21b/D1/D2** Black or brown (7.5-10YR 2-3/2-4) sandy clay loam to silty/sandy light medium clay, massive or weak to moderate prismatic or subangular/angular blocky; rarely few faint mottles; rarely few manganiferous segregations; rarely few fine to medium pebbles; field pH 6.5-7.5.

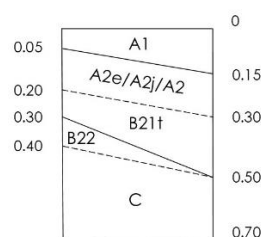
**Sites:** LARA: 280, 367, 432, 740, 2011.

**Distribution:** Small isolated occurrences. Upper Logan River at Mount Ernest; Upper Palen Creek near Mount Lindesay; Back Creek; Logan River west of Rathdowney; Mid Cainbale Creek.

**MUNDOOLUN (Mu)**

VERSION 1

<b>Concept:</b>	Shallow, slightly acidic brown or grey texture contrast to gradational soils on sandstone. Soils are frequently bleached and/or mottled and may also be saline.
<b>Soil Classification:</b>	<b>Brown or Grey Chromosol</b> , Brown Kandosol, Brown Dermosol.
<b>Landform:</b>	Slopes of undulating rises to steep hills. Slope 4-25%.
<b>Lithology and geology:</b>	Sandstones of Koukandowie formation (Jbmk) and Gatton sandstone (Jbmj).
<b>Vegetation:</b>	<i>Corymbia citriodora</i> , <i>Eucalyptus melanophloia</i> , <i>E. tereticornis</i> , <i>E. siderophloia</i> , <i>E. crebra</i> , <i>E. moluccana</i> .
<b>Permeability/Drainage:</b>	Slowly to moderately permeable / Imperfectly drained to well drained.
<b>Surface features:</b>	Hard setting or firm, no microrelief, occasional sheet or gully erosion, very few to many sandstone cobbles to boulders.



- A1** Black or grey (10YR 2-5/1-2) loamy sandy to clay loam (rarely light clay); massive or weak to moderate polyhedral structure; field pH 5.5-6.5; abrupt to gradual change to
- A2e/A2j/A2** Frequently present, grey or brown (10YR 4-6/2-3 & 10YR 7-8/1-2 dry) loamy sand to sandy clay loam; massive or weak to moderate angular/subangular blocky structure; commonly few medium to large pebbles; field pH 5.5-6.0; abrupt to clear change to
- B21t** Brown or grey (7.5YR-2.5Y 4-5/2-6, 6/3) sandy clay loam to sandy medium clay; massive or weak to moderate angular/subangular blocky or strong prismatic structure; frequent distinct red or orange mottles; occasionally few sandstone or quartz pebbles; field pH 5.5-6.0; clear to diffuse change to
- B22t/B3** Where present, brown or grey (7.5YR-2.5Y 5/2-6) sandy clay loam to medium clay; moderate to strong angular blocky or prismatic structure; frequent few distinct orange, pale or grey mottles; rarely few sandstone pebbles; field pH 5.5-7.0; clear to gradual change to
- C** Massive sandstone, weathering in situ.

**Sites:** LARA: 136, 137, 140, 146, 161, 163, 166, 170, 176, 211, 215, 522, 2020, 2205; SEQ: 220.

**Distribution:** From Rathdowney in the south to Undullah, Jimboomba and Mundoolun in the north.

**NERANLEIGH (Nr)**

VERSION 1

**Concept:**

Moderately deep to deep, acidic to neutral, red and brown gradational or uniformly fine soils over greenstone, mudstone, chert, arenite, conglomerate or sandstone. Soils are occasionally bleached and/or mottled.

**Soil Classification:**

**Brown or Red Dermosol**, Yellow Dermosol.

**Landform:**

Lower, mid and upper slopes (rarely crests or ridges) of rolling and steep low hills and hills. Slope 10% to >>30%.

**Geology:**

Greenstone, mudstone, chert, arenite/sandstone and basalt of Neranleigh-Fernvale beds (DCf, DCf/g, DCf/mc, DCf/c).

**Vegetation:**

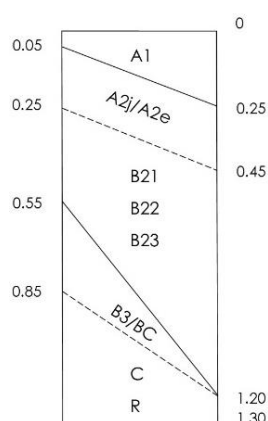
*Corymbia intermedia*, *C. citriodora*, *C. also C. tessellaris*, *Eucalyptus tereticornis*, *E. moluccana* and *Acacia* spp.

**Permeability/Drainage:**

Moderately permeable / Moderately well drained.

**Surface features:**

Firm, no microrelief, frequently few greenstone, chert, mudstone or basalt pebbles to cobbles, occasional greenstone or chert outcropping, frequent sheet or rill erosion.



- A1** Brown, black or grey (10YR 2-5/2-4) clay loam to medium clay; weak to strong angular/subangular blocky structure; occasionally few greenstone or basalt pebbles; field pH 5.5-7.0; clear change to
- A2j/A2e** Occasionally present, brown or grey (10YR 6/3 & 10YR 7/2 dry) sandy clay loam to light clay; massive or weak to strong angular/subangular blocky structure; common few pebbles; field pH 5.0 to 6.5, abrupt or clear change to
- B21** Brown, red or yellow (2.5-10YR 4-6/3-6) light to medium clay; moderate to strong angular/subangular blocky or prismatic structure; rare pale or distinct mottles; common few pebbles, field pH 5.0-7.0; clear to gradual change to
- B22/B23** Where present, brown, red or grey (5-10YR 5/3-6, 6-7/2-4) light to medium heavy clay; moderate angular/subangular blocky structure; few to common mottles; few to common pebbles; field pH 5.5-7.0; clear or gradual change to
- B3/BC** Where present, brown, grey or yellow (2.5-10YR 3-6/2-4) light medium to medium heavy clay; weak to strong angular blocky structure; common to many distinct mottles; common to abundant pebbles; field pH 5.0-7.0; abrupt or clear change to
- C/R** Moderate to very weak, massive, greenstone, mudstone, sandstone or basalt.

**Sites:** LARA: 222, 223, 226, 227, 228, 229, 237, 240, 794, 795, 797, 798, 808, 2257.

**Distribution:** Located in the north-east portion of the survey area.

**Neranleigh Shallow Phase (NrSp)** – As above, uniformly medium textured Black Dermosol with strongly acidic black B21 and a soil depth <0.5m.

Sites – LARA: 805, 806.

**NINDOOINBAH (Ni)**

VERSION 1

**Concept:**

Moderately deep, red or brown, neutral to strongly alkaline gradational and uniformly fine soils with a dark surface horizon underlain by frequently mottled brown, yellow or grey subsoils over sandstone or siltstone from 0.5 m.

**Soil Classification:**

**Red or Brown Dermosol**

**Landform:**

Slopes (rarely crests or ridges) of undulating to rolling rises to hills. Slopes <20%.

**Geology:**

Siltstones and sandstones of Walloon Coal Measures (Jw) and Beaudesert Beds (Te).

**Vegetation:**

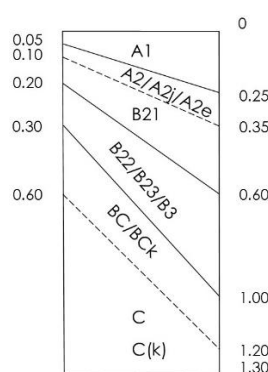
*Eucalyptus moluccana*, *E. tereticornis*, *E. siderophloia*, *E. crebra*, *Corymbia tessellaris*, *C. citriodora*.

**Permeability/Drainage:**

Slowly to moderately permeable / Imperfectly to moderately well drained.

**Surface features:**

Firm or hard setting some periodic cracking, no microrelief, occasionally few to many sandstone (rarely siltstone or basalt) pebbles to cobbles, frequent sheet or rill erosion, very rare sandstone outcropping.



- A1** Black or brown (5-10YR2-3/1-4) clay loam to light medium clay; massive or weak to strong angular/ subangular blocky or polyhedral structure; very rarely few sandstone or siltstone pebbles; field pH 5.5-6.5; clear change to
- A2(e/f)** Very rarely present, black, brown or grey (7.5-10YR 3-5/2-3 & 10YR 7/2 dry) light to medium clay; massive or weak to moderate polyhedral structure; field pH 6.0; clear change to
- B21** Red or brown (2.5-10YR 3-5/3-8) medium to heavy clay; moderate to strong polyhedral, angular/subangular blocky or lenticular structure, occasional slickensides; frequently few to common faint or distinct grey, orange or red mottles; rarely very few pebbles; field pH 6.0-8.5; clear to gradual change to
- B22/B23/B3** Brown, yellow or grey (7.5YR-2.5Y 5-6/2-6) medium to heavy clay; massive or weak to moderate subangular blocky, polyhedral or lenticular structure, occasional slickensides; commonly few to common distinct mottles; rarely few pebbles; occasionally few to common manganiferous, ferromanganiferous or calcareous segregations; field pH 6.0-8.5; clear to diffuse change to
- BC(k)** Occasionally present, grey (10YR-2.5Y 4/2, 6/3) light to medium clay; massive or weakly structured; occasionally mottled; frequently few to common pebbles or calcareous segregations; field pH 6.0-8.5; clear to diffuse change to
- C(k)** Frequently present, weak to very weak, massive, grey or yellow siltstone/sandstone saprolite, frequently common calcareous segregations, field pH 6.0-9.0.

**Sites:** LARA: 21, 114, 291, 337, 338, 580, 582, 586, 739, 758, 784, 2000, 2081, 2082, 2085, 2086, 2094, 2097, 2099, 2100, 2151, 2162, 2172, 2190, 2192, 2193, 2203, 2204; SEQ: 120.

**Distribution:** Upper Logan/Barney View, Oaky Creek, Josephville, Bromelton, Kagaru, Woodhill, Kerry/Kerry Creek, Nindooindah, Tabragalba, Beaudesert.

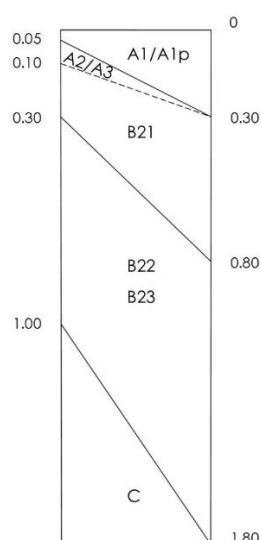
**Nindooindah Acidic Phase (NiAp)** – As above, moderately deep to very deep with B21 & below having a pH ≤ 5.5 & no calcareous segregations.

Sites - LARA: 70, 118, 250, 332, 339, 2211, 2212; SEDG: 5; SEQ: 136; MFM: 329.

## NINDOOINBAH DEEP PHASE (NiDp)

VERSION 1

<b>Concept:</b>	Deep to very deep, red or brown, neutral to strongly alkaline non-cracking uniformly fine (rarely gradational) soils with a dark surface horizon underlain by frequently mottled brown, yellow or grey subsoils over sandstone or siltstone from 1.0 m.
<b>Soil Classification:</b>	<b>Red or Brown Dermosol</b>
<b>Landform:</b>	Slopes (rarely crests) of undulating to rolling rises to hills. Slopes <25%.
<b>Geology:</b>	Siltstones (rarely sandstones) of Walloon Coal Measures (Jw) and Beaudesert Beds (Te).
<b>Vegetation:</b>	<i>Eucalyptus moluccana</i> , <i>E. siderophloia</i> , <i>Corymbia citriodora</i> , also <i>Acacia</i> spp.
<b>Permeability/Drainage:</b>	Moderately permeable / Imperfectly to moderately well drained.
<b>Surface features:</b>	Firm or hard setting, no microrelief, occasionally very few sandstone or siltstone pebbles to cobbles, occasional sheet, or rill or gully erosion, rare sandstone outcropping.



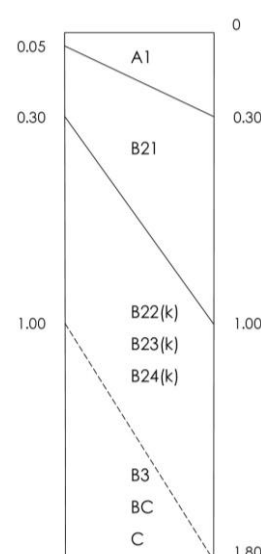
<b>A1(p)</b>	Black or brown (rarely grey) (7.5-10YR 2-4/1-4) light to medium clay (often silty); massive or weak to strong angular/subangular blocky or polyhedral structure; rarely few siltstone pebbles; field pH 5.5-6.5; clear change to
<b>A2/A3</b>	Occasionally present, brown or grey (7.5-10YR 3/3, 2-4/2-4) clay loam to light medium clay; massive or moderate to strong subangular blocky or polyhedral structure; occasionally few faint mottles; field pH 5.5-6.5; clear to diffuse change to
<b>B21</b>	Red or brown (2.5-10YR 3-5/3-6) medium to medium heavy clay; moderate to strong angular/subangular blocky, lenticular or polyhedral structure, rare slickensides; frequently few to common distinct red or grey mottles; rarely few pebbles or manganiferous nodules; field pH 6.0-8.0; clear to diffuse change to
<b>B22/B23</b>	Grey, yellow or brown (2.5YR-2.5Y 3-7/1-6) light to heavy clay; moderate to strong angular/subangular blocky, lenticular or polyhedral structure, rare slickensides; frequently few to many faint to prominent red, orange or grey mottles; rarely few sandstone or siltstone pebbles; rarely few calcareous or manganiferous nodules; field pH 6.0-8.5; clear to gradual change to
<b>C</b>	Occasionally present, weak to very weak, massive, siltstone or sandstone saprolite.
<b>Sites:</b>	LARA: 17, 22, <b>30, 290</b> , 293, 331, 2098, 2101, 2126, 2189; SEQ: 132, 303; SEDG: 6, 7, 8, 13.

**Distribution:** Distributed throughout the above geologies.

## PALEN (Pa)

VERSION 1

<b>Concept:</b>	Deep to very deep, black, cracking clays on basalt and basalt colluvium. Subsoils are neutral to strongly alkaline, calcic, slightly gravelly and may have salinity at depth.
<b>Soil Classification:</b>	<b>Black Vertosol, Brown Vertosol, Black Dermosol.</b>
<b>Landform:</b>	Lower slopes, fans, foot slopes and benches of rolling to steep low hills and hills. Slopes <20%.
<b>Geology:</b>	Albert basalt (Tfa) and Tertiary/Quaternary basalt colluvium (TQr/Qr/TQcb).
<b>Vegetation:</b>	<i>Eucalyptus tereticornis</i> , <i>E. siderophloia</i> , <i>E. melliodora</i> , <i>E. moluccana</i> , <i>Corymbia tessellaris</i> , <i>Araucaria cunninghamii</i> , <i>Angophora floribunda</i> , <i>A. subvelutina</i> , <i>Grevillea robusta</i> .
<b>Permeability/Drainage:</b>	Moderately permeable / Moderately well drained.
<b>Surface features:</b>	Firm to hard setting with periodic cracking, rare gilgai, occasional basalt pebbles to stones, occasional sheet, rill or gully erosion.



<b>A1</b>	Black (2.5-10YR 2-3/1-2) light to medium heavy clay (often silty); moderate to strong polyhedral or angular/subangular blocky structure; occasionally few fine basalt pebbles; field pH 6.0-7.5; sharp to gradual change to
<b>B21</b>	Black, rarely brown (7.5-10YR 2-3/1-3) light to heavy clay (often silty); moderate to strong lenticular, polyhedral or subangular blocky structure, with slickensides; occasionally few basalt pebbles; occasionally few medium calcareous or manganiferous nodules; field pH 6.0-9.0; clear to diffuse change to
<b>B22(k)/B23(k)/B24(k)</b>	Black, brown or grey (2.5-10YR 2-4/1-4) medium to medium heavy clay; moderate to strong lenticular, prismatic, polyhedral or subangular blocky structure, with slickensides; frequently few basalt pebbles; few to many medium to coarse calcareous and/or manganiferous segregations; field pH 6.5-9.0; clear to diffuse change to
<b>B3/BC</b>	Where present, black or brown (7.5-10YR 3/2-4, 4/6, 2.5Y3/2) light to medium clay; moderate to strong lenticular, polyhedral or subangular blocky structure, with slickensides; few to many basalt pebbles; few medium calcareous and manganiferous nodules; field pH 8.5-9.0; clear change to
<b>C</b>	Where present, weak to strong basalt rock, massive.
<b>Sites:</b>	LARA: 58, 350, <b>360, 364, 368, 435, 441, 450, 458, 461, 467, 471, 482, 484, 495, 496, 499, 500, 647, 649, 653, 656, 660, 671, 673, 681, 684, 694, 702, 703, 704, 726, 733, 755, 2017, 2037, 2038, 2060, 2072, 2139, 2141, 2175, 2182, 2184, 2187, 2264, 2268.</b>

**Distribution:** Located throughout basalt areas of the Logan and Albert Rivers and their tributaries.

**PAYNE (Pn)**

VERSION 1

**Concept:**

Deep to very deep, brown and grey, acidic to neutral cracking clays on sedimentary alluvium. Light to medium heavy clays over brown and grey medium to heavy clays. Subsoils are acidic to neutral, mottled and often sodic.

**Soil Classification:**

**Brown Vertosol**, Grey Vertosol.

**Landform:**

Plains and terrace plains on plains and terraces.

**Geology:**

Quaternary alluvium (Qa, Qha/2, Qpa/1).

**Vegetation:**

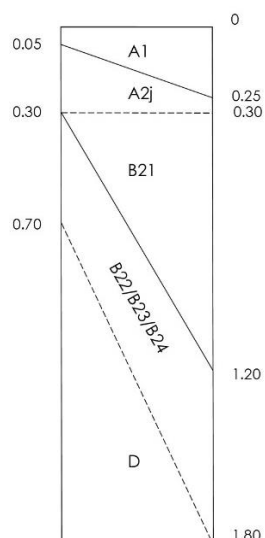
*Eucalyptus tereticornis*, *E. moluccana*.

**Permeability/Drainage:**

Slowly to moderately permeable / Poorly to moderately well drained.

**Surface features:**

Frequently self-mulching, also firm or hard setting. Gilgai common.



- A1** Black or brown (10YR 3/2-3, 5/3) light to medium heavy clay; moderate to strong granular or angular/subangular blocky structure; occasionally very few to many fine faint to distinct mottles; rarely few medium manganiferous nodules; field pH 5.5-6.5; clear change to
- A2j** Rarely present, grey (10YR 5/2 & 10YR 7/1 dry) light clay; moderate angular blocky structure; many fine distinct mottles; few medium manganiferous segregations; field pH 5.5-6.0; clear change to
- B21** Brown or grey (10YR 4-5/2-4, 4/6, 2.5Y5/3) medium to heavy clay; moderate to strong subangular blocky or polyhedral grading to lenticular structure often with slickensides; very frequently common to many medium to coarse distinct mottles; frequently few medium manganiferous segregations; field pH 4.5-7.0; gradual change to
- B22/B23/B24** Grey or brown (10YR 4-5/2-6, 2.5Y5-6/1-4) medium to heavy clay; moderate to strong lenticular structure frequently with slickensides; common to many medium faint to distinct mottles; frequently few to common manganiferous segregations; field pH 4.5-7.0; clear to gradual change to
- D** Where present, brown (10YR 4/3) light medium clay; strong prismatic structure; many coarse manganiferous segregations; field pH 4.5-6.5.

**Sites:** LARA: 45, 3002; SEQ: 96, 97, 127, 161, 172, 188, 325; MFM: 184, 189.

**Distribution:** Scattered along the Logan River from Round Mountain to South Maclean.

**PHILP (Pp)**

VERSION 1

**Concept:**

Moderately deep to deep, brown, black or red, strongly acidic to neutral non-cracking clays on rhyolite.

**Soil Classification:**

**Brown Dermosol**, Black Dermosol, Red Dermosol.

**Landform:**

Slopes of rolling to steep low hills, hills and mountains. Slope 5 to >30%.

**Geology:**

Mount Gillies Rhyolite (Tfg/re, Tfg/ri, Tfg); Mount Barney central complex (Tbsr); Rhyolite intrusions; (Tir); Chinghee conglomerate (Tfg/c); Chillingham Volcanics (Rch, Rch/b, Rch/r).

**Vegetation:**

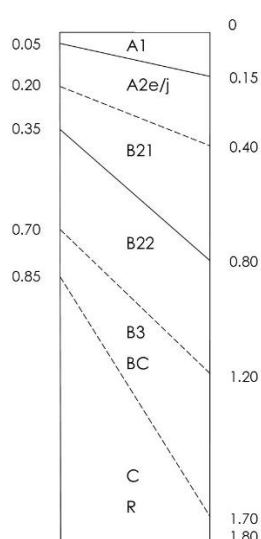
*Eucalyptus tereticornis*, *E. moluccana*, *E. microcorys*, *Angophora* spp., *Allocasuarina torulosa*, *Pteridium esculentum*.

**Permeability/Drainage:**

Moderately permeable / Moderately well to well drained.

**Surface features:**

Firm to hard setting, no microrelief, frequent sheet erosion, frequent cobbles to boulders.



- A1** Black (7.5-10YR 2-3/1-2) clay loam to light medium clay; moderate to strong polyhedral or subangular blocky structure; occasionally few rhyolite pebbles; field pH 5.5-7.5; abrupt or clear change to
- A2e/j** Occasionally present, brown or grey (10YR 3/3, 4/1 & 10YR 7/1-2 dry) clay loam to light medium clay; massive or moderate to strong subangular blocky structure; few small to medium rhyolite or quartz pebbles; field pH 5.0-6.0; abrupt or clear change to
- B21** Brown, black or red (2.5-10YR 2-3/2, 3-4/3-6) clay loam to medium heavy clay; moderate to strong subangular blocky or polyhedral structure, often with slickensides; rarely few faint or distinct mottles; frequently few to common rhyolite, basalt or quartz pebbles; field pH 4.5-7.0; abrupt, clear or gradual change to
- B22** Where present, brown or grey (2.5-10YR 3/6, 5/2, 4/8) medium to medium heavy clay; occasionally few distinct mottles; rarely few rhyolite pebbles; strong polyhedral or weak to moderate angular blocky or lenticular structure, with rare slickensides; field pH 4.5-7.0; clear change to
- B3/BC** Where present, brown, red or grey (2.5-10YR 3/4-6, 7/1) light clay to medium clay; massive or weak or moderate subangular blocky structure; common medium pebbles; rarely few manganiferous segregations; field pH 4.5-7.5.
- C/R** Where present, yellow/white, light to medium clay, often sandy. Weak to very weak or strong, massive, rhyolite.

**Sites:** LARA: 110, 111, 232, 292, 307, 438, 439, 668, 688, 741, 2084; MFM: 81.

**Distribution:** Mt Maroon; Upper Running Creek; Darlington; Cainbale; Tamborine/Cedar Creek.

**PINE VALE (Pv)**

VERSION 1

**Concept:**

Moderately deep to deep, grey, strongly acidic to neutral, bleached, mottled texture contrast soils on sandstone or siltstone. May be saline.

**Soil Classification:**

**Grey Chromosol**, Grey Kurosol.

**Landform:**

Slopes of undulating to rolling rises and low hills. Slope <20%.

**Geology:**

Sandstones and siltstones of Koukandowie formation (Jbmk) and Gatton Sandstone (Jbmg).

**Vegetation:**

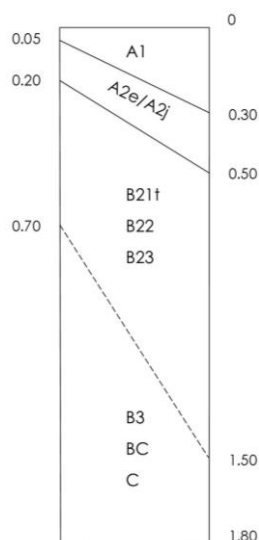
*Eucalyptus moluccana*, *E. crebra*, *E. tereticornis*, *E. siderophloia*, *Corymbia citriodora*, *C. tessellaris*, *Acacia* spp.

**Permeability/Drainage:**

Slowly to moderately permeable / Imperfectly drained.

**Surface features:**

Firm or hard setting, no gilgai, occasional sheet erosion, rare sandstone or quartz cobbles, stones or outcrops.



**A1** Grey or black (7.5-10YR 2-5/1-2) loamy sand to sandy clay loam; massive or weak to moderate angular/subangular structure; very rarely very few distinct orange mottles or quartz pebbles; field pH 4.5-6.5; clear or gradual change to

**A2e/ A2j** Grey or brown (7.5-10YR 2.5Y 4-6/1-4 & 7.5-10YR 7-8/1-3 dry) loamy sand to sandy clay loam; massive or weak to moderate angular/subangular structure; rarely few distinct mottles; rarely few quartz pebbles; occasionally few to common manganiferous segregations; field pH 4.5-6.5; abrupt or clear change to

**B21t/ B22t/ B23t** Grey (10YR-5Y 4-5/1-2, 6-7/1-3) sandy light to medium heavy clay; massive or strong prismatic structure or weak to moderate lenticular or angular/subangular blocky structure; common to many distinct orange or red mottles; rarely few quartz pebbles; occasionally few to common manganiferous segregations; field pH 4.0-7.0; clear to gradual change to

**B3/ BC** Occasionally present, grey or brown (7.5-10YR 5/2-6, 6-7/2) sandy clay loam to medium clay; massive or weak angular blocky structure; occasionally few substrate mottles or coarse fragments; field pH 4.5-7.0; abrupt change to

**C** Where present, weak, massive sandstone or siltstone.

**Sites:** LARA: 147, 151-2, 155, 158, 160, **162**, **165**, 167, 174, **178**, 180-3, 189, 193, **194**, 362, 372, 420, **511**, 2241, 2243, 2248, 2253, 2259; SEQ: 64-5, 165, 185, 202, 205, 206, 208, 211, 216-7, 237-8, 266, 243, 404, 408; MFM: 325.

**Distribution:** Back & Palen Creeks, Biddaddaba, Tabragalba, Undullah, Flagstone, Cedar Grove, Jimboomba, Maclean, Perry, Mundoolun, Collins Creek. Also an isolated occurrence at Rathdowney.

**RATHDOWNEY (Ra)**

VERSION 1

**Concept:**

Moderately deep to deep, red, acidic to neutral, frequently bleached texture contrast soils (also gradational to uniformly fine soils) over sandstone or siltstone from 0.6 m. Occasionally mottled and/or sodic.

**Soil Classification:**

**Red Chromosol**, Red Sodosol, Red Dermosol.

**Landform:**

Crests, ridges, upper slopes and steeper mid slopes of rolling to steep rises, low hills and hills. Slope up to >30%.

**Geology:**

Sandstones and siltstones of Koukandowie formation (Jbmk), Gatton Sandstone (Jbmg), Heifer Creek Sandstone (Jbmh).

**Vegetation:**

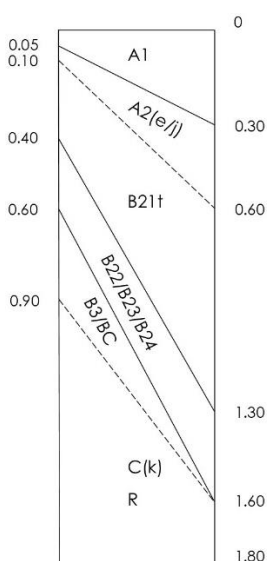
*Eucalyptus moluccana*, *E. crebra*, *E. melliodora*, *E. tereticornis*, *E. fibrosa*, *E. siderophloia*, *Corymbia citriodora*, *C. tessellaris*, *Flindersia australis*, *Acacia* spp., *Lophostemon confertus*, *Ficus macrophylla*, *Araucaria cunninghamii*.

**Permeability/Drainage:**

Slowly to moderately permeable / Moderately well drained to well drained.

**Surface features:**

Firm to hard setting, no microrelief, frequent sheet erosion, frequent sandstone pebbles to boulders.



**A1** Black or brown (7.5-10YR 2/1, 2-3/2-4) sandy clay loam to light clay; massive or weak or moderate angular/subangular blocky or polyhedral structure; rare faint mottling; frequently few to common pebbles; field pH 5.5-7.0; sharp to clear change to

**A2(e/j)** Frequently present, brown, grey, black or red (5-10YR 2-7/2-6 & 5-10YR 5-8/1-4 dry) sandy loam to light clay; massive or weak to moderate angular/subangular blocky or polyhedral structure; occasionally few faint or distinct mottles; occasionally few to common gravels; field pH 5.5-6.5; abrupt or clear change to

**B21t** Red (2.5-5YR 3-6/4-8) light medium to medium heavy clay; moderate to strong polyhedral, subangular blocky or prismatic structure, occasionally with slickensides; few faint to prominent mottles; occasionally few medium sandstone, siltstone or quartz gravels; field pH 5.5-7.0; clear to diffuse change to

**B22t/ B23t/ B24t** Where present, brown, grey, yellow, rarely red (5-10YR 4-7/1-8) light medium to medium heavy clay; weak to strong subangular blocky or polyhedral structure, common slickensides; few to many faint to prominent mottles; occasionally few fine gravels; field 5.5-8.0; clear to gradual change to

**B3/ BC** Where present, grey, brown, yellow or red (2.5-10YR-2.5Y 5/4, 5-7/1-2) light medium to medium clay; massive or weak to strong subangular blocky or polyhedral structure; many faint mottles; few to common pebbles to cobbles; field pH 6.0-8.5; clear to diffuse change to

**C(k)/R** Weak to very weak or strong, massive sandstone or siltstone; rarely few to many calcareous segregations.

**Sites:** LARA: 125, **327**, **329**, 333, 341, 361, 374, 378, 385, 386, 398, **403**, **404**, 417, **428**, **454**, 510, 520, 544, 551, 560, 620, 751, **774**, **775**, 2028, 2115, 2260, 2270.

**Distribution:** Rathdowney to Knapps Creek and Tabragalba, Mt Maroon; Upper Running Creek; Darlington; Cainbale; Tamborine and Cedar Creek.

**RICHARDS (Ri)**

VERSION 1

**Concept:**

Moderately deep to very deep, mottled, grey, slightly acidic to alkaline gradational or uniformly fine soils over siltstone or sandstone from 0.65 m. Subsoils may be sodic and/or saline.

**Soil Classification:****Grey Dermosol****Landform:**

Mid and lower slopes and flats of undulating to rolling rises, low hills and hills. Slope <15%.

**Geology:**

Sandstones and siltstones of Koukandowie formation (Jbmk) and Heifer Creek Sandstone (Jbmh).

**Vegetation:**

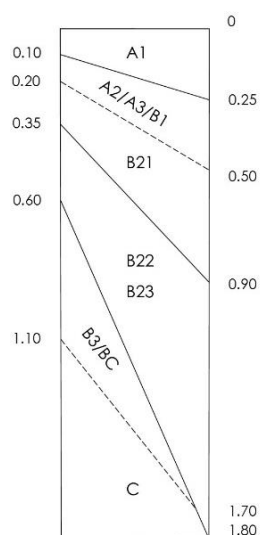
*Eucalyptus moluccana*, *E. tereticornis*, *E. siderophloia*, *Corymbia citriodora*, *C. tessellaris*, *Acacia* spp., *Ficus* spp.

**Permeability/Drainage:**

Slowly to moderately permeable / Poorly to imperfectly drained.

**Surface features:**

Firm or hard setting, no microrelief, occasional sheet erosion, occasionally few sandstone or quartz pebbles to stones.



- A1** Black (7.5-10YR 2-3/1-2) clay loam to light medium clay (frequently sandy); massive or weak to moderate polyhedral or subangular blocky structure; rarely few small pebbles; field pH 6.0-7.0; abrupt to gradual change to
- A(2/3)/B1** Occasionally present and rarely sporadically bleached, black, brown or grey (7.5-10YR 3-5/1-4) clay loam to light medium clay; massive or moderate subangular blocky or polyhedral structure; occasionally few faint mottles; rarely very few small pebbles; rarely few manganiferous nodules; field pH 6.0; clear change to
- B21** Grey (7.5-10YR 4-6/1-2) light medium to medium heavy clay (often sandy); moderate to strong subangular blocky or polyhedral structure; common to many faint or distinct mottles; commonly few sandstone or siltstone pebbles; occasionally few manganiferous nodules; field pH 6.0-8.5; clear or gradual change to
- B22/B23** Grey or brown (10YR-2.5Y 4-6/1-4) sandy light medium to medium heavy clay; moderate to strong subangular blocky or polyhedral structure; few to many faint or distinct mottles; occasionally few sandstone or siltstone pebbles; occasionally few to many manganiferous or calcareous nodules; field pH 6.0-8.5; clear change to
- B3/BC** Where present, grey or brown (10YR 4-5/3-6, 7/2) silty/sandy light medium to medium clay; massive or weak to moderate subangular blocky or polyhedral structure; common sandstone coarse fragments; rarely few distinct mottles; pH 6.0-8.0; clear change to
- C** Grey or brown, massive, weak, sandstone or siltstone.

**Sites:** LARA: 325, 328, 334, 344, 347, 370, 377, 394, 566, 2110, 2194, 2196; SEQ: 91, 106, 130.

**Distribution:** Back Creek, Palen Creek, Barney View, Tamrookum, Bromelton, Undullah, Cedar Grove, Tabragalba.

**ROBINSON (Rs)**

VERSION 1

**Concept:**

Very shallow to shallow, black or brown, sand over buried layers of sediment or coarse bedload (gravel, cobble, or stone). Profile depths range from very shallow (over bedload/rock) to giant and stratified (over multiple buried alluvial horizons).

**Soil Classification:****Stratic or Clastic Rudosol****Landform:**

Stream channels, stream banks and levees on flood plains.

**Geology:**

Quaternary alluvium (Qa, Qha/1, Qhe).

**Vegetation:**

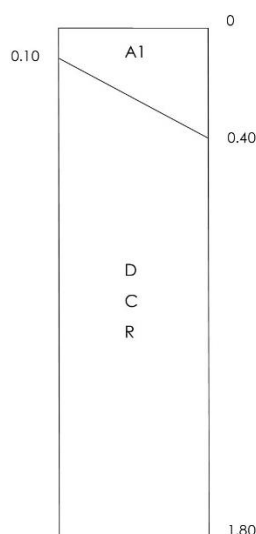
*Eucalyptus tereticornis*, *Angophora subvelutina*, *Corymbia intermedia*; also *Araucaria cunninghamii*, *Callistemon* spp.

**Permeability/Drainage:**

Moderately to highly permeable / Well to rapidly drained.

**Surface features:**

Loose or firm, no microrelief, occasional surface erosion, common large pebbles to stones and boulders.



- A11/A12** Black or brown (10YR 2-3/1-3) loam to light clay; massive or weakly structured; field pH 5.5 to 7.0, clear or abrupt change to
- D** Frequently present, brown (10YR 3-5/3) sand to light clay; massive or weak to moderate angular blocky structure; frequently few to common pebbles; field pH 6.0 to 8.5.
- C/R** Present in shallow soils over bedload/rock in stream channels and adjacent benches. Weathered to unweathered rock of various origin depending upon surrounding geology, including rhyolite, basalt, sandstone and siltstone.

**Sites:** LARA: 2007, 2057, 2174, 2177, 2230; MFM: 186.

**Distribution:** Scattered in narrow bands along Logan River tributaries such as Mount Barney Creek and Widgee Creek. Also found much further downstream on the Logan River at Josephville and Chambers Flat and also a small tributary west of Veresdale.



**SARABAH (Sa)**

VERSION 1

**Concept:**

Very shallow to shallow black and brown uniformly fine textured soils over basalt from 0.1 m. Subsoils are neutral and may be saline or very slightly gravelly.

**Soil Classification:****Black or Brown Dermosol****Landform:**

Crests, ridges, upper and mid slopes of rolling to steep low hills, hills and mountains. Slope 0-40%.

**Geology:**

Albert Basalt (Tfa), Basalt flows (Tv), Beaudesert Beds (Te).

**Vegetation:**

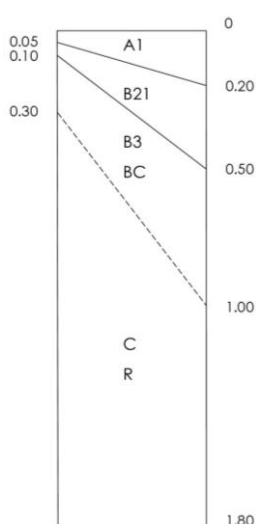
*Eucalyptus tereticornis*, *E. microcorys*, *E. siderophloia*, *E. Crebra*, *E. moluccana*, *E. melliodora*, *Corymbia tessellaris*, *C. intermedia*, *C. citriodora*, *Araucaria cunninghamii*, *Xanthorrhoea* spp.

**Permeability/Drainage:**

Moderately permeable / Moderately well drained.

**Surface features:**

Firm or hard setting, frequent periodic cracking, no microrelief, frequent surface pebbles, cobbles, stones or boulders, frequent sheet erosion.



**A1** Black or brown (7.5-10YR 2-3/1-3) clay loam to light medium clay; moderate or strong subangular blocky or polyhedral structure; commonly very few to common medium to large basalt pebbles; field pH 6.0-7.5; abrupt to gradual change to

**B21** Black or brown (7.5-10YR 2-3/1-4, 4/3-4) light to medium heavy clay; moderate to strong polyhedral or angular/subangular blocky structure, occasional slickensides; very frequently very few to many basalt pebbles to cobbles; field pH 5.5-7.0; abrupt to gradual change to

**B3/BC** Where present, black or brown (7.5-10YR 2-3/2-4, 4-5/4-6) light to light medium clay; weak to moderate subangular blocky or polyhedral structure; abundant basalt pebbles, cobble or stone; field pH 5.0-7.5; abrupt or clear change to

**C** Yellow-brown, massive, weak, weathering basalt, field pH 6.5-7.5.

**R** Where present, massive, hard basalt rock.

**Sites:** LARA: 90, 112, 381, 440, **444**, 445, **459**, 460, 469, 472, 474, 479, 480, 491, 517, 608, 628, 641, **686**, 687, 692, **699**, 706, 719, 761, 778, 779, 2018, 2019, 2026, 2036, 2050, 2051, 2059, 2069, 2070, 2087, 2088, 2113, 2118, 2120, 2144, 2252, 2261; MFM: 319, 322.

**Distribution:** Found throughout the basalt geology areas from Running Creek, Rathdowney and Darlington in the south to Mount Dunsinane (Beaudesert) and Biddaddaba/Tabragalba/ Veresdale in the north.

**Sarabah Tenosolic Variant (SaTv) – Leptic Tenosol.** As above but lacking a B21 horizon. Usually on crests with slopes of 1-4%. Sites – LARA: 59, 288.

**SAVILLE (Sv)**

VERSION 1

**Concept:**

Deep to very deep (rarely moderately deep) brown and grey, sodic, mottled and bleached texture contrast soils on sandstone and siltstone. Subsoils are strongly acidic to strongly alkaline and are occasionally calcic or saline at depth.

**Soil Classification:****Grey or Brown Sodosol, Grey Kurosol.****Landform:**

Mid and lower slopes (also flats) of undulating to rolling rises and low hills, rarely on terraces. Slope <15%.

**Geology:**

Sandstones and siltstones of Walloon Coal Measures (Jw) and Beaudesert Beds (Te).

**Vegetation:**

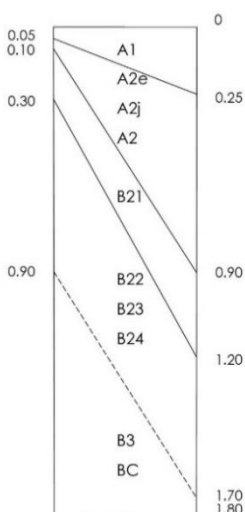
*Eucalyptus moluccana*, *E. tereticornis*, *E. siderophloia*, *Corymbia citriodora*.

**Permeability/Drainage:**

Very slowly to slowly permeable / Poorly drained to moderately well drained.

**Surface features:**

Firm or hard setting, very rare microrelief, common few sandstone, occasionally few siltstone or quartz pebbles to cobbles and stones, common sheet erosion.



**A1** Black, grey or brown (7.5-10YR 2-5/2-3) sandy loam to clay loam sandy; massive or weak to moderate polyhedral, subangular blocky or cast structure; rarely few sandstone or quartz pebbles; very rarely few manganiferous nodules; field pH 6.0-7.0; abrupt or clear change to

**A2(e/j)** Grey or brown (10YR 4-6/2-3 & 10YR 6-8/1-3 dry) sandy loam to clay loam sandy; massive or weak to moderate subangular blocky or polyhedral structure; rarely few pebbles or manganiferous nodules; field pH 6.0-7.0; abrupt or clear change to

**B21** Grey or brown (10YR 3-5/3-6, 4-6/1-2 3-6/1-6) light medium to medium heavy clay; moderate to strong polyhedral, angular/subangular blocky or prismatic structure, rarely massive; few to many distinct orange/red mottles; rarely few quartz pebbles; very rarely few manganiferous nodules; field pH 5.5-6.5; abrupt to gradual change to

**B22/B23/B24** Where present, grey or brown or yellow (7.5YR-2.5Y 3-6/3-4, 4-5/1-2) light to medium heavy clay; moderate to strong angular/subangular blocky, polyhedral or lenticular structure, rare slickensides; common to many distinct mottles; rarely few to many pebbles; rarely few manganiferous or calcareous segregations; field pH 4.5-9.0; diffuse change to

**B3/BC** Where present, grey, brown or yellow (10YR 4-7/2-4) sandy light medium to medium heavy clay; weak to moderate angular/subangular blocky or polyhedral structure; common faint mottles; few to common pebbles; field pH 5.5-9.0.

**C** Rarely present, weak, massive sandstone or siltstone; field pH 5.5-6.0.

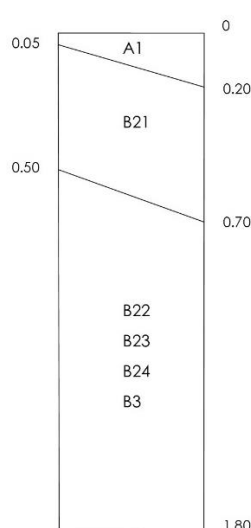
**Sites:** LARA: 61, 131, **393**, **596**, **781**, 782, 2122, 2123, 2131, 2161, 3000, **9017**; SEQ: 301, 327, 332; SPFD: 107, 119.

**Distribution:** Upper Logan, Tamrookum, Christmas Creek, Allenvie, Beaudesert, Woodhill, Veresdale, Tabragalba, Nindoinbah.

**SHAWS (Sh)**

VERSION 1

<b>Concept:</b>	Deep to very deep, black, frequently mottled, uniformly fine soils formed on colluvium. Surfaces are black and subsoils are neutral to alkaline and may be very slightly gravelly and/or saline and rarely calcic.
<b>Soil Classification:</b>	<b>Black Dermosol</b> , Brown Dermosol.
<b>Landform:</b>	Lower slopes and fans on rolling low hills and hills. Slope 1-15%.
<b>Geology:</b>	Tertiary/Quaternary siltstone or greenstone colluvium (TQr).
<b>Vegetation:</b>	<i>Eucalyptus tereticornis</i> , <i>E. moluccana</i> , <i>Araucaria cunninghamii</i> .
<b>Permeability/Drainage:</b>	Moderately permeable / Imperfectly drained.
<b>Surface features:</b>	Firm or hard setting, frequent periodic cracking, no microrelief, rare ferruginised cobbles, frequent sheet or gully erosion.



- A1** Black (10YR 2-3/1-2) light to medium clay (often silty); moderate polyhedral, subangular blocky or granular structure; rarely few fine gravels; field pH 6.0-6.5; abrupt to gradual change to
- B21** Black, rarely brown (10YR 2-3/1-4) light medium to medium heavy clay; moderate to strong polyhedral, angular/subangular blocky or prismatic structure, rarely with slickensides; rarely few faint mottles; rarely few fine gravels; field pH 6.0-8.0; gradual or diffuse change to
- B22/ B23/ B24** Where present, grey or brown (10YR 2.5 Y4-6/1-4) light medium to medium heavy clay; massive or weak to strong prismatic, polyhedral, subangular or lenticular structure with frequent slickensides; few distinct brown, red or orange mottles; few siltstone pebbles; few fine to medium manganiferous or calcareous segregations; field pH 6.0-9.0.
- B3** Rarely present, grey (10YR 5/1) sandy light medium clay; massive; few faint orange mottles; few manganese nodules; field pH 8.0-8.5.

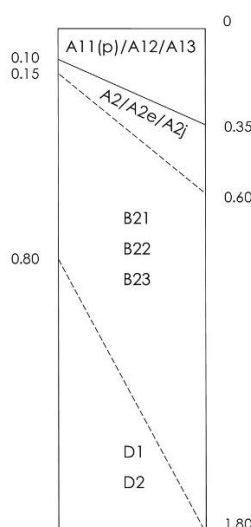
**Sites:** LARA: 224, 744, 748, 757, 2149, 2150.

**Distribution:** Upper Logan River and Upper Palen Creek; Tabragalba; Cedar Creek (Albert River).

**SIPPEL (SI)**

VERSION 1

<b>Concept:</b>	Deep to very deep brown and grey texture contrast soils formed on alluvium. Sandy loam and clay loam surfaces over sandy clay loam to medium heavy clay. Subsoils are neutral to alkaline and occasionally calcic and/or mottled, saline or sodic at depth.
<b>Soil Classification:</b>	<b>Brown Chromosol</b> , Grey Chromosol, Brown Dermosol.
<b>Landform:</b>	Plains, terrace plains, levees and channel benches on flood plains and terraces.
<b>Geology:</b>	Quaternary alluvium (Qa, Qha/2).
<b>Vegetation:</b>	<i>Eucalyptus tereticornis</i> , <i>E. crebra</i> , <i>Corymbia citriodora</i> .
<b>Permeability/Drainage:</b>	Slowly to moderately permeable / Poorly drained to moderately well drained.
<b>Surface features:</b>	Firm or hard setting, loose where sandy loam, no microrelief, rare 2-6 mm pebbles.



- A11(p)/ A12/ A13** Grey, black or brown (10YR 2-5/1-4) clayey sand to clay loam fine sandy; massive or weakly to moderately structured; occasionally few medium ferromanganiferous nodules; occasionally slightly gravelly; field pH 5.5-7.0; abrupt to gradual change to
- A2(e/j)** Occasionally present, grey or brown (10YR 4/2-4 & 7/3 dry) sandy loam to clay loam fine sandy; massive or weak to moderate subangular blocky or granular structure; occasionally many medium manganiferous segregations; field pH 6.0-6.5; clear change to
- B21/ B22/ B23** Brown or grey (7.5-10YR 3-5/3, 5/1-2, 2.5Y5/3) fine sandy clay loam to medium heavy clay; massive or weak to strong polyhedral, lenticular or subangular blocky structure rarely with slickensides; occasionally very few to few faint to distinct orange and/or dark mottles; occasionally very few to few medium manganiferous and/or calcareous nodules; rarely slightly gravelly; field pH 7.0-9.5; abrupt to clear change to
- D1/ D2** Where present, brown (10YR 3-5/4-6) sand to sandy light medium clay; massive or weak to moderate subangular blocky structure; field pH 7.0-8.0.

**Sites:** LARA: 23, 312, 391, 2199; SEQ: 81, 323; SPFD: 108, 120, 122.

**Distribution:** On the Logan River and Mount Barney Creek at Barney View; at the downstream end of Allen Creek at Bromelton. Isolated occurrences on the Logan River at Woodhill and Jimboomba.

**SPENCER (Sp)**

VERSION 1

**Concept:** Deep to very deep, neutral to alkaline, grey or brown, sodic, texture-contrast soils, with frequent bleach formed on alluvium. Subsoil is mottled and alkaline to strongly alkaline. Occasionally saline at depth.

**Soil Classification:** **Grey Sodosol**, Brown Sodosol.

**Landform:** Plains and terrace flats on alluvial and flood plains and terraces.

**Geology:** Quaternary alluvium (Qa).

**Vegetation:** *Eucalyptus tereticornis*, *Grevillea robusta*, *Casuarina cunninghamiana*.

**Permeability/Drainage:** Slowly permeable / Poorly to imperfectly drained.

**Surface features:** Firm or hard setting, no microrelief.



**A1/Ap** Black, brown or grey (7.5-10YR 3-5/2-3) fine sandy clay loam to clay loam (silty/fine sandy); weak to strong granular or subangular blocky structure; field pH 5.5-6.5; clear change to

**A2/A2j/A2e** Grey or brown (10YR 4-7/2-4 & 10YR 6-7/1-2 dry) frequent sporadically/conspicuously bleached fine sandy loam to clay loam; massive or weak to moderate angular blocky structure; occasionally few to common faint or distinct mottles; field pH 5.5-8.0; sharp to clear change to

**B21t** Grey or brown (10YR 4/1-3) medium to medium heavy clay; moderate to strong angular blocky structure (rarely lenticular), rare slickensides; few to many distinct orange or brown mottles; rarely few manganiferous segregations; field pH 6.0-8.0.

**B22t/B23t** Grey or brown (7.5YR-2.5Y 4-5/1-4) medium to medium heavy clay; moderate to strong angular blocky structure (rarely lenticular), rare slickensides; many distinct orange or brown mottles; occasionally few manganiferous segregations; field pH 6.0-9.0.

**Sites:** LARA: 1, 74, **807**; SEQ: 113; SEDG: 9.

**Distribution:** Isolated occurrences. On the Logan River adjacent to Mount Ernest, and at Woodhill and Cedar Grove. Also on Swan Creek at Bromelton and on the Cedar Creek tributary of the Albert River at Cedar Creek.

**STOCKLEIGH (St)**

VERSION 1

**Concept:** Moderately deep to very deep, acidic to neutral, grey, texture-contrast soils on sandstone. Subsoils are mottled and may become strongly alkaline or saline at depth.

**Soil Classification:** **Grey Chromosol**, Grey Kurosol.

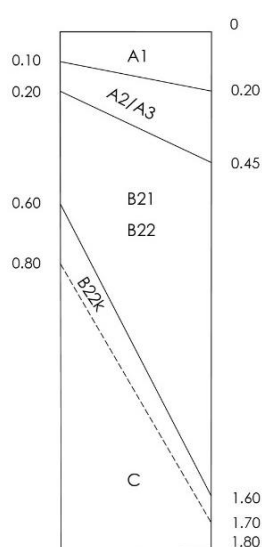
**Landform:** Slopes of undulating to rolling rises and low hills. Slopes <15%.

**Geology:** Sandstones of Koukandowie Formation (Jbmk) and Gatton Sandstones (Jbmg).

**Vegetation:** *Eucalyptus tereticornis*, *E. moluccana*, *E. crebra*, *E. siderophloia*, *Corymbia tessellaris*, *Araucaria cunninghamii*.

**Permeability/Drainage:** Moderately permeable / Imperfectly drained.

**Surface features:** Hard setting or firm, no microrelief, rare sheet erosion, occasionally few sandstone cobbles or stones, rare sandstone outcrop.



**A1** Black, brown or grey (7.5-10YR 2-4/1-3) loamy sand to sandy clay loam (rarely clay loam); single grained or weak to moderate angular/subangular blocky or polyhedral structure; field pH 5.5-6.0; abrupt to gradual change to

**A2/A3** Grey or brown (7.5-10YR 4-6/2-3, 4-5/4 & 10YR 6/1-4 dry) loamy sand to sandy clay loam (rarely clay loam); single grained or weak to moderate polyhedral or angular/subangular blocky structure; occasionally few mottles; occasionally few sandstone pebbles; field pH 5.5-6.5; abrupt to clear change to

**B21/B22** Grey (10YR-5Y 4-7/1-3) sandy light to medium heavy clay; frequently massive but also moderate to strong prismatic, lenticular or angular blocky structure; common to many distinct orange or brown mottles; rarely few small or medium gravels; rarely few manganiferous nodules; field pH 5.0-7.5; clear change to

**B22k** Where present, grey (10YR-5Y 5-6/1-2) sandy light to medium clay; massive or moderate prismatic structure, often with slickensides; common distinct orange mottles; rarely few sandstone pebbles; few to common calcareous or manganiferous nodules; field pH 8.5.

**C** Where present, massive brown sandstone.

**Sites:** LARA: **135, 156**, 330, **369**, 416; SEQ: 186, 197, 209, 250, 410; MFM: 326.

**Distribution:** Flanagan Reserve, Knapp Creek, Mundoolun, Flagstone, Birnam, Maclean, Jimboomba.

## TAMBORINE (Ta)

VERSION 1

### Concept:

Deep to very deep red, acidic to neutral, uniformly fine soils high in free iron oxide. Not saline.

### Soil Classification:

**Red Ferrosol**, Red Dermosol.

### Landform:

Crests and slopes of undulating to steep low hills and rises. Slope 0.5-15%.

### Geology:

Beechmont basalt (Tlb) and Hobwee basalt (Tlh).

### Vegetation:

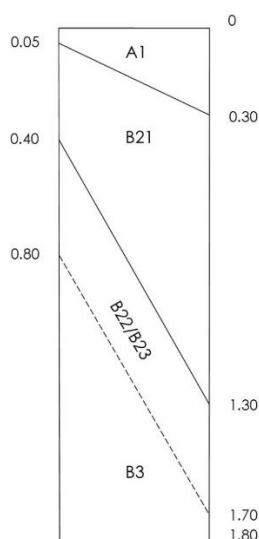
*Eucalyptus saligna subsp. saligna* or *E. grandis* tall open forest. Also *Eucalyptus microcorys*, *E. acmenoides*, *Lophostemon confertus*.

### Permeability/Drainage:

Moderately to highly permeable / Moderately well to well drained.

### Surface features:

Firm or hard setting, occasional periodic cracking, no microrelief, frequent surface pebbles to stones, common basalt outcropping.



**A1** Red or brown (2.5-7.5YR 3-4/3-4, 10R 3/4) clay loam to light clay; moderate to strong angular/subangular blocky or granular structure; field pH 4.5-6.0; clear or gradual change to

**B21** Red or brown (2.5-7.5YR 3-4/3-6, 10R 4/3-6) clay loam to medium heavy clay; strong polyhedral or angular/subangular blocky structure; field pH 4.5-6.0; gradual or diffuse change to

**B22/ B23/ B3** Red (2.5-5YR 3-4/3-6, 10R 4/3-8) light to medium heavy clay; moderate to strong polyhedral or angular/subangular blocky structure; frequently few to common fine to medium basalt pebbles; field pH 4.5-6.0.

**Sites:** LARA: 94, 95, 96; MFM: 363, 364; SOC: 10, 11, 12.

**Distribution:** Tamborine, O'Reillys.

## TARTAR (Tt)

VERSION 1

### Concept:

Deep to very deep black and brown, uniformly fine, non-cracking soils over basalt from 1.0m. Subsoils are neutral to alkaline and may be slightly gravelly, vertic and/or calcic. Salinity is rare.

### Soil Classification:

**Black or Brown Dermosol**

### Landform:

Mid and lower slopes, benches, fans and foot slopes of rolling and steep low hills, hills and mountains. Slope 1-25%.

### Geology:

Albert Basalt (Tfa) and basalt flows (Ttv).

### Vegetation:

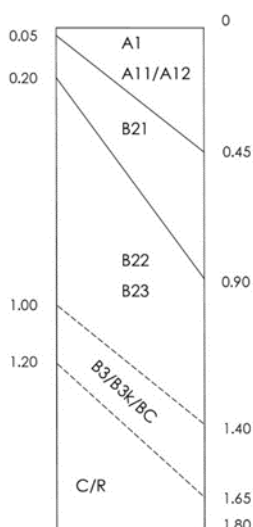
*Eucalyptus tereticornis*, *E. siderophloia*, *E. microcorys*, *Grevillea robusta*, *Casuarina cunninghamiana*, *Araucaria cunninghamii*, *Ficus* spp., *Corymbia intermedia*, *C. tessellaris*, *Acacia* spp., *Xanthorrhoea* spp.

### Permeability/Drainage:

Moderately permeable / Imperfectly to moderately well drained.

### Surface features:

Firm or hard setting, occasional periodic cracking, no microrelief, frequent basalt surface cobbles or stones, common sheet erosion.



**A1/ A11/ A12** Black or brown (7.5-10YR 2-3/1-3) clay loam to medium clay (often silty); moderate to strong subangular blocky or polyhedral structure, rare slickensides; commonly few basalt pebbles to cobbles; field pH 6.0-7.5; abrupt to gradual change to

**B21** Black or brown, rarely grey (7.5-10YR 2-4/1-4) light to medium heavy clay; moderate to strong polyhedral or angular/subangular blocky structure, often with slickensides and weak lenticular structure; rarely few mottles; frequently few fine basalt pebbles; occasionally few calcareous or manganiferous nodules; field pH 6.0-8.5; clear to diffuse change to

**B22/ B23/ B23k** Where present, black, brown or grey (7.5-10YR 2-5/1-4) light to medium heavy clay; moderate to strong subangular blocky, polyhedral, prismatic or lenticular structure often with slickensides; few faint to distinct mottles; few fine basalt and/or quartz pebbles; few to common calcareous or manganiferous nodules; field pH 6.0-8.5; abrupt to diffuse change to.

**B3/ B3k BC** Where present, brown or grey (7.5-10YR 4 7/1 3, 3 5/3 4) light to medium heavy clay; massive or weak to moderate angular/subangular blocky, prismatic or lenticular structure; occasionally few distinct orange mottles; occasionally few to many basalt pebbles; frequently few medium calcareous or manganiferous segregations; field pH 7.5-9.0.

**C/R** Where present, very weak to strong, massive, basalt rock, occasionally with few calcareous segregations where saprolite; field pH 5.5-8.5.

**Sites:** LARA: 88, 248, 279, 343, 434, 447, **451, 478**, 516, 518, **602**, 614, 658, **659**, 679, 705, 2022, 2023, 2024, 2181, 2250.

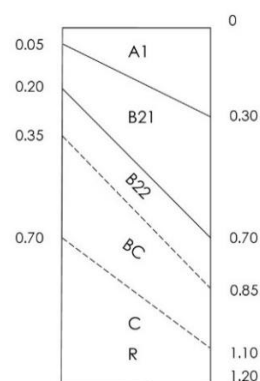
**Distribution:** Mount Gillies, Back Creek, Running Creek, Rathdowney, Widgee Creek, Il Bogan/Bromelton, Laravale, Mount Dunsinane, Lamington, Kerry, Darlington, Cainbale, Canungra Creek, Biddaddaba.

## TARTAR SHALLOW PHASE (TtSp)

VERSION 1

<b>Concept:</b>	Shallow to moderately deep, neutral to alkaline, black and brown uniformly fine soils over hard or weathered basalt from 0.6 m.
<b>Soil Classification:</b>	<b>Black or Brown Dermosol</b>
<b>Landform:</b>	Crests, ridges, mid and upper slopes of rolling to steep low hills, hills and mountains. Slope 0-30%.
<b>Lithology and geology:</b>	Albert Basalt (Tfa), Beaudesert Beds (Te).
<b>Vegetation:</b>	<i>Eucalyptus moluccana</i> , <i>E. siderophloia</i> , <i>E. melanophloia</i> , <i>E. melliodora</i> , <i>E. crebra</i> , <i>Corymbia citriodora</i> , <i>C. tessellaris</i> , <i>Flindersia australis</i> , <i>Acacia</i> spp., <i>Grevillea robusta</i> , <i>Araucaria cunninghamii</i> .
<b>Permeability/Drainage:</b>	Moderately permeable / Moderately well drained.

**Surface features:** Firm with frequent periodic cracking, no microrelief, frequently few to many large basalt pebbles to boulders, common sheet or rill erosion and soil creep.



<b>A1</b>	Black or brown (7.5-10YR 2-3/1-4) clay loam to medium clay; weak to strong polyhedral or subangular blocky structure; occasionally few basalt pebbles; field pH 6.0-7.0; sharp to clear change to
<b>B21</b>	Black or brown (7.5-10YR 2-3/1-4, 4/3-4) light to medium heavy clay; moderate to strong subangular blocky, lenticular or polyhedral structure, often with slickensides; rarely few distinct orange mottles; few to many medium or large basalt pebbles; occasionally common manganiferous segregations; field pH 6.0-7.5; abrupt to gradual change to
<b>B22</b>	Where present, brown (5-10YR 3-4/3-6, 2.5Y4/4) light medium to medium heavy clay; moderate to strong subangular blocky, polyhedral or lenticular structure, common slickensides; occasionally few faint to distinct red/orange mottles; occasionally very few basalt pebbles; rarely few to common medium manganiferous nodules; field pH 6.0-8.5; abrupt or clear change to
<b>B3/BC</b>	Where present, brown (5-10YR 3-5/3-4) light to medium heavy clay; massive or weak to moderate polyhedral, subangular blocky or prismatic structure; occasionally few basalt pebbles; rarely many medium calcareous segregations; field pH 6.5-8.5; clear change to
<b>C/R</b>	Yellow-brown, very weak to hard, massive basalt rock; field pH 6.0-8.5.

**Sites:** LARA: 89, **285**, 287, 342, **351**, 352, 452, 457, 462, 468, 473, 498, 626, 635, **657**, 664, 685, 697, 2055, 2183, 2214, 2216.

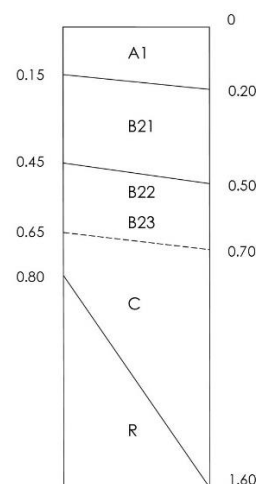
**Distribution:** Mount Gillies, Back Creek, Running Creek, Christmas Creek, Widgee Creek, Bromelton, Hillview, Darlington, Widgee Creek and Sarabah, Veresdale.

## TELEMON (Tm)

VERSION 1

<b>Concept:</b>	Moderately deep, red, uniformly fine soils. Subsoils are neutral to alkaline and may be very slightly gravelly or calcic.
<b>Soil Classification:</b>	<b>Red Dermosol</b> , Red Vertosol.
<b>Landform:</b>	Ridges, upper and mid slopes of rolling low hills and hills. Slope 7-30%.
<b>Geology:</b>	Albert Basalt (Tfa), Beaudesert Beds (Te/3).
<b>Vegetation:</b>	<i>Eucalyptus tereticornis</i> .
<b>Permeability/Drainage:</b>	Moderately permeable / Moderately well drained to well drained.

**Surface features:** Firm or hard setting, frequent periodic cracking, no microrelief, frequent surface cobbles or stones.



<b>A1</b>	Black (10YR2-3/2) light medium clay; moderate to strong subangular blocky structure; field pH 6.0-6.5; clear change to
<b>B21</b>	Red (2.5-5YR 3-5/3-6) light medium to medium heavy clay; moderate to strong polyhedral or subangular blocky structure, may have slickensides; field pH 6.0-8.0; clear change to
<b>B22/B3</b>	Where present, brown (7.5-10YR 4-5/3-4) light medium to medium heavy clay; moderate prismatic or strong polyhedral structure often with slickensides; occasionally many basalt pebbles; field pH 6.0-8.0; clear change to
<b>C</b>	Weak to very weak, massive, weathering basalt, occasionally few medium calcareous segregations; field pH 8.0-8.5.
<b>R</b>	Where present, massive, hard basalt rock.

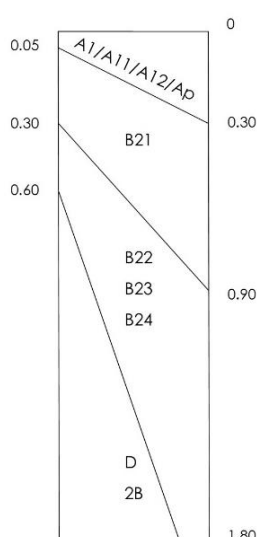
**Sites:** LARA: 57, **490**, 2171.

**Distribution:** Running Creek, Oaky Creek and Josephville.

**WATERFORD (Wa)**

VERSION 1

<b>Concept:</b>	Deep to very deep, acidic grey, brown (and occasionally black) cracking clays on alluvium. Subsoils are grey, mottled, strongly acidic, and/or occasionally sodic or saline. Buried horizons rarely encountered within 1.8 m.
<b>Soil Classification:</b>	<b>Grey Vertosol, Brown Vertosol, Black Vertosol.</b>
<b>Landform:</b>	Plains and terrace plains on terraces and flood plains.
<b>Geology:</b>	Quaternary alluvium (Qa, Qpa).
<b>Vegetation:</b>	<i>Eucalyptus tereticornis</i> , <i>E. moluccana</i> , <i>E. crebra</i> , <i>Corymbia citriodora</i> ; also <i>Melaleuca</i> spp.
<b>Permeability/Drainage:</b>	Slowly permeable or occasionally moderately permeable / Poorly to imperfectly drained.
<b>Surface features:</b>	Hard setting or firm with frequent periodic cracking, frequent gilgai.



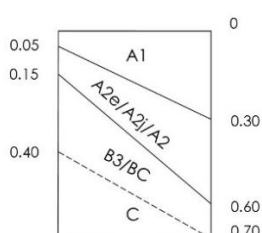
- A1(p)/A11/A12** Black, brown or grey (7.5-10YR 2-4/1-4) light to medium clay; moderate to strong (rarely weak) angular blocky or granular structure; occasionally few to common medium faint to distinct mottles; occasionally few medium manganiferous segregations; field pH 5.5-6.5 clear or gradual change to
- B21** Grey, brown or black (7.5-10YR 3-5/1-4); medium to heavy clay; moderate to strong angular/subangular blocky or lenticular structure; few to many fine to coarse faint or distinct mottles; occasionally few to many medium manganiferous segregations; field pH 5.0-6.0; clear or gradual change to
- B22/B23/B24** Grey or brown (7.5-10YR 4-6/1-4, 2.5Y 4-6/1-3) medium to heavy clay; moderate to strong lenticular structure with slickensides; few to many faint or distinct fine to coarse mottles; occasionally common to many fine manganiferous segregations; field pH 4.0-6.0; gradual change to
- D/2B** Rarely present, brown (7.5-10YR 4/4) fine sandy light clay; moderate angular blocky structure; field pH 5.0-6.0.
- Sites:** LARA: 80; SEQ: 75, 83, 93, 105, 121, 138, 157, 168, 169, 170, 174, 175, 176, 229, 230, 231, 236, 251, 304, 306, 317, 326, 330, 337, 340, 342, 343, 344, 359; MFM: 196, 197, 211.

**Distribution:** Allen Creek at Gleneagle; Teviot Brook downstream of Wyaralong Dam; Logan River downstream of Woodhill.

**WOOLLAMAN (Wm)**

VERSION 1

<b>Concept:</b>	Very shallow to moderately deep, acidic to neutral, uniformly sandy to loamy soils over sandstone from 0.25 m.
<b>Soil Classification:</b>	<b>Leptic/Bleached Leptic Tenosol, Brown Orthic Tenosol, Leptic Rudosol.</b>
<b>Landform:</b>	Crests and upper slopes (rarely mid slopes or benches) of undulating to rolling rises and low hills. Slope 1-25%.
<b>Geology:</b>	Sandstones of the Koukandowie Formation (Jbmk), Gatton Sandstones (Jbmg) and Walloon Coal Measures (Jw). Also Beaudesert Beds (Te).
<b>Vegetation:</b>	<i>Eucalyptus moluccana</i> , <i>E. melanophloia</i> , <i>E. crebra</i> , <i>E. major</i> , <i>E. tereticornis</i> , <i>E. siderophloia</i> , <i>Corymbia tessellaris</i> , <i>C. intermedia</i> , <i>C. citriodora</i> , <i>Angophora</i> spp.
<b>Permeability/Drainage:</b>	Moderately to highly permeable / Well drained to rapidly drained.
<b>Surface features:</b>	Loose to firm or hard setting, common sheet or rill erosion, common few sandstone pebbles to stones, occasional sandstone outcropping.



- A1** Black, brown or grey (7.5-10YR 2-5/1-3) loamy sand to clay loam; single grained, massive or weak to moderate angular/subangular blocky structure; occasionally common sandstone or quartz pebbles; field pH 4.5-7.5; abrupt to gradual change to
- A2(e/j)** Brown, yellow or grey (10YR 3-7/2-6 & 10YR 6-8/2-4 dry) loamy sand to clay loam; single grained, massive or weak angular/subangular blocky structure; rarely few fine distinct orange mottles; occasionally few to common sandstone or quartz pebbles; field pH 4.0-7.0; clear change to
- B3/BC** Where present, brown, grey or yellow (10YR 4-7/3-4) loamy sand to sandy loam; massive or weak angular blocky structure; occasionally few distinct orange mottles; few to many sandstone pebbles; rarely few manganiferous segregations; field pH 4.5-6.5.
- C** Massive, weak to strong sandstone, weathering in situ.

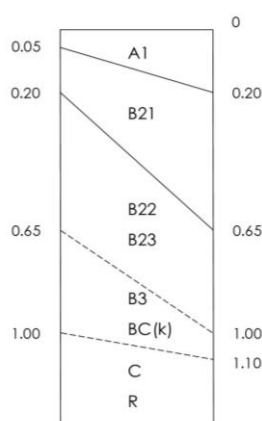
**Sites:** LARA: 33, 36, 142, 186, 187, 188, 191, 192, 195, 270, 502, 504, 525, 583, 752; SEQ: 177, 183, 210, 224, 239, 241, 247, 267, 328.

**Distribution:** Throughout the Marburg subgroup geologies from Rathdowney in the south to Mundoolun and Greenbank in the north. Also in the Upper Logan, Oaky Creek, Nindooibah and Woodhill.

**WONGLEPONG (Wo)**

VERSION 1

<b>Concept:</b>	Shallow to moderately deep, black, cracking and non-cracking clays over basalt colluvium or basalt rock from 0.75 m. Subsoils are neutral to strongly alkaline and may be saline or calcic at depth.
<b>Soil Classification:</b>	<b>Black Vertosol</b> , Black Dermosol, Brown Dermosol.
<b>Landform:</b>	Slopes, benches and valley flats of rolling to steep hills and mountains. Slope 0.5-20%.
<b>Geology:</b>	Tertiary/Quaternary basalt colluvium (TQr/Qr/TQcb) and Beechmont basalt (Tlb).
<b>Vegetation:</b>	<i>Eucalyptus tereticornis</i> , <i>E. siderophloia</i> , <i>E. melliodora</i> , <i>Corymbia citriodora</i> , <i>C. tessellaris</i> , <i>Toona australis</i> .
<b>Permeability/Drainage:</b>	Moderately permeable / Imperfectly to moderately well drained.
<b>Surface features:</b>	Self-mulching or firm with frequent periodic cracking, no microrelief, frequent sheet or rill erosion, frequent basalt pebbles to boulders.



<b>A1</b>	Black (7.5-10YR 2-3/1-2) clay loam to medium clay; moderate to strong granular or angular/subangular blocky structure; frequently few basalt pebbles; field pH 6.0-8.0; clear change to
<b>B21</b>	Black (7.5-10YR 2-3/1-2) light to medium heavy clay; moderate to strong angular/subangular blocky, prismatic or lenticular structure, frequent slickensides; few to many basalt pebbles; field pH 6.0-8.0; abrupt to gradual change to
<b>B22/ B23</b>	Where present, black or brown (7.5-10YR 2-4/1-4) medium to medium heavy clay; moderate to strong lenticular or subangular blocky structure, with slickensides; few to common faint or distinct mottles; few to common basalt pebbles; field pH 6.0-9.0; clear change to
<b>B3/ BC(k)</b>	Where present, grey or brown (10YR 3/3, 5/2) light medium to medium heavy clay; massive or weak to moderate angular/subangular blocky or lenticular structure; few to common faint or distinct mottles; few to many basalt pebbles; frequently few to common medium to coarse calcareous or manganiferous segregations; field pH 6.0-8.5.
<b>C/R</b>	Massive, weak to strong basalt rock.

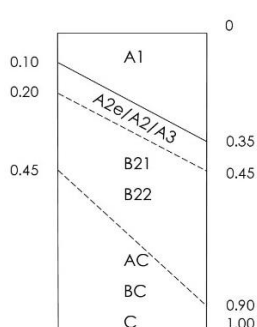
**Sites:** LARA: 71, 244, 245, 256, 257, **693**, 714, **715**, 2052, **9010**.

**Distribution:** Logan River at Mount Lindesay; Albert River at Mount Alexander; Wonglepong, upper Widgee Creek.

**YARRABILBA (Ya)**

VERSION 1

<b>Concept:</b>	Very shallow to moderately deep, strongly acidic to neutral, sandy to sandy loamy soils over sandstone from 0.2 m.
<b>Soil Classification:</b>	<b>Leptic/Bleached Leptic Tenosol</b> , Brown/Grey Orthic Tenosol, Leptic Rudosol.
<b>Landform:</b>	Crests and slopes of undulating to rolling rises and low hills (rarely steep hills). Slope 2-30% (but as high as 50%).
<b>Geology:</b>	Sandstones of the Woogaroo Subgroup (RJbw) and Ipswich Coal Measures (Ri).
<b>Vegetation:</b>	<i>Eucalyptus moluccana</i> , <i>E. crebra</i> , <i>E. tereticornis</i> , <i>Corymbia intermedia</i> , <i>C. citriodora</i> , <i>Allocasuarina torulosa</i> , <i>Acacia</i> spp.
<b>Permeability/Drainage:</b>	Moderately to highly permeable / Well drained.
<b>Surface features:</b>	Loose to firm, occasional sheet or rill erosion, rare sandstone cobbles/sandstone outcropping.



<b>A1</b>	Grey, brown or black (10YR 2-5/1-3) sand to sandy loam; single grained, massive or weakly structured; field pH 4.5-7.0; clear or gradual change to
<b>A2(e)/ A3</b>	Occasionally present, occasionally bleached, grey or brown (10YR 4-6/2-6) loamy sand; single grained, massive or weakly structured; field pH 5.0-6.5; abrupt to gradual change to
<b>B21</b>	Where present, brown or grey (10YR 4-5/2, 4-5/3-8) sand to sandy loam; single grained, massive or weakly structured; rarely few sandstone pebbles; rarely few ferromanganiferous nodules; field pH 4.5-6.5; abrupt or clear change to
<b>B22</b>	Where present, brown (10YR 4/3, 5/8) sand to sandy loam; single grained or weakly structured; rarely few ferromanganiferous nodules; field pH 5.0-6.5; abrupt or clear change to
<b>AC/ BC</b>	Rarely present, yellow or brown, single grained loamy sand or massive sandy loam; field pH 5.5-6.0; clear change to
<b>C</b>	Massive sandstone, weathering in situ.

**Sites:** LARA: 121, 122, 205, 206, 235, **791**, 2005; SEQ: 1, 180, 200, 228, 255, 259, 350, 356, 370 MFM; 361, 374.

**Distribution:** Upper Logan River, New Beith, Stockleigh, Logan Village, Yarrabilba, Tamborine, Plunkett, Benobble.

## **Appendix 2: Soil Key**



		SPC Name	Primary ASC	Secondary ASC
<i>Group 1 – Alluvial soils (Qa/Qpa/Qha)</i>				
<b>1.1 Coarse textured soils – texture is sandy loam or lighter</b>				
1.1.1	Acidic to neutral, over buried horizons (D) or coarse bed load.	Cressbrook (Cr)	RUER, RUAO	
1.1.2	Grey or black LS (± bleached A2 horizon) over brown LS, acidic to neutral, over buried, massive, sandy D horizons within 1.0m.	Jimboomba (Jm)	TEIO	
<b>1.2 Coarse to medium textured soils – sandy loam to clay loam (rarely light clay)</b>				
1.2.1	Very shallow to shallow A horizon only over sediments or coarse bed load (gravel, cobble, stone, buried layers).	Robinson (Rs)	RUAO	RUER, RUHH
<b>1.3 Uniformly medium textured soils – sandy clay loam to clay loam (rarely light clay)</b>				
1.3.1	SCL-LC over black or brown, neutral SCL-SLC - D horizons within 1.8m. Deep to very deep, not gravelly.	Logan (SEQ) (Lg)	KAAB, KAAE	
<b>1.4 Soils have a strong texture contrast between A and B horizons</b>				
1.4.1	<u>Brown or yellow colour class - neutral to alkaline</u>  0.1-0.0.6m CS-CLFS over brown neutral to alkaline SCL-MC. May have D horizons within 1.8m.  Up to 0.5m SL-CL over sodic, grey or brown, neutral to alkaline MC-MHC - may have D horizons below.	Sippel (Sl)  Spencer (Sp)	CHAB  SOAD	CHAD  SOAB, CHAB
1.4.2	<u>Brown or yellow colour class - acidic to neutral</u>  Up to 0.15m SCL-CL, ± bleached A2, over acidic, mottled brown or grey MC-HC on sandstone alluvium.  Up to 0.4m, SL-CL, ± bleached A2, over neutral, mottled brown SLC-MHC. pH6.0-7.0.	Cookes (Co)  Kilmoylar (Km)	CHAB  CHAB	CHAC
1.4.3	<u>Grey colour class</u>  Up to 0.8m frequently bleached grey or black LS-CL over frequently mottled grey SLC-SMHC on SA/ZS alluvium, pH5.5-8.0, ±mottle/calcareous segs. May be sodic, overlies C horizons or may have D horizons within 1.8m.  Up to 0.2m bleached grey or black SL-CL over acidic, frequently mottled, grey MC-MHC - pH4.0-7.0.	Beausang (Bg)  Maclean (Ma)	CHAD  KUAD	SOAD  CHAD
1.4.4	<u>Black colour class</u>  Neutral soils (pH<=7.0).  Neutral to alkaline soils (pH>=7.0), may be calcic.	Grigor (Gr)  Gunyah (Gy)	CHAE  CHAB, CHAE	
<b>1.5 Non-cracking gradational soils</b>				
1.5.1	SCL-LC surface over acidic to alkaline black, brown or grey LC-MHC. Subsoils (including D horizons) are neutral to alkaline and occasionally calcic (pH 6.5-8.5).	Lockyer (Ly)	DEAE, DEAB	KAAE, KAAB
1.5.2	ZL-ZCL surface over neutral, black or brown LC-MC with neutral (pH 6.5-7.5) D horizon within 1.8m.	Monsildale (Mn)	DEAE	DEAB
1.5.3	Strongly acidic grey and brown soils.	Bromelton (Bn)	DEAD	DEAB
<b>1.6 Non-cracking uniformly fine soils (clays)</b>				
1.6.1	<u>Black, grey or brown with calcic sub-soil</u>  LC-LMC surface over neutral to alkaline black grey or brown LMC-MHC, frequently mottled, calcareous &/or manganiferous segs.  ZLC-MC surface over alkaline black LMC-MC calcareous segs at depth. Overlies sandy clay D horizon within 1.8m.	Lockrose (Ls)  Hooper (Hr)	DEAE, DEAD  DEAE	DEAB
1.6.2	<u>Non-calcareous sub-soil, black, grey or brown colour class</u>  Neutral to alkaline soils.	Bremer (B)	DEAE/AB/AD	

		SPC Name	Primary ASC	Secondary ASC
	As for Bremer but over D horizon(s) within 1.2m.	Bremer Buried Phase (BBp)	DEAE	DEAB, DEAD
1.6.3	<u>Strongly acidic soils</u>	Maroon (Mr)	DEAD	DEAB
<b>1.7 Cracking, hard setting clay soils - not self-mulching</b>				
1.7.1	Grey colour class (Neutral to alkaline)	Basel (Bs)	VEAD	VEAM, HYED
1.7.2	Brown colour class (Alkaline, calcic)	Duggua (Du)	VEAB	
1.7.3	Black colour class (Neutral to alkaline, ± mottles/calcareous segs)	Bell (SEQ) (Bl)	VEAE	
1.7.4	<u>Acidic soils</u>			
	Grey, brown, rarely black soils	Waterford (Wa)	VEAD, VEAB	VEAE
	Brown or grey with bleached A horizon (A2j/e)	Bridge (Br)	VEAB, VEAD	
<b>1.8 Cracking, self-mulching clays</b>				
1.8.1	Black soils that are alkaline and calcic	Blenheim (Bm)	VEAE	
1.8.2	Black soils that re alkaline but not calcic	Cooeeimbardi (Cb)	VEAE	
1.8.3	Browns soils that are strongly acidic to neutral, mottled and may be sodic	Payne (Pn)	VEAB	VEAD
<i>Group 2 – Basalt soils on Albert Basalt (Tfa) or Tertiary Volcanics (Tv)</i>				
<b>2.1 Very shallow to shallow soils (depth &lt;0.5m)</b>				
2.1.1	Soils with weak pedologic organisation apart from an A horizon	Sarabah Tenosol Variant (SaTv)	TECY	TEBF
2.1.2	Black or brown, uniformly fine, non-cracking, structured clay soils	Sarabah (Sa)	DEAE, DEAB	
2.1.3	Black and brown cracking clays	Gorman (Go)	VEAE, VEAB	
<b>2.2 Moderately deep soils (depth 0.5-1.0m)</b>				
2.2.1	Red, uniformly fine clay soils	Telemon (Tm)	DEAA	
2.2.2	Black and brown non-cracking clay soils	Tartar Shallow Phase (TtSp)	DEAE, DEAB	
2.2.3	Black and brown cracking clays	Chinghee (Ch)	VEAE, VEAB	
<b>2.3 Deep soils (depth 1.0-1.5m)</b>				
2.3.1	Black and brown non-cracking clay soils	Tartar (Tt)	DEAE, DEAB	DEAD
2.3.2	Black and brown (rarely grey) cracking clays – self-mulching	Lindesay (Li)	VEAE, VEAB	VEAD
2.3.3	Black and brown cracking clays – epipedal	Chinghee (Ch)	VEAE	VEAB
<b>2.4 Very deep soils (depth &gt;1.5m)</b>				
2.4.1	Black and brown non-cracking clay soils	Tartar (Tt)	DEAE, DEAB	DEAD
2.4.2	Black and brown cracking clays – self-mulching	Glenapp (Gp)	VEAE	
2.4.3	Black and brown cracking clays – epipedal	Palen (Pa)	VEAE	VEAB
2.4.4	Grey cracking clays	Lindesay (Li)	VEAD	
<i>Group 3 – Basalt soils on Beechmont and Hobwee Basalt (Tlb/Tlh) or basalt/dolerite intrusives (Tid)</i>				
<b>3.1 Very shallow to moderately deep soils on crests and ridges of hills and mountains</b>				
3.1.1	Red and black (rarely brown) uniformly fine soils	Cainbale (Ce)	DEAE	DEAA, DEAB
3.1.2	Soils with weak pedologic organisation apart from an A horizon	Sarabah Tenosol Variant (SaTv)	TECY	TEBF
<b>3.2 Shallow to moderately deep soils on benches and in valley flats</b>				

		SPC Name	Primary ASC	Secondary ASC
3.2.1	Black uniformly fine soils	Wonglepong (Wo)	DEAE	VEAE
<b>3.3 Deep to very deep, red (rarely brown) Ferrosols and Dermosols</b>				
3.3.1	Red, uniformly fine soils	Tamborine (Ta)	FEAA	DEAA
<i>Group 4 – Soils on Tertiary colluvium and Tertiary/Quaternary residual deposits (Qr/TQr/TQcb)</i>				
<b>4.1 Soils derived from basalt colluvium</b>				
4.1.1	Shallow to moderately deep - black & brown cracking/non-cracking and uniformly fine clay soils	Wonglepong (Wo)	VEAE	DEAE, DEAB
4.1.2	Deep to very deep soils – self-mulching	Glenapp (Gp)	VEAE	
4.1.3	Deep to very deep soils – epipedal	Palen (Pa)	VEAE	DEAE
<b>4.2 Soils derived from other colluvium</b>				
4.2.1	Moderately deep to deep, grey soils formed on rhyolite or sandstone colluvium	Ernest (Er)	DEAD	KUAD
4.2.2	Deep to very deep, black, clay soils formed on siltstone colluvium	Shaws (Sh)	DEAE	DEAB
<i>Group 5 – Soils formed on Rhyolite or Granophyre (Tfg, Tfg/ri, Tfg/re, Tbsr, Tbgr)</i>				
<b>5.1 Very shallow to moderately deep soils</b>				
5.1.1	Black or brown sandy loam to clay loam soils (slopes and crests of rises to mountains)	Barney (Ba)	TECY	TEAW, RUCY
<b>5.2 Moderately deep to deep soils</b>				
5.2.1	Clay loam to clay soils on rolling-steep low hills, hills & mountains	Philp (Pp)	DEAB	DEAA, DEAE
<i>Group 6 – Soils formed on the Marburg Subgroup (Jbmk, Jbmg, Jbmh/Jbm)</i>				
<b>6.1 Very shallow or shallow soils (&lt;0.5m deep)</b>				
6.1.1	Red soils	Cedar Vale (Cv)	CHAA, DEAA	KUAA, SOAA
6.1.2	Brown, yellow and grey soils	Mundoolun (Mu)	CHAB, CHAD	KAAB, DEAB
6.1.3	Soils with weak pedologic organisation	Woollaman (Wm)	TECY, TEAW	TEIO, RUCY
<b>6.2 Moderately deep soils (0.5 to &lt;1.0m deep)</b>				
6.2.1	Acidic to neutral red soils	Rathdowney (Ra)	CHAA	DEAA, SOAA
6.2.2	Strongly acidic red soils	Flanagan (Fl)	KUAA	KAAA
6.2.3	Brown and yellow texture contrast soils – bleached but not sodic	Birnam (Bi)	CHAB, CHAC	CHAE, KUAB
6.2.4	Brown and yellow texture contrast soils – sodic	Koukandowie (Kk)	SOAB, SOAC	CHAC, KUAC
6.2.5	Brown & yellow gradational/uniform soils	Glenoake (Gl)	DEAB	DEAC
6.2.6	Grey texture contrast soils – not sodic, not bleached	Stockleigh (St)	CHAD	KUAD
6.2.7	Grey texture contrast soils – not sodic, bleached	Pine Vale (Pv)	CHAD, KUAD	
6.2.8	Grey texture contrast soils – sodic and bleached	Lowood (Lw)	SOAD, CHAD	KUAD
<b>6.3 Deep to very deep soils (&gt;1.0m deep)</b>				
6.3.1	<u>Red soils</u>			
	Strongly acidic red soils	Flanagan (Fl)	DEAA, CHAA	KUAA, SOAA
	Acidic to neutral red soils	Rathdowney	CHAA	DEAA, SOAA
6.3.2	<u>Brown or yellow texture contrast soils</u>			

		SPC Name	Primary ASC	Secondary ASC
	Yellow, not-sodic	Birnam (Bi)	CHAC	CHAE
	Brown, not sodic, bleached, neutral to alkaline	Knapp (Kn)	CHAB	
	Brown, not sodic, bleached, acidic	Knapp Acidic Phase (KnAp)	KUAB	
	Brown, not sodic, not bleached, neutral to alkaline	Hardgrave (Ha)	CHAB	
	Sodic soils	Koukandowie (Kk)	SOAB	CHAB (Sodic)
6.3.3	<u>Brown gradational/uniform soils</u>			
	Not sodic	Dulbolla (Db)	DEAB	DEAC
	Sodic	Dulbolla Sodic Phase (DbSp)	DEAB	
6.3.4	<u>Grey texture contrast soils</u>			
	Not sodic, not bleached	Stockleigh (St)	CHAD	KUAD
	Not sodic, bleached	Pine Vale (Pv)	CHAD, KUAD	
	Sodic and bleached	Lowood (Lw)	SOAD, CHAD	KUAD
<b>6.4 Deep to very deep cracking clays on siltstone</b>				
6.4.1	Brown and black, alkaline, calcic soils	Kagaru (Ka)	VEAB, VEAE	
6.4.2	Brown, black and grey acidic to neutral soils	Gould (Gd)	VEAB, VEAE	VEAD
<b>6.5 Moderately deep to very deep, non-cracking grey clays</b>		Richards (Ri)	DEAD	
<i>Group 7 – Soils formed on Walloon Coal Measures (Jw)</i>				
<b>7.1 Shallow to moderately deep soils (&lt;1.0m deep)</b>				
7.1.1	Soils with weak pedologic organisation	Woollaman (Wm)	TEAW, TECY	
7.1.2	Red texture contrast soils	Drynian (Dn)	CHAA, KUAA	CHAC
7.1.3	Brown texture contrast soils - neutral to alkaline	Brabazon (Bz)	CHAB	
7.1.4	Brown texture contrast soils – acidic	Brabazon Acidic Variant (BzAv)	KUAB	
7.1.5	Black, non-cracking, uniformly fine soils - neutral to strongly alkaline	Edendale (Ed)	DEAE	
7.1.6	Black, uniformly fine, non-cracking soils - acidic	Edendale Acidic Variant (EdAv)	DEAE	
7.1.7	Grey, non-cracking, uniformly fine soils - slightly acidic to strongly alkaline	Lillydale (Ld)	DEAD	
7.1.8	Grey, non-cracking, bleached, uniformly fine and gradational soils - strongly acidic to neutral	Lillydale Acidic Phase (LdAp)	DEAD	
7.1.9	Red and brown, uniformly fine soils over brown, yellow or grey subsoils - neutral to alkaline	Nindooibah (Ni)	DEAA, DEAB	
7.1.10	Red and brown, uniformly fine soils over brown, yellow or grey subsoils - acidic	Nindooibah Acidic Variant (NiAv)	DEAA, DEAB	
7.1.11	Red and brown, uniformly fine soils with matching subsoils	Josephville (Jo)	DEAA, DEAB	
<b>7.2 Deep to very deep soils (&gt;1.0m deep)</b>				
7.2.1	Red and brown, non-cracking, uniformly fine soils - neutral to strongly alkaline	Nindooibah Deep Phase (NiDp)	DEAA, DEAB	
7.2.2	Red and brown, non-cracking, uniformly fine soils - strongly acidic	Nindooibah Acidic Variant (NiAv)	DEAA, DEAB	
7.2.3	Black, non-cracking, uniformly fine soils - neutral to strongly alkaline	Edendale (Ed)	DEAE	

		SPC Name	Primary ASC	Secondary ASC
7.2.4	Grey, non-cracking, uniformly fine soils - slightly acidic to strongly alkaline	Lillydale (Ld)	DEAD	
7.2.5	Grey, non-cracking, bleached, uniformly fine and gradational soils - strongly acidic to neutral	Lillydale Acidic Phase (LdAp)	DEAD	
7.2.6	Red, texture contrast soils - acidic to strongly acidic	Drynan Deep Variant (DnDv)	CHAA	KUAA
7.2.7	Red and calcic texture contrast soils - strongly alkaline	Drynan Alkaline Variant (DnAv)	CHAA	
7.2.8	Brown, black or grey texture contrast soils (non-sodic) - neutral to strongly alkaline	Laravale (Lv)	CHAB	CHAE, CHAD
7.2.9	Grey texture contrast soils - not-sodic	Brennan (Be)	CHAD	KUAD
7.2.10	Grey or brown texture contrast soils - sodic	Saville (Sv)	SOAD	SOAB
<b>7.3 Deep to very deep cracking clays on siltstone</b>				
7.3.1.	Brown and black, alkaline, calcic soils	Kagaru (Ka)	VEAB, VEAE	
7.3.2	Brown, black and grey acidic to neutral soils	Gould (Gd)	VEAB, VEAE	
<i>Group 8 – Soils formed on Tertiary Sediments (Ts)</i>				
<b>8.1 Brown and red gradational or uniformly fine soils (neutral)</b>		Dunsinane (Ds)	DEAA, DEAB	KAAB
<b>8.2 Brown, acidic texture contrast soils</b>		Brabazon Acidic Variant (BzAv)	KUAB	
<i>Group 9 – Soils formed on the Chillingham Volcanics (Rch)</i>				
<b>9.1 Brown, black or red gradational and uniformly fine soils</b>		Philp (Pp)	DEAB	DEAA, DEAE
<b>9.2 Grey gradational and uniformly fine soils</b>		Ernest (Er)	DEAD	KUAD
<i>Group 10 – Soils formed on the Ipswich Coal Measures (Ri)</i>				
<b>10.1 Soils with weak pedologic organisation and B2 horizons with &lt;15% clay</b>		Yarrabilba (Ya)	TEAW, TECY	TEIO, RUCY
<b>10.2 Red, acidic texture contrast soils</b>		Kooralbyn (Ko)	CHAB, KUAB	CHAA
<b>10.3 Grey and yellow texture contrast soils</b>		Clutha (Cl)	KUAD, KUAC	DEAD
<i>Group 11 – Soils formed on the Woogaroo Subgroup (Rlbw)</i>				
<b>11.1 Soils with weak pedologic organisation and B2 horizons with &lt;15% clay</b>		Yarrabilba (Ya)	TEAW, TECY	TEIO, RUCY
<b>11.2 Moderately deep to deep soils (0.5-1.5m deep)</b>				
11.2.1	Brown (rarely red) texture contrast soils	Kooralbyn (Ko)	CHAB, KUAB	CHAA
11.2.2	Sodic brown texture contrast soils	Koukandowie (Kk)	SOAB	
11.2.3	Grey and yellow texture contrast soils	Clutha (Cl)	CHAC, CHAD	KUAD, KUAC
11.2.4	Sodic grey texture contrast soils	Lowood (Lw)	SOAD	
<b>11.3 Very deep soils (&gt;1.5m deep)</b>				
11.3.1	Brown (rarely red) texture contrast soils	Kooralbyn Deep Phase (KoDp)	KUAB	
11.3.2	Grey and yellow texture contrast soils	Clutha Deep Variant (ClDv)	KUAD, CHAD	CHAC
11.3.3	Sodic brown texture contrast soils	Koukandowie (Kk)	SOAB	
<i>Group 12 – Soils formed on the Neranleigh-Fernvale Beds (DCf, DCf/w, DCf/g, DCf/c, DCf/mc)</i>				
<b>12.1 Very shallow to shallow soils (&lt;0.5m deep)</b>				
12.1.1	Shallow, poorly developed, acidic to neutral soils	Ferny (Fy)	TECY, TEAW	RUCY, RUHH

		<b>SPC Name</b>	<b>Primary ASC</b>	<b>Secondary ASC</b>
12.1.2	Strongly acidic, grey and brown gradational and texture contrast soils	Corbould (Cd)	KAAD, KAAB	KUAB, KUAC
12.1.3	Acidic, black, uniformly medium soils	Neranleigh Shallow Variant (NrSv)	DEAE	
<b>12.2 Moderately deep to deep soils (0.5-1.5m deep)</b>				
12.2.1	Strongly acidic grey and brown gradational and texture contrast soils	Corbould (Cd)	KAAD, KAAB	KUAB, KUAC
12.2.2	Acidic to neutral red and brown gradational or uniformly fine soils	Neranleigh (Nr)	DEAB, DEAA	DEAC
<i>Group 13 – Soils formed on the Mount Barney Beds (Cy)</i>				
<b>13.1 Shallow, poorly developed acidic to neutral soils</b>		Ferny (Fy)	TECY	
<b>13.2 Grey and yellow texture contrast soils</b>		Clutha (Cl)	CHAC, CHAD	KUAD, KUAC
<i>Group 14 – Soils formed on the Beaudesert Beds (Te/1, Te/2, Te/3)</i>				
<b>14.1 Moderately deep soils (0.5-1.0m deep)</b>				
14.1.1	Soils with weak pedologic organisation	Woollaman (Wn)	TEAW, TECY	
14.1.2	Red acidic to neutral texture contrast soils	Drynian (Dn)	CHAA, KUAA	CHAC
14.1.3	Red, strongly alkaline and calcic texture contrast soils	Drynian Alkaline Variant (DnAv)	CHAA	
14.1.4	Red and brown, uniformly fine soils with matching subsoils	Josephville (Jo)	DEAA, DEAB	
14.1.5	Red and brown, neutral to alkaline, uniformly fine soils over brown, yellow or grey subsoils	Nindooibah (Ni)	DEAA, DEAB	
<b>14.2 Deep to very deep soils (&gt;1.0m deep)</b>				
14.2.1	Brown, black or grey neutral to strongly alkaline texture contrast soils (non-sodic)	Laravale (Lv)	CHAB	CHAE, CHAD
14.2.2	Grey texture contrast soils - not-sodic	Brennan (Be)	CHAD	KUAD
14.2.3	Red and brown, neutral to strongly alkaline non-cracking, uniformly fine soils	Nindooibah Deep Phase (NiDp)	DEAA, DEAB	
14.2.4	Red and brown, strongly acidic non-cracking, uniformly fine soils	Nindooibah Acidic Variant (NiAv)	DEAA, DEAB	
14.2.5	Grey or brown sodic texture contrast soils	Saville (Sv)	SOAD, SOAB	
<b>14.3 Cracking clays on siltstone</b>				
14.3.1	Brown and black, alkaline, calcic soils	Kagaru (Ka)	VEAB, VEAE	
14.3.2	Brown, black and grey acidic to neutral soils	Gould (Gd)	VEAB, VEAE	



## Appendix 3: Soil Morphological and Analytical Data

Unless otherwise stated, all soils were analysed by Queensland Government laboratories at Analytical Services, Ecosciences Precinct, Dutton Park, Brisbane. Explanation of laboratory methods used and their codes can be found in Rayment and Lyons (2011).

Where appropriate laboratory results have been reported on an oven dry basis (where necessary they have been converted from air dry using the conversion provided by Baker & Eldershaw (1993)).

Due to project constraints, six of the sampled 19 LARA sites have chemistry from only a limited number of horizons and no bulk surface sample (these are marked with a (P) in Table A1).

**Table A1. Soil Profile Classes analysed by geological group**

SPC represented	Project	Site No.	SPC represented	Project	Site No.
<b>Soils on Quaternary Alluvium</b>			<b>Soils on Neogene to Pleistocene colluvium</b>		
<i>Basel</i> (Bs)	LARA	9014 (P)	<i>Glenapp</i> (Gp)	LARA	9008 (P)
<i>Basel</i> (Bs)	SEQ	402	<i>Glenapp</i> (Gp)	LARA	9016 (P)
<i>Bell</i> (SEQ) (Bl)	LARA	9001	<i>Wonglepong</i> (Wo)	LARA	9010 (P)
<i>Bell</i> (SEQ) (Bl)	LARA	9006 (P)			
<i>Bell</i> (SEQ) (Bl)	SEQ	95	<b>Soils on Neogene basalts</b>		
<i>Bell</i> (SEQ) (Bl)	SEQ	115	<i>Glenapp</i> (Gp)	LARA	9004 (P)
<i>Bell</i> (SEQ) (Bl)	SEQ	383	<i>Glenapp</i> (Gp)	LARA	9007
<i>Bell</i> (SEQ) (Bl)	SEQ	393	<i>Tamborine</i> (Ta)	SOC	11
<i>Blenheim</i> (Bm)	LARA	9002			
<i>Blenheim</i> (Bm)	LARA	9009	<b>Soils on Beaudesert Beds</b>		
<i>Blenheim</i> (Bm)	LARA	9012	<i>Saville</i> (Sv)	LARA	9017 (P)
<i>Blenheim</i> (Bm)	LARA	9013 (P)			
<i>Blenheim</i> (Bm)	LARA	9015 (P)	<b>Soils on Walloon Coal Measures</b>		
<i>Blenheim</i> (Bm)	LARA	9018 (P)	<i>Gould</i> (Gd)	MFM	425
<i>Bremer Buried Phase</i> (BBp)	LARA	9003 (P)			
<i>Gunyah</i> (Gy)	LARA	9005	<b>Soils on Koukandowie Formation</b>		
<i>Hooper</i> (Hr)	LARA	9011 (P)	<i>Koukandowie</i> (Kk)	SEQ	152
<i>Kilmoylar</i> (Km)	LARA	9000 (P)			
<i>Kilmoylar</i> (Km)	SEQ	162			
<i>Sippel</i> (Sl)	SPFD	108			
<i>Waterford</i> (Wa)	SEQ	317			

## References

Baker, DE and Eldershaw, VJ 1993, *Interpreting soil analyses – for agricultural land use in Queensland*, Queensland Department of Primary Industries, Brisbane.

Rayment, GE and Lyons, DJ 2011, *Soil Chemical Methods - Australasia*, CSIRO Publishing Melbourne.



Project LARA Site 9000					
Site characteristics					
Slope %:	2	Slope type	Estimate		
Morphological type:	Flat	Landform element:	Plain		
Landform pattern:	Flood plain	Geology:	Qa-SEQ: Clay, silt, sand, gravel; flood plain alluvium		
Observation type:	Relatively undisturbed soil core	Soil name:	Kilmoylar		
Location measurement method:	Averaging GPS	Depth to water:	N/A		
Runoff:	Very slow	Microrelief:	Zero or none		
Permeability:	Moderately permeable 50-500mm/day	Microrelief component:	N/A		
Drainage:	Moderately well drained	Substrate lithology:	Sandstone		
Rock outcrop:	No bedrock exposed	Surface condition:	Firm		
Surface coarse fragments:	No coarse fragments	Erosion:	No type recorded - old data only		
Disturbance:	Complete clearing - pasture - cultivation at some stage				

Site location					
Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-28.25612	152.74572	56	475058	6874399

Soil classification			
Australian Soil Classification	ASC confidence	Great Soil Group	Principal Profile Form
Haplic, Eutrophic, Brown Chromosol; medium, non-gravelly, clay loamy, clayey, very deep.	All necessary analytical data is available.	Brown Podzolic	Db

Vegetation		
Community name	<i>Eucalyptus tereticornis</i> woodland, open woodland	
Stratum	Species	Common name
Tallest	<i>Eucalyptus tereticornis</i>	blue gum, forest red gum
	<i>Allocasuarina torulosa</i>	forest she-oak

Profile morphology				
No	Horizon	Upper depth (m)	Lower depth (m)	Description
1	A1	0	0.2	Dark brown (10YR 3/3) moist; zero mottles; fine sandy clay loam; no coarse fragments; weak 10-20mm angular blocky structure; no segregations; moist, weak strength; no cutans; moderately permeable 50-500mm/day; well drained; clear to:
2	B21	0.2	1.1	Strong brown (7.5YR 4/6) moist; very few <2% fine <5mm orange mottles; very few <2% fine <5mm grey mottles; fine sandy light medium clay; no coarse fragments; moderate 20-50mm prismatic structure; moderate 5-10mm subangular blocky structure; no segregations; moist, weak strength; few faint slickenside cutans; moderately permeable 50-500mm/day; moderately well drained; diffuse to:
3	B22	1.1	1.7	Strong brown (7.5YR 4/6) moist; very few <2% fine <5mm orange mottles; very few <2% fine <5mm grey mottles; fine sandy medium clay; no coarse fragments; moderate 20-50mm prismatic structure; very few <2% fine <2mm manganiferous soft segregations; moist, firm strength; few faint slickenside cutans; moderately permeable 50- 500mm/ day; moderately well drained.

Laboratory test results LARA 9000							
				Sample	1	2	3
				Upper depth (m)	0	0.2	1.1
				Lower depth (m)	0.1	0.3	1.2
Group	Method	Code	Units	Bulked Sample	N	N	N
Profile General	pH - 1:5 water	4A1	pH		-	6.1	6.4
	EC - 1:5 water	3A1	dS/m		-	0.01	0.01
	Cl - 1:5 water - automated	5A2	mg Cl/kg		-	<20	<20
	Water sol NO3 - automated	7B1	mg/kg		-	<1	<1
	Coarse sand	2Z2_CS	%		16	14	12
	Fine sand	2Z2_FS	%		58	58	53
	Silt	2Z2_Silt	%		19	19	13
	Clay	2Z2_Clay	%		12	12	22
	Moisture content - air-dry	2A1	%		<1.5	<1.5	1.7
	Moisture content - 15 bar	2E1	%		9.5	8.3	14.2
	Moisture content - 1/3 bar	2E2	%		24.7	20.3	24.5
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1			0.6	0.76	0.74
	Dispersion ratio (R2)	2Z1_R2			0.24	0.4	0.27
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g			2.33	5.92
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g			0.83	3.10
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g			<0.080	0.15
	Exch Na - NH4Cl no wash adjusted	15A3_Na	meq/100g			<0.080	0.147
	Exch K - NH4Cl no wash	15A1_K	meq/100g			0.5	0.36

Project LARA Site 9001						
Site characteristics						
Slope %:	0.5		Slope type	Estimate		
Morphological type:	Flat		Landform element:	Plain		
Landform pattern:	Flood plain		Geology:	Qa-SEQ: Clay, silt, sand, gravel; flood plain alluvium		
Observation type:	Relatively undisturbed soil core		When described:	26/09/2017		
Location measurement method:	Averaging GPS		Soil name:	Bell (SEQ)		
Runoff:	Very slow		Depth to water:	N/A		
Permeability:	Moderately permeable 50-500mm/day		Microrelief:	Zero or none		
Drainage:	Moderately well drained		Microrelief component:	N/A		
Rock outcrop:	No bedrock exposed		Substrate lithology:	Altered Substrate Materials		
Surface coarse fragments:	No coarse fragments		Surface condition:	Periodic cracking		
Disturbance:	Cultivation - Irrigated, past or present		Erosion:	N/A		
Site location						
Datum	Latitude (dd)		Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-28.28426		152.79192	56	479595	6871290
Soil classification						
Australian Soil Classification			ASC confidence	Great Soil Group	Principal Profile Form	
Haplic, Epipedal, Black Vertosol; non-gravelly, fine, medium fine, very deep.			All necessary analytical data is available	Black Earth	Ug5.17	
Profile morphology						
No	Horizon	Upper depth (m)	Lower depth (m)	Description		
1	A1p	0	0.32	Very dark brown (10YR 2/2) moist; zero mottles; fine sandy light clay; no coarse fragments; moderate 2-5mm polyhedral structure; no segregations; moist, weak strength; no cutans; moderately permeable 50-500mm/day; moderately well drained; clear to:		
2	B21	0.32	1.06	Very dark greyish brown (10YR 3/2) moist; zero mottles; fine sandy medium clay; no coarse fragments; moderate 2-5mm lenticular structure; strong 2-5mm polyhedral structure; no segregations; moist, firm strength; common distinct slickenside cutans; moderately permeable 50-500mm/day; moderately well drained; diffuse to:		
3	D	1.06	1.8	Dark yellowish brown (10YR 3/4) moist; zero mottles; fine sandy light medium clay; no coarse fragments; strong 5-10mm polyhedral structure; moderate 2-5mm polyhedral structure; no segregations; moist, firm strength; common distinct slickenside cutans; moderately permeable 50-500mm/day; moderately well drained.		

Laboratory test results LARA 9001											
				Sample	1	2	3	4	5	6	7
				Upper depth (m)	0	0	0.2	0.5	0.8	1.1	1.4
				Lower depth (m)	0.1	0.1	0.3	0.6	0.9	1.2	1.5
Group	Method	Code	Units	Bulked Sample	Y	N	N	N	N	N	N
Profile General	pH - 1:5 water	4A1	pH		5.9	5.6	6.2	6.9	7.2	7.4	7.5
	EC - 1:5 water	3A1	dS/m		0.19	0.26	0.1	0.12	0.12	0.12	0.11
	Cl - 1:5 water - automated	5A2	mg Cl/kg		226	338	126	61	76	75	74
	Water sol NO3 - automated	7B1	mg/kg		9	9	<1	<1	<1	<1	<1
	OC - Walkley/Black	6A1	%		1.4						
	Total N - Kjeldahl, automated	7A2	%		0.137						
	Coarse sand	2Z2_CS	%			13	13	7	7	9	18
	Fine sand	2Z2_FS	%			43	39	32	37	41	40
	Silt	2Z2_Silt	%			25	26	18	16	16	16
	Clay	2Z2_Clay	%			21	24	49	40	35	28
	Total P - Kjeldahl P (KP)	9A3a	%		0.099						
	Moisture content - air-dry	2A1	%			2.1	2.2	4	3.8	3.3	3.5
	Moisture content - 15 bar	2E1	%			14.6	15.1	27.3	23.1	20.5	20
	Moisture content - 1/3 bar	2E2	%			26.4	26.1	39.6	36.4	33	34.8
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1				0.64	0.5	0.43	0.45	0.52	0.55
	Dispersion ratio (R2)	2Z1_R2				0.24	0.21	0.19	0.18	0.2	0.18
	CaPhos Extr S - ICPAES	10B3	mg/kg		17						
	P (BiCarb Extr)- automated	9B2	mg/kg		64						
Alcoholic Cations	Exch Ca - Alch NH4Cl pH8.5 pre wash	15C1_Ca	meq/100g							19.2	18.8
	Exch Mg - Alch NH4Cl pH8.5 pre wash	15C1_Mg	meq/100g							4.32	4.23
	Exch Na - Alch NH4Cl pH8.5 pre wash	15C1_Na	meq/100g							1.25	0.98
	Exch K - Alch NH4Cl pH8.5 pre wash	15C1_K	meq/100g							0.41	0.57
	CEC - Alch NH4Cl pH8.5 pre wash	15C1_CEC	meq/100g							25	26
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g			7.57	8.86	20.7	21.8		
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g			4.22	4.02	5.79	5234		
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g			1.15	0.54	1.57	1.82		
	Exch Na - NH4Cl no wash adjusted	15A3_Na	meq/100g			0.20	0.171	1.39	1.60		
	Exch K - NH4Cl no wash	15A1_K	meq/100g			0.14	0.15	0.51	0.47		

Laboratory test results LARA 9001 (continued)											
				Sample	1	2	3	4	5	6	7
				Upper depth (m)	0	0	0.2	0.5	0.8	1.1	1.4
				Lower depth (m)	0.1	0.1	0.3	0.6	0.9	1.2	1.5
Group	Method	Code	Units	Bulked Sample	Y	N	N	N	N	N	N
Other Cations	Exchangeable Sodium Percentage (ESP)	15N1	%							5.1	3.8
	Base Saturation Percentage (BSP)	15L1	%							102	96
	Ca/Mg ratio	15M1_Ca/Mg								4.45	4.46
	Calcium to cation exchange capacity ratio	15M1Ca/CE C								0.782	0.738
	Magnesium to cation exchange capacity ratio	15M1_Mg/CE C								0.176	0.166
Other Bulk	DTPA Extr Cu	12A1_Cu	mg/kg		1.1						
	DTPA Extr Fe	12A1_Fe	mg/kg		110						
	DTPA Extr Mn	12A1_Mn	mg/kg		47.8						
	DTPA Extr Zn	12A1_Zn	mg/kg		4.5						
	Extr K - HCl	18B1	mg K/kg		0.15						
	P (Acid) - automated	9G2	mg P/kg		250						

Project LARA Site 9002					
Site characteristics					
Slope %:	0		Slope type:	Estimate	
Morphological type:	Flat		Landform element:	Plain	
Landform pattern:	Flood plain		Geology:	Qa-SEQ: Clay, silt, sand, gravel; flood plain alluvium	
Observation type:	Relatively undisturbed soil core		When described:	26/09/2017	
Location measurement method:	Averaging GPS		Soil name:	Blenheim	
Runoff:	No runoff		Depth to water:	N/A	
Permeability:	Moderately permeable 50-500mm/day		Microrelief:	Melonhole gilgai	
Drainage:	Moderately well drained		Microrelief component:	Not recorded	
Rock outcrop:	No bedrock exposed		Substrate lithology:	Basalt	
Surface coarse fragments:	No coarse fragments		Surface condition:	Self-mulching	
Disturbance:	Complete clearing - pasture - cultivation at some stage		Erosion:	N/A	

Site location					
Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-28.23314	152.88473	56	488691	6876966

Soil classification			
Australian Soil Classification	ASC confidence	Great Soil Group	Principal Profile Form
Endocalcareous, Self-mulching, Black Vertosol; non-gravelly, medium fine, medium fine, very deep.	All necessary analytical data is available		Ug5.17

Vegetation		
Community name	<i>Eucalyptus tereticornis</i> woodland, open woodland	
Stratum	Species	Common name
Tallest	<i>Eucalyptus tereticornis</i>	blue gum, forest red gum

Profile morphology				
No	Horizon	Upper depth (m)	Lower depth (m)	Description
1	A1	0	0.21	Black (10YR 2/1) moist; zero mottles; medium heavy clay; very few <2% subangular basalt medium pebbles 6-20 mm ferruginized; strong 2-5mm polyhedral structure; no segregations; moist, firm strength; no cutans; moderately permeable 50-500mm/day; moderately well drained; clear to:
2	B21	0.21	1.8	Very dark brown (10YR 2/2) moist; zero mottles; medium heavy clay; no coarse fragments; strong 2-5mm lenticular structure; very few <2% medium 2-6mm calcareous nodules; moist, weak strength; many prominent slickenside cutans; moderately permeable 50-500mm/day; moderately well drained.

Laboratory test results LARA 9002											
				Sample	1	2	3	4	5	6	7
				Upper depth (m)	0	0	0.21	0.5	0.8	1.1	1.4
				Lower depth (m)	0.1	0.1	0.31	0.6	0.9	1.2	1.5
Group	Method	Code	Units	Bulked Sample	Y	N	N	N	N	N	N
Profile General	pH - 1:5 water	4A1	pH		6.3	6.1	6.6	7.7	8.15	8.33	8.25
	EC - 1:5 water	3A1	dS/m		0.07	0.1	0.08	0.26	0.58	0.84	0.9
	Cl - 1:5 water - automated	5A2	mg Cl/kg		25	46	40	304	832	1211	1368
	Water sol NO3 - automated	7B1	mg/kg		1	1	<1	<1	<1	<1	<1
	OC - Walkley/Black	6A1	%		2.9						
	Total N - Kjeldahl, automated	7A2	%		0.26						
	Coarse sand	2Z2_CS	%			4	4	2	<1.0	<1.0	<1.0
	Fine sand	2Z2_FS	%			18	17	9	13	23	20
	Silt	2Z2_Silt	%			21	26	13	17	26	33
	Clay	2Z2_Clay	%			56	53	76	72	57	48
	Total P - Kjeldahl P (KP)	9A3a	%		0.112						
	Moisture content - air-dry	2A1	%			7.1	6.4	8.1	7.6	7.2	6.9
	Moisture content - 15 bar	2E1	%			40.8	38.8	48.8	45.8	37.6	36.6
	Moisture content - 1/3 bar	2E2	%			58.2	56	68.6	65	57.9	53.3
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1				0.49	0.59	0.65	0.63	0.64	0.61
	Dispersion ratio (R2)	2Z1_R2				0.25	0.35	0.41	0.34	0.31	0.24
	CaPhos Extr S - ICPAES	10B3	mg/kg		11						
	P (BiCarb Extr)- automated	9B2	mg P/kg		193						
Alcoholic Cations	Exch Ca - Alch NH4Cl pH8.5 pre wash	15C1_Ca	meq/100g					31.2	29.6	26.4	28.1
	Exch Mg - Alch NH4Cl pH8.5 pre wash	15C1_Mg	meq/100g					30.1	29.6	25.1	27.6
	Exch Na - Alch NH4Cl pH8.5 pre wash	15C1_Na	meq/100g					4.85	6.41	6.94	7.04
	Exch K - Alch NH4Cl pH8.5 pre wash	15C1_K	meq/100g					0.32	0.26	0.26	0.30
	CEC - Alch NH4Cl pH8.5 pre wash	15C1_CEC	meq/100g					65	62	54	57
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g			25.1	24.2				
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g			22.7	22.0				
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g			1.12	2.10				
	Exch Na - NH4Cl no wash adjusted	15A3_Na	meq/100g			1.00	1.98				
	Exch K - NH4Cl no wash	15A1_K	meq/100g			1.84	0.48				

Laboratory test results LARA 9002 (continued)											
				Sample	1	2	3	4	5	6	7
				Upper depth (m)	0	0	0.21	0.5	0.8	1.1	1.4
				Lower depth (m)	0.1	0.1	0.31	0.6	0.9	1.2	1.5
Group	Method	Code	Units	Bulked Sample	Y	N	N	N	N	N	N
Other Cations	Exchangeable Sodium Percentage (ESP)	15N1	%					6.9	9.5	12	11.5
Other Bulk	DTPA Extr Cu	12A1_Cu	mg/kg		6.3						
	DTPA Extr Fe	12A1_Fe	mg/kg		291.3						
	DTPA Extr Mn	12A1_Mn	mg/kg		24.5						
	DTPA Extr Zn	12A1_Zn	mg/kg		2.6						
	Extr K - HCl	18B1	mg K/kg		1.3						
	P (Acid) - automated	9G2	mg P/kg		222						



Project LARA Site 9003					
Site characteristics					
Slope %:	0.5		Slope type	Abney level or clinometer and tape	
Morphological type:	Flat		Landform element:	Plain	
Landform pattern:	Flood plain		Geology:	Qa-SEQ: Clay, silt, sand, gravel; flood plain alluvium	
Observation type:	Relatively undisturbed soil core		When described:	26/09/2017	
Location measurement method:	Averaging GPS		Soil name:	Bremer Buried Phase	
Runoff:	Very slow		Depth to water:	N/A	
Permeability:	Moderately permeable 50-500mm/day		Microrelief:	Zero or none	
Drainage:	Moderately well drained		Microrelief component:	N/A	
Rock outcrop:	No bedrock exposed		Substrate lithology:	Altered substrate materials	
Surface coarse fragments:	No coarse fragments		Surface condition:	Periodic cracking; Firm	
Disturbance:	Cultivation - Irrigated, past or present		Erosion:	N/A	
Site location					
Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-28.23514	152.88886	56	489096	6876744
Soil classification					
Australian Soil Classification			ASC confidence	Great Soil Group	Principal Profile Form
Melanic, Eutrophic, Black Dermosol; thin, non-gravelly, clayey, clayey, very deep.			All necessary analytical data is available	NSG	Uf6.11
Vegetation					
Community name		Grevillea robusta			
Stratum		Species	Common name		
Tallest		Grevillea robusta	silky oak, southern silky oak		
		Acacia cunninghamii			
Profile morphology					
No	Horizon	Upper depth (m)	Lower depth (m)	Description	
1	A1	0	0.08	Very dark brown (10YR 2/2) moist; zero mottles; light clay; no coarse fragments; moderate 2-5mm subangular blocky structure; no segregations; moderately moist, very firm strength; no cutans; moderately permeable 50-500mm/day; moderately well drained; gradual to:	
2	B21	0.08	0.32	Very dark brown (10YR 2/2) moist; zero mottles; fine sandy light clay; no coarse fragments; moderate 2-5mm subangular blocky structure; no segregations; moderately moist, firm strength; no cutans; moderately permeable 50-500mm/day; moderately well drained; gradual to:	
3	D1	0.32	1.4	Very dark brown (10YR 2/2) moist; zero mottles; sandy clay loam; no coarse fragments; massive structure; no segregations; moderately moist, weak strength; no cutans; highly permeable >500mm/day; well drained; gradual to:	
4	D2	1.4	1.8	Black (10YR 2/1) moist; zero mottles; light medium clay; no coarse fragments; strong 2-5mm polyhedral structure; no segregations; moderately moist, weak strength; common faint slickenside cutans; moderately permeable 50- 500mm/day; moderately well drained.	

Laboratory test results LARA 9003							
				Sample	1	2	3
				Upper depth (m)	0	0.2	0.8
				Lower depth (m)	0.08	0.3	0.9
Group	Method	Code	Units	Bulked Sample	N	N	N
Profile General	pH - 1:5 water	4A1	pH		6.4	7	8
	EC - 1:5 water	3A1	dS/m		0.24	0.04	0.03
	Cl - 1:5 water - automated	5A2	mg Cl/kg		85	<20	<20
	Water sol NO3 - automated	7B1	mg/kg		59	2	<1
	Coarse sand	2Z2_CS	%		6	5	22
	Fine sand	2Z2_FS	%		50	52	54
	Silt	2Z2_Silt	%		34	29	15
	Clay	2Z2_Clay	%		16	21	14
	Moisture content - air-dry	2A1	%		4.6	4.5	4.1
	Moisture content - 15 bar	2E1	%		25.4	21.5	15.7
	Moisture content - 1/3 bar	2E2	%		42.7	40.2	33.7
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1			0.41	0.42	0.46
	Dispersion ratio (R2)	2Z1_R2			0.18	0.14	0.21
Alcoholic Cations	Exch Ca - Alch NH4Cl pH8.5 pre wash	15C1_Ca	meq/100g				22.8
	Exch Mg - Alch NH4Cl pH8.5 pre wash	15C1_Mg	meq/100g				10.8
	Exch Na - Alch NH4Cl pH8.5 pre wash	15C1_Na	meq/100g				0.51
	Exch K - Alch NH4Cl pH8.5 pre wash	15C1_K	meq/100g				0.21
	CEC - Alch NH4Cl pH8.5 pre wash	15C1_CEC	meq/100g				35
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g		22.5	25.2	
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g		13.4	12.3	
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g		0.3	0.30	
	Exch Na - NH4Cl no wash adjusted	15A3_Na	meq/100g		<0.080	0.30	
	Exch K - NH4Cl no wash	15A1_K	meq/100g		2.24	0.39	
Other Cations	Exchangeable Sodium Percentage (ESP)	15N1	%				1.5
	Base Saturation Percentage (BSP)	15L1	%				99
	Ca/Mg ratio	15M1_Ca/Mg					2.11
	Calcium to cation exchange capacity ratio	15M1_Ca/CEC					0.66
	Magnesium to cation exchange capacity ratio	15M1_Mg/CEC					0.312

Project LARA Site 9004					
Site characteristics					
Slope %:	6		Slope type:	Abney level or clinometer and tape	
Morphological type:	Lower slope		Landform element:	Footslope	
Landform pattern:	Low hills		Geology:	Albert Basalt: Olivine basalt	
Observation type:	Relatively undisturbed soil core		When described:	26/09/2017	
Location measurement method:	Averaging GPS		Soil name:	Glenapp	
Runoff:	Slow		Depth to water:	N/A	
Permeability:	Moderately permeable 50-500mm/day		Microrelief:	Zero or none	
Drainage:	Moderately well drained		Microrelief component:	N/A	
Rock outcrop:	No bedrock exposed		Substrate lithology:	Basalt	
Surface coarse fragments:	No coarse fragments		Surface condition:	Periodic cracking; Firm; Self-mulching	
Disturbance:	Complete clearing - pasture - cultivation at some stage		Erosion:	N/A	
Site location					
Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-28.25223	152.89142	56	489349	6874852
Soil classification					
Australian Soil Classification			ASC confidence	Great Soil Group	Principal Profile Form
Endocalcareous, Self-mulching, Black Vertosol; non-gravelly, medium fine, very fine, very deep.			All necessary analytical data is available	Black Earth	Ug5.15
Vegetation					
Community name		<i>Eucalyptus tereticornis</i> woodland, open woodland			
Stratum		Species	Common name		
Tallest		<i>Eucalyptus tereticornis</i>	blue gum, forest red gum		
Profile morphology					
No	Horizon	Upper depth (m)	Lower depth (m)	Description	
1	A1	0	0.02	Black (10YR 2/1) moist; very few <2% fine <5mm brown mottles; silty medium heavy clay; very few <2% subrounded basalt small pebbles 2-6 mm ferruginized; strong 5-10mm angular blocky structure; moderate 2-5mm subangular blocky structure; no segregations; moderately moist, firm strength; no cutans; moderately permeable 50-500mm/day; moderately well drained; sharp to:	
2	B21	0.02	0.65	Black (10YR 2/1) moist; zero mottles; heavy clay; very few <2% rounded basalt small pebbles 2-6 mm ferruginized; strong 2-5mm polyhedral structure; moderate 2-5mm lenticular structure; no segregations; moist, very firm strength; common prominent slickenside cutans; many roots; moderately permeable 50-500mm/day; moderately well drained; diffuse to:	
3	B22	0.65	1.14	Brown (10YR 4/3) moist; zero mottles; medium heavy clay; no coarse fragments; moderate 10-20mm subangular blocky structure; moderate 2-5mm subangular blocky structure; very few <2% medium 2-6mm calcareous nodules; moderately moist, strong strength; common distinct slickenside cutans; common roots; moderately permeable 50-500mm/day; moderately well drained; diffuse to:	
4	B23	1.14	1.6	Dark yellowish brown (10YR 3/4) moist; zero mottles; medium heavy clay; no coarse fragments; moderate 2-5mm lenticular structure; few 2-10% medium 2-6mm calcareous nodules; moderately moist, very firm strength; common prominent slickenside cutans; moderately permeable 50-500mm/day; moderately well drained.	

Laboratory test results LARA 9004							
				Sample	1	2	3
				Upper depth (m)	0.1	0.5	0.8
				Lower depth (m)	0.2	0.6	0.9
Group	Method	Code	Units	Bulked Sample	N	N	N
Profile General	pH - 1:5 water	4A1	pH		6.7	8.4	9.1
	EC - 1:5 water	3A1	dS/m		0.07	0.32	0.28
	Cl - 1:5 water - automated	5A2	mg Cl/kg		<20	53	22
	Water sol NO3 - automated	7B1	mg/kg		1	<1	<1
	Coarse sand	2Z2_CS	%		4	6	23
	Fine sand	2Z2_FS	%		24	18	35
	Silt	2Z2_Silt	%		29	24	16
	Clay	2Z2_Clay	%		53	57	28
	Moisture content - air-dry	2A1	%		5.6	5.9	4.4
	Moisture content - 15 bar	2E1	%		33	35.9	19.5
	Moisture content - 1/3 bar	2E2	%		50.3	51.6	33.6
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1			0.52	0.57	0.88
	Dispersion ratio (R2)	2Z1_R2			0.31	0.33	0.32
	Citrate/dithionite Extr Al	13C1_Al	%		0.3		
	Citrate/dithionite Extr Fe	13C1_Fe	%		3.4		
Alcoholic Cations	Exch Ca - Alch NH4Cl pH8.5 pre wash	15C1_Ca	meq/100g			22.7	13.8
	Exch Mg - Alch NH4Cl pH8.5 pre wash	15C1_Mg	meq/100g			26.6	18.5
	Exch Na - Alch NH4Cl pH8.5 pre wash	15C1_Na	meq/100g			3.31	3.26
	Exch K - Alch NH4Cl pH8.5 pre wash	15C1_K	meq/100g			0.20	0.10
	CEC - Alch NH4Cl pH8.5 pre wash	15C1_CEC	meq/100g			49	32
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g		23.1		
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g		19.9		
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g		1.31		
	Exch Na - NH4Cl no wash adjusted	15A3_Na	meq/100g		1.31		
	Exch K - NH4Cl no wash	15A1_K	meq/100g		0.3		
Other Cations	Exchangeable Sodium Percentage (ESP)	15N1	%			6.4	9.9
	Base Saturation Percentage (BSP)	15L1	%			102	108
	Ca/Mg ratio	15M1_Ca/Mg				0.852	0.746
	Calcium to cation exchange capacity ratio	15M1_Ca/CEC				0.438	0.419
	Magnesium to cation exchange capacity ratio	15M1_Mg/CEC				0.514	0.561

Project LARA Site 9005					
Site characteristics					
Slope %:	0		Slope type:	Estimate	
Morphological type:	Flat		Landform element:	Plain	
Landform pattern:	Flood plain		Geology:	Qa-SEQ: Clay, silt, sand, gravel; flood plain alluvium	
Observation type:	Relatively undisturbed soil core		When described:	27/09/2017	
Location measurement method:	Averaging GPS		Soil name:	Gunyah	
Runoff:	No runoff		Depth to water:	N/A	
Permeability:	Moderately permeable 50-500mm/day		Microrelief:	Zero or none	
Drainage:	Well drained		Microrelief component:	N/A	
Rock outcrop:	No bedrock exposed		Substrate lithology:	Altered substrate materials	
Surface coarse fragments:	No coarse fragments		Surface condition:	Firm; Periodic cracking	
Disturbance:	Cultivation - Irrigated, past or present		Erosion:	N/A	
Site location					
Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-28.18143	152.98672	56	498696	6882699
Soil classification					
Australian Soil Classification			ASC confidence	Great Soil Group	Principal Profile Form
Melanic, Eutrophic, Black Chromosol; medium, non-gravelly, loamy, clay loamy, very deep.			All necessary analytical data is available		Dd3.53
Vegetation					
Community name		Grevillea robusta			
Stratum		Species	Common name		
Tallest		Grevillea robusta	silky oak, southern silky oak		
		Casuarina cunninghamiana	river sheoak		
Profile morphology					
No	Horizon	Upper depth (m)	Lower depth (m)	Description	
1	A1	0	0.12	Very dark brown (10YR 2/2) moist; zero mottles; sandy loam; no coarse fragments; weak 5-10mm angular blocky structure; no segregations; moist, very weak strength; no cutans; highly permeable >500mm/day; rapidly drained; clear to:	
2	B21	0.12	0.65	Very dark brown (10YR 2/2) moist; zero mottles; clay loam, sandy; very few <2% rounded basalt medium pebbles 6-20 mm; weak 5-10mm angular blocky structure; no segregations; moderately moist, weak strength; no cutans; moderately permeable 50-500mm/day; well drained; gradual to:	
3	B22	0.65	1.75	Black (10YR 2/1) moist; zero mottles; clay loam, sandy; no coarse fragments; weak 5-10mm subangular blocky structure; no segregations; moist, weak strength; no cutans; moderately permeable 50-500mm/day; well drained.	

Laboratory test results LARA 9005												
					Sample	1	2	3	4	5	6	7
					Upper depth (m)	0	0	0.2	0.5	0.8	1.1	1.4
					Lower depth (m)	0.1	0.1	0.3	0.6	0.9	1.2	1.5
Group	Method	Code	Units	Bulked Sample	Y	N	N	N	N	N	N	N
Profile General	pH - 1:5 water	4A1	pH		7.2	7.4	6.7	7.5	7.7	7.9	7.8	
	EC - 1:5 water	3A1	dS/m		0.07	0.13	0.03	0.02	0.02	0.02	0.02	0.02
	Cl - 1:5 water - automated	5A2	mg Cl/kg		<20	40	<20	<20	<20	<20	<20	<20
	Water sol NO3 - automated	7B1	mg/kg		7	17	4	<1	<1	<1	<1	1
	OC - Walkley/Black	6A1	%		1.4							
	Total N - Kjeldahl, automated	7A2	%		0.122							
	Coarse sand	2Z2_CS	%			19	33	33	32	43	6	
	Fine sand	2Z2_FS	%			55	40	39	39	32	48	
	Silt	2Z2_Silt	%			18	18	18	17	15	24	
	Clay	2Z2_Clay	%			14	14	16	16	14	23	
	Total P - Kjeldahl P (KP)	9A3a	%		0.099							
	Moisture content - air-dry	2A1	%			4.1	3.2	3.6	3.8	3.8	4.6	
	Moisture content - 15 bar	2E1	%			16	13.7	14.2	15.1	14.1	19.2	
	Moisture content - 1/3 bar	2E2	%			34.1	27.9	27.1	30.6	25.4	33.6	
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1				0.46	0.5	0.57	0.63	0.66	0.64	
	Dispersion ratio (R2)	2Z1_R2				0.21	0.21	0.19	0.19	0.21	0.18	
	CaPhos Extr S - ICPAES	10B3	mg/kg		10							
	P (BiCarb Extr)- automated	9B2	mg P/kg		81							
Alcoholic Cations	Exch Ca - Alch NH4Cl pH8.5 pre wash	15C1_Ca	meq/100g			21.4		20.1	21.4	19	25.9	
	Exch Mg - Alch NH4Cl pH8.5 pre wash	15C1_Mg	meq/100g			12		9.3	10.4	9.90	13.6	
	Exch Na - Alch NH4Cl pH8.5 pre wash	15C1_Na	meq/100g			0.2		0.17	0.21	0.22	0.28	
	Exch K - Alch NH4Cl pH8.5 pre wash	15C1_K	meq/100g			0.98		0.22	0.24	0.27	0.33	
	CEC - Alch NH4Cl pH8.5 pre wash	15C1_CEC	meq/100g			34		30	32	29	40	
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g				17.2					
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g				9.2					
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g				0.17					
	Exch Na - NH4Cl no wash adjusted	15A3_Na	meq/100g				0.169					
	Exch K - NH4Cl no wash	15A1_K	meq/100g				0.71					
Other Cations	Exchangeable Sodium Percentage (ESP)	15N1	%			0.6		0.6	0.7	0.8	0.7	
	Base Saturation Percentage (BSP)	15L1	%			105		101	100	102	104	

Laboratory test results LARA 9005 (continued)											
				Sample	34	35	36	37	38	39	40
				Upper depth (m)	0	0	0.2	0.5	0.8	1.1	1.4
				Lower depth (m)	0.1	0.1	0.3	0.6	0.9	1.2	1.5
Group	Method	Code	Units	Bulked Sample	Y	N	N	N	N	N	N
Other Cations	Ca/Mg ratio	15M1_Ca/Mg				1.87		2.16	2.06	1.89	1.91
	Calcium to cation exchange capacity ratio	15M1Ca/CE C				0.657		0.679	0.666	0.659	0.671
	Magnesium to cation exchange capacity	15M1_Mg/CE C				0.352		0.314	0.323	0.348	0.352
Other Bulk	DTPA Extr Cu	12A1_Cu	mg/kg		1						
	DTPA Extr Fe	12A1_Fe	mg/kg		69.5						
	DTPA Extr Mn	12A1_Mn	mg/kg		9.7						
	DTPA Extr Zn	12A1_Zn	mg/kg		1.4						
	Extr K - HCl	18B1	mg/kg		1.20						
	P (Acid) - automated	9G2	mg/kg		541						

Project LARA Site 9006 - Site characteristics					
Slope %:	0.5		Slope type:	Estimate	
Morphological type:	Flat		Landform element:	Plain	
Landform pattern:	Flood plain		Geology:	Qa-SEQ: Clay, silt, sand, gravel; flood plain alluvium	
Observation type:	Relatively undisturbed soil core		When described:	27/09/2017	
Location measurement method:	Averaging GPS		Soil name:	Bell (SEQ)	
Runoff:	No runoff		Depth to water:	N/A	
Permeability:	Moderately permeable 50-500mm/day		Microrelief:	Zero or none	
Drainage:	Moderately well drained		Microrelief component:	N/A	
Rock outcrop:	No bedrock exposed		Substrate lithology:	Altered substrate materials	
Surface coarse fragments:	No coarse fragments		Surface condition:	Periodic cracking; Hard setting	
Disturbance:	Cultivation - Irrigated, past or present		Erosion:	N/A	
Site location					
Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-28.19315	152.99694	56	499700	6881401
Soil classification					
Australian Soil Classification			ASC confidence	Great Soil Group	Principal Profile Form
Endocalcareous, Epipedal, Black Vertosol; non-gravelly, medium fine, medium fine, very deep.			All necessary analytical data is available	Black Earth	Ug5.15
Vegetation					
Community name		Casuarina cunninghamiana			
Stratum		Species	Common name		
Tallest		Casuarina cunninghamiana; Grevillea robusta; Eucalyptus tereticornis		river sheoak; silky oak, southern silky oak; blue gum, forest red gum	
Profile morphology					
No	Horizon	Upper depth (m)	Lower depth (m)	Description	
1	A1	0	0.03	Black (10YR 2/1) moist; zero mottles; silty medium heavy clay; no coarse fragments; strong 2-5mm subangular blocky structure; no segregations; dry, very firm strength; no cutans; moderately permeable 50-500mm/day; moderately well drained; sharp to:	
2	B21	0.03	0.32	Black (10YR 2/1) moist; zero mottles; silty medium heavy clay; no coarse fragments; moderate 5-10mm subangular blocky structure; moderate 2-5mm lenticular structure; no segregations; moist, firm strength; few faint slickenside cutans; moderately permeable 50-500mm/day; moderately well drained; clear to:	
3	B22	0.32	0.55	Dark brown (10YR 3/3) moist; zero mottles; medium clay; no coarse fragments; strong 2-5mm lenticular structure; no segregations; moist, weak strength; common distinct slickenside cutans; moderately permeable 50-500mm/day; moderately well drained; gradual to:	
4	B23	0.55	1.22	Dark brown (10YR 3/3) moist; zero mottles; silty light medium clay; no coarse fragments; moderate 5-10mm prismatic structure; strong 2-5mm subangular blocky structure; very few <2% medium 2-6mm calcareous nodules; moist, weak strength; common distinct slickenside cutans; moderately permeable 50-500mm/day; moderately well drained; clear to:	
5	D1	1.22	1.7	Dark brown (10YR 3/3) moist; zero mottles; silty light clay; no coarse fragments; moderate 10-20mm prismatic structure; no segregations; moderately moist, firm strength; no cutans; moderately permeable 50-500mm/day; moderately well drained.	



Laboratory test results LARA 9006							
				Sample	1	2	3
				Upper depth (m)	0.1	0.4	0.8
				Lower depth (m)	0.2	0.5	0.9
Group	Method	Code	Units	Bulked Sample	N	N	N
Profile General	pH - 1:5 water	4A1	pH		6.7	8	8.2
	EC - 1:5 water	3A1	dS/m		0.05	0.04	0.05
	Cl - 1:5 water - automated	5A2	mg Cl/kg		<20	<20	<20
	Water sol NO3 - automated	7B1	mg/kg		4	<1	<1
	Coarse sand	2Z2_CS	%		1	1	3
	Fine sand	2Z2_FS	%		25	36	51
	Silt	2Z2_Silt	%		31	26	24
	Clay	2Z2_Clay	%		44	36	25
	Moisture content - air-dry	2A1	%		5.1	5.8	5.5
	Moisture content - 15 bar	2E1	%		27.6	26.1	22
	Moisture content - 1/3 bar	2E2	%		42.5	41.2	38.3
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1			0.6	0.55	0.73
	Dispersion ratio (R2)	2Z1_R2			0.25	0.26	0.32
Alcoholic Cations	Exch Ca - Alch NH4Cl pH8.5 pre wash	15C1_Ca	meq/100g			32.3	32.8
	Exch Mg - Alch NH4Cl pH8.5 pre wash	15C1_Mg	meq/100g			13.5	14.3
	Exch Na - Alch NH4Cl pH8.5 pre wash	15C1_Na	meq/100g			0.89	1.15
	Exch K - Alch NH4Cl pH8.5 pre wash	15C1_K	meq/100g			0.30	0.37
	CEC - Alch NH4Cl pH8.5 pre wash	15C1_CEC	meq/100g			47	49
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g		25.4		
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g		12.3		
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g		0.45		
	Exch Na - NH4Cl no wash adjusted	15A3_Na	meq/100g		0.45		
	Exch K - NH4Cl no wash	15A1_K	meq/100g		0.50		
Other Cations	Exchangeable Sodium Percentage (ESP)	15N1	%			2	2.6
	Base Saturation Percentage (BSP)	15L1	%			106	108
	Ca/Mg ratio	15M1_Ca/Mg				2.38	2.29
	Calcium to cation exchange capacity ratio	15M1_Ca/CEC				0.725	0.727
	Magnesium to cation exchange capacity ratio	15M1_Mg/CEC				0.305	0.318

Project LARA Site 9007					
Site characteristics					
Slope %:	11		Slope type:	Abney level or clinometer and tape	
Morphological type:	Lower slope		Landform element:	Footslope	
Landform pattern:	Low hills		Geology:	Albert Basalt: Olivine basalt	
Observation type:	Relatively undisturbed soil core		When described:	27/09/2017	
Location measurement method:	Averaging GPS		Soil name:	Glenapp	
Runoff:	Moderately rapid		Depth to water:	N/A	
Permeability:	Moderately permeable 50-500mm/day		Microrelief:	Zero or none	
Drainage:	Moderately well drained		Microrelief component:	N/A	
Rock outcrop:	No bedrock exposed		Substrate lithology:	Basalt	
Surface coarse	No coarse fragments		Surface condition:	Self-mulching; Periodic cracking	
Disturbance:	Complete clearing - pasture - cultivation at some stage		Erosion:	N/A	
Site location					
Datum	Latitude (dd)		Longitude (dd)	Easting (m)	Northing (m)
GDA94	-28.1901		153.00029	500028	6881739
Soil classification					
Australian Soil Classification			ASC confidence	Great Soil Group	Principal Profile Form
Endocalcareous, Self-mulching, Black Vertosol; non-gravelly, medium fine, medium fine, very deep.			All necessary analytical data is available	Black Earth	Ug5.15
Profile morphology					
No	Horizon	Upper depth (m)	Lower depth (m)	Description	
1	A1	0	0.05	Black (10YR 2/1) moist; zero mottles; silty medium clay; no coarse fragments; moderate 2-5mm subangular blocky structure; no segregations; moderately moist, very firm strength; few faint slickenside cutans; moderately permeable 50-500mm/day; moderately well drained; abrupt to:	
2	B21	0.05	0.45	Black (10YR 2/1) moist; zero mottles; silty medium clay; no coarse fragments; strong 5-10mm prismatic structure; strong 2-5mm lenticular structure; no segregations; moist, firm strength; common prominent slickenside cutans; moderately permeable 50-500mm/day; moderately well drained; clear to:	
3	B22	0.45	0.65	Dark brown (10YR 3/3) moist; zero mottles; silty medium clay; no coarse fragments; moderate 2-5mm lenticular structure; no segregations; moist, weak strength; common prominent slickenside cutans; moderately permeable 50-500mm/day; moderately well drained; gradual to:	
4	B23	0.65	1.2	Dark yellowish brown (10YR 3/4) moist; zero mottles; silty light medium clay; few 2-10% subangular basalt medium pebbles 6-20 mm calcified; very few <2% subangular basalt small pebbles 2-6 mm calcified; moderate 5-10mm prismatic structure; strong 2-5mm subangular blocky structure; very few <2% medium 2-6mm calcareous nodules; moist, weak strength; few faint slickenside cutans; moderately permeable 50-500mm/day; moderately well drained; gradual to:	
5	B24	1.2	1.6	Dark yellowish brown (10YR 3/4) moist; zero mottles; silty light medium clay; very few <2% subangular basalt small pebbles 2-6 mm calcified; moderate 10-20mm prismatic structure; moderate 2-5mm subangular blocky structure; no segregations; moist, weak strength; few faint slickenside cutans; moderately permeable 50-500mm/day; moderately well drained;	

Laboratory test results LARA 9007											
				Sample	1	2	3	4	5	6	7
				Upper depth (m)	0	0	0.2	0.5	0.8	1.1	1.4
				Lower depth (m)	0.05	0.05	0.3	0.6	0.9	1.2	1.5
Group	Method	Code	Units	Bulked Sample	Y	N	N	N	N	N	N
Profile General	pH - 1:5 water	4A1	pH		6.6	6.3	7	8.3	8.6	8.6	8.3
	EC - 1:5 water	3A1	dS/m		0.07	0.16	0.07	0.17	0.29	0.3	0.32
	Cl - 1:5 water - automated	5A2	mg Cl/kg		<20	73	41	93	167	275	406
	Water sol NO3 - automated	7B1	mg/kg		6	11	<1	<1	<1	<1	<1
	OC - Walkley/Black	6A1	%		3.2						
	Total N - Kjeldahl, automated	7A2	%		0.326						
	Coarse sand	2Z2_CS	%			10	2	3	11	10	17
	Fine sand	2Z2_FS	%			30	18	20	27	28	32
	Silt	2Z2_Silt	%			27	28	31	29	31	26
	Clay	2Z2_Clay	%			32	55	50	35	33	30
	Total P - Kjeldahl P (KP)	9A3a	%		0.195						
	Moisture content - air-dry	2A1	%			5.4	5.9	6	5.1	4.7	4.8
	Moisture content - 15 bar	2E1	%			31.1	29.7	29.7	22	21.6	20
	Moisture content - 1/3 bar	2E2				49.7	46.4	45.6	35.1	36.1	33.4
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1				0.51	0.52	0.6	0.7	0.78	0.83
	Dispersion ratio (R2)	2Z1_R2				0.29	0.3	0.36	0.23	0.21	0.23
	CaPhos Extr S - ICPAES	10B3	mg/kg		8						
	P (BiCarb Extr)- automated	9B2	mg P/kg		113						
Alcoholic Cations	Exch Ca - Alch NH4Cl pH8.5 pre wash	15C1_Ca	meq/100g					31.5	26.2	24.0	24.3
	Exch Mg - Alch NH4Cl pH8.5 pre wash	15C1_Mg	meq/100g					19.7	18.4	16.4	16.7
	Exch Na - Alch NH4Cl pH8.5 pre wash	15C1_Na	meq/100g					2.09	2.53	2.55	2.57
	Exch K - Alch NH4Cl pH8.5 pre wash	15C1_K	meq/100g					0.33	0.32	0.31	0.26
	CEC - Alch NH4Cl pH8.5 pre wash	15C1_CEC	meq/100g					54	47	43	44
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g			22.7	26.1				
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g			14.9	16.8				
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g			0.35	1.01				

Laboratory test results LARA 9007 (continued)											
				Sample	1	2	3	4	5	6	7
				Upper depth (m)	0	0	0.2	0.5	0.8	1.1	1.4
				Lower depth (m)	0.05	0.05	0.3	0.6	0.9	1.2	1.5
Group	Method	Code	Units	Bulked Sample	Y	N	N	N	N	N	N
Acid Cations	Exch Na - NH4Cl no wash adjusted	15A3_Na	meq/100g			0.14	0.90				
	Exch K - NH4Cl no wash	15A1_K	meq/100g			2.59	0.7				
Other Cations	Exchangeable Sodium Percentage (ESP)	15N1	%					4.3	5.7	5.8	6.2
	Base Saturation Percentage (BSP)	15L1	%					110	106	98	106
	Ca/Mg ratio	15M1_Ca/Mg						1.59	1.42	1.46	1.45
	Calcium to cation exchange capacity ratio	15M1Ca/CE C						0.644	0.584	0.545	0.585
	Magnesium to cation exchange capacity ratio	15M1_Mg/CE C						0.404	0.41	0.374	0.403
Other Bulk	DTPA Extr Cu	12A1_Cu	mg/kg		2						
	DTPA Extr Fe	12A1_Fe	mg/kg		134						
	DTPA Extr Mn	12A1_Mn	mg/kg		28.9						
	DTPA Extr Zn	12A1_Zn	mg/kg		2.3						
	Extr K - HCl	18B1	mg/kg		1.22						
	P (Acid) - automated	9G2	mg P/kg		951						
Other Analyses Completed	Total P - Kjeldahl P (KP)	9A3a	%		0.195						

Project LARA Site 9008						
Site characteristics						
Slope %:	2		Slope type:	Abney level or clinometer and tape		
Morphological type:	Lower slope		Landform element:	Fan		
Landform pattern:	Hills		Geology:	TQr-SEQ: Pediment slope wash, clay, scree, soil		
Observation type:	Relatively undisturbed soil core		When described:	27/09/2017		
Location measurement method:	Averaging GPS		Soil name:	Glenapp		
Runoff:	Very slow		Depth to water:	N/A		
Permeability:	Moderately permeable 50-500mm/day		Microrelief:	Zero or none		
Drainage:	Moderately well drained		Microrelief component:	N/A		
Rock outcrop:	No bedrock exposed		Substrate lithology:	Basalt		
Surface coarse fragments:	Very few <2%,Large pebbles 20-60 mm, Subangular, Basalt		Surface condition:	Self-mulching; Periodic cracking		
Disturbance:	Cultivation - Irrigated, past or present		Erosion:	N/A		
Site location						
Datum	Latitude (dd)		Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-28.22708		153.00256	56	500251	6877642
Soil classification						
Australian Soil Classification			ASC confidence	Great Soil Group	Principal Profile Form	
Endocalcareous, Self-mulching, Black Vertosol; non-gravelly, medium fine, medium fine, very deep.			All necessary analytical data is available	Black Earth	Ug5.17	
Profile morphology						
No	Horizon	Upper depth (m)	Lower depth (m)	Description		
1	A1p	0	0.5	Black (10YR 2/1) moist; zero mottles; silty medium heavy clay; no coarse fragments; moderate 2-5mm lenticular structure; no segregations; moist, firm strength; common distinct slickenside cutans; moderately permeable 50- 500mm/ day; moderately well drained; clear to:		
2	B21	0.5	0.75	Dark brown (10YR 3/3) moist; zero mottles; silty medium clay; no coarse fragments; moderate 10-20mm prismatic structure; moderate 2-5mm lenticular structure; very few <2% medium 2-6mm calcareous nodules; moist, firm strength; common prominent slickenside cutans; moderately permeable 50-500mm/day; moderately well drained; clear to:		
3	B22	0.75	1.7	Brown (10YR 4/3) moist; few 2-10% medium 5-15mm dark mottles; very few <2% fine <5mm red substrate influence; silty medium clay; few 2-10% subangular basalt large pebbles 20-60 mm ferruginized; strong 5-10mm subangular blocky structure; weak 2-5mm lenticular structure; very few <2% medium 2-6mm calcareous nodules; very few <2% medium 2-6mm calcareous soft segregations; moderately moist, weak strength; few distinct slickenside cutans; common distinct clay skin cutans; moderately permeable 50-500mm/day; moderately well drained.		

Laboratory test results LARA 9008							
				Sample	1	2	3
				Upper depth (m)	0	0.2	0.8
				Lower depth (m)	0.05	0.3	0.9
Group	Method	Code	Units	Bulked Sample	N	N	N
Profile General	pH - 1:5 water	4A1	pH		6.5	7.8	8.8
	EC - 1:5 water	3A1	dS/m		0.13	0.11	0.57
	Cl - 1:5 water - automated	5A2	mg Cl/kg		111	71	588
	Water sol NO3 - automated	7B1	mg/kg		11	5	<1
	Coarse sand	2Z2_CS	%		2	<1.0	11
	Fine sand	2Z2_FS	%		15	15	44
	Silt	2Z2_Silt	%		26	24	20
	Clay	2Z2_Clay	%		60	64	28
	Moisture content - air-dry	2A1	%		6.6	7.1	5.5
	Moisture content - 15 bar	2E1	%		31.6	38.2	23.6
	Moisture content - 1/3 bar	2E2	%		52.5	60.7	39.6
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1			0.6	0.64	0.77
	Dispersion ratio (R2)	2Z1_R2			0.34	0.37	0.32
Alcoholic Cations	Exch Ca - Alch NH4Cl pH8.5 pre wash	15C1_Ca	meq/100g			28.5	21.9
	Exch Mg - Alch NH4Cl pH8.5 pre wash	15C1_Mg	meq/100g			32.0	25.0
	Exch Na - Alch NH4Cl pH8.5 pre wash	15C1_Na	meq/100g			2.82	5.79
	Exch K - Alch NH4Cl pH8.5 pre wash	15C1_K	meq/100g			0.24	0.19
	CEC - Alch NH4Cl pH8.5 pre wash	15C1_CEC	meq/100g			64	53
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g		24.9		
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g		27.0		
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g		1.34		
	Exch Na - NH4Cl no wash adjusted	15A3_Na	meq/100g		1.03		
	Exch K - NH4Cl no wash	15A1_K	meq/100g		0.43		
Other Cations	Exchangeable Sodium Percentage (ESP)	15N1	%			4.2	12.8
	Base Saturation Percentage (BSP)	15L1	%			95	117
	Ca/Mg ratio	15M1_Ca/Mg				0.888	0.876
Other cations	Calcium to cation exchange capacity ratio	15M1_Ca/CEC				0.425	0.483
	Magnesium to cation exchange capacity ratio	15M1_Mg/CEC				0.479	0.552

Project LARA Site 9009					
Site characteristics					
Slope %:	0.5		Slope type:	Estimate	
Morphological type:	Flat		Landform element:	Plain	
Landform pattern:	Flood plain		Geology:	Qa-SEQ: Clay, silt, sand, gravel; flood plain alluvium	
Observation type:	Relatively undisturbed soil core		When described:	27/09/2017	
Location measurement method:	Averaging GPS		Soil name:	Blenheim	
Runoff:	Very slow		Depth to water:	N/A	
Permeability:	Moderately permeable 50-500mm/day		Microrelief:	Normal gilgai	
Drainage:	Moderately well drained		Microrelief component:	N/A	
Rock outcrop:	No bedrock exposed		Substrate lithology:	Basalt	
Surface coarse fragments:	No coarse fragments		Surface condition:	Self-mulching; Periodic cracking	
Disturbance:	Cultivation - Irrigated, past or present		Erosion:	N/A	
Site location					
Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-28.18034	153.04149	56	504073	6882820
Soil classification					
Australian Soil Classification			ASC confidence	Great Soil Group	Principal Profile Form
Endocalcareous, Self-mulching, Black Vertosol; non-gravelly, medium fine, very fine, very deep.			All necessary analytical data is available	Black Earth	Ug5.17
Vegetation					
Community name		Eucalyptus tereticornis woodland, open woodland			
Stratum		Species	Common name		
Tallest		Eucalyptus tereticornis; Casuarina cunninghamiana	blue gum, forest red gum; river sheoak		
Profile morphology					
No	Horizon	Upper depth (m)	Lower depth (m)	Description	
1	A1	0	0.05	Black (10YR 2/1) moist; zero mottles; medium clay; no coarse fragments; moderate 5-10mm angular blocky structure; no segregations; moderately moist, firm strength; no cutans; moderately permeable 50-500mm/day; moderately well drained; clear to:	
2	B21	0.05	0.5	Very dark brown (10YR 2/2) moist; zero mottles; medium heavy clay; no coarse fragments; moderate 20-50mm prismatic structure; moderate 2-5mm lenticular structure; no segregations; moist, firm strength; few distinct slickenside cutans; common roots; moderately permeable 50-500mm/day; moderately well drained; gradual to:	
3	B22	0.5	0.85	Very dark brown (10YR 2/2) moist; zero mottles; medium heavy clay; no coarse fragments; moderate 10-20mm prismatic structure; moderate 2-5mm lenticular structure; very few <2% medium 2-6mm calcareous nodules; moist, firm strength; common distinct slickenside cutans; few roots; moderately permeable 50-500mm/day; moderately well drained; clear to:	
4	D	0.85	1.75	Dark brown (10YR 3/3) moist; zero mottles; light medium clay; no coarse fragments; moderate 20-50mm prismatic structure; no segregations; moist, firm strength; no cutans; few roots; moderately permeable 50-500mm/day; moderately well drained.	

Laboratory test results LARA 9009											
				Sample	1	2	3	4	5	6	7
				Upper depth (m)	0	0	0.2	0.5	0.75	1.1	1.4
				Lower depth (m)	0.05	0.05	0.3	0.6	0.85	1.2	1.5
Group	Method	Code	Units	Bulked Sample	Y	N	N	N	N	N	N
Profile General	pH - 1:5 water	4A1	pH		6.5	7	6.8	7.4	8	8.1	8.3
	EC - 1:5 water	3A1	dS/m		0.11	0.38	0.07	0.12	0.18	0.19	0.13
	Cl - 1:5 water - automated	5A2	mg Cl/kg		<20	173	<20	<20	<20	<20	<20
	Water sol NO3 - automated	7B1	mg/kg		22	57	<1	<1	<1	<1	<1
	OC - Walkley/Black	6A1	%		2.8						
	Total N - Kjeldahl, automated	7A2	%		0.280						
	Coarse sand	2Z2_CS	%			11	6	3	5	5	10
	Fine sand	2Z2_FS	%			32	28	27	33	41	39
	Silt	2Z2_Silt	%			27	29	29	25	25	24
	Clay	2Z2_Clay	%			35	46	46	44	32	33
	Total P - Kjeldahl P (KP)	9A3a	%		0.134						
	Moisture content - air-dry	2A1	%			4.9	5.1	5.6	5.1	5	4.4
	Moisture content - 15 bar	2E1	%			25.8	27.6	27.3	24.3	23.1	20.9
	Moisture content - 1/3 bar	2E2	%			41.6	39.5	42.6	35.8	34.4	32.3
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1				0.57	0.58	0.51	0.48	0.65	0.64
	Dispersion ratio (R2)	2Z1_R2				0.31	0.38	0.29	0.21	0.15	0.27
	CaPhos Extr S - ICPAES	10B3	mg/kg		29						
	P (BiCarb Extr)- automated	9B2			148						
Alcoholic Cations	Exch Ca - Alch NH4Cl pH8.5 pre wash	15C1_Ca	meq/100g					29.4	30.6	28.8	26.0
	Exch Mg - Alch NH4Cl pH8.5 pre wash	15C1_Mg	meq/100g					16.1	15.4	14.4	12.3
	Exch Na - Alch NH4Cl pH8.5 pre wash	15C1_Na	meq/100g					0.84	1.02	1.67	1.95
	Exch K - Alch NH4Cl pH8.5 pre wash	15C1_K	meq/100g					0.43	0.40	0.47	0.56
	CEC - Alch NH4Cl pH8.5 pre wash	15C1_CEC	meq/100g					47	47	45	41
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g			33	24				
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g			8.41	13				
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g			0.97	0.70				



Laboratory test results LARA 9009 (continued)											
				Sample	1	2	3	4	5	6	7
				Upper depth (m)	0	0	0.2	0.5	0.75	1.1	1.4
				Lower depth (m)	0.05	0.05	0.3	0.6	0.85	1.2	1.5
Group	Method	Code	Units	Bulked Sample	Y	N	N	N	N	N	N
Acid Cations	Exch Na - NH4Cl no wash adjusted	15A3_Na	meq/100g			0.486	0.700				
	Exch K - NH4Cl no wash	15A1_K	meq/100g			1.28	0.30				
Other Cations	Exchangeable Sodium Percentage (ESP)	15N1	%					1.8	2.3	4	5.1
	Base Saturation Percentage (BSP)	15L1	%					102	106	107	106
	Ca/Mg ratio	15M1_Ca/Mg						1.83	1.98	2.05	2.1
	Calcium to cation exchange capacity ratio	15M1Ca/CE C						0.643	0.68	0.681	0.675
	Magnesium to cation exchange capacity ratio	15M1_Mg/CE C						0.35	0.344	0.333	0.321
Other Bulk	DTPA Extr Cu	12A1_Cu	mg/kg		2.7						
	DTPA Extr Fe	12A1_Fe	mg/kg		158						
	DTPA Extr Mn	12A1_Mn	mg/kg		25.8						
	DTPA Extr Zn	12A1_Zn	mg/kg		4.7						
	Extr K - HCl	18B1	mg/kg		0.30						
	P (Acid) - automated	9G2	mg P/kg		408						

Project LARA Site 9010						
Site characteristics						
Slope %:	16		Slope type:	Abney level or clinometer and tape		
Morphological type:	Upper slope		Landform element:	Fan		
Landform pattern:	Hills		Geology:	Qr-9543: Residual soil, colluvium; sand, soil, clay, rock debris		
Observation type:	Relatively undisturbed soil core		When described:	27/09/2017		
Location measurement method:	Averaging GPS		Soil name:	Wonglepong		
Runoff:	Moderately rapid		Depth to water:	N/A		
Permeability:	Moderately permeable 50-500mm/day		Microrelief:	Zero or none		
Drainage:	Moderately well drained		Microrelief component:	N/A		
Rock outcrop:	No bedrock exposed		Substrate lithology:	Basalt		
Surface coarse fragments:	Common 10-20%,Cobbles 60-200 mm, Subangular, Basalt; Common 10-20%,Stones 200-600 mm, Subangular, Basalt; Few 2-		Surface condition:	Firm; Periodic cracking		
Disturbance:	Complete clearing - pasture - but never cultivated		Erosion:	Minor or present, active, sheet/rill erosion		
Site location						
Datum	Latitude (dd)		Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-28.17778		153.04862	56	504773	6883103
Soil classification						
Australian Soil Classification			ASC confidence		Great Soil Group	Principal Profile Form
Endocalcareous, Epipedal, Black Vertosol; moderately gravelly, medium fine, very fine, moderate.			All necessary analytical data is available		Black Earth	Ug5.13
Vegetation						
Community name		Corymbia tessellaris woodland				
Stratum		Species		Common name		
Tallest		Corymbia tessellaris; Eucalyptus siderophloia		Moreton Bay ash; Grey ironbark		
Profile morphology						
No	Horizon	Upper depth (m)	Lower depth (m)	Description		
1	A1	0	0.2	Very dark brown (10YR 2/2) moist; zero mottles; medium clay; very few <2% subangular basalt medium pebbles 6-20 mm; very few <2% subrounded rhyolite medium pebbles 6-20 mm; moderate 10-20mm angular blocky structure; no segregations; moderately moist, very firm strength; no cutans; many roots; moderately permeable 50- 500mm/ day; moderately well drained; clear to:		
2	B21	0.2	0.65	Black (10YR 2/1) moist; zero mottles; medium heavy clay; very few <2% subangular basalt small pebbles 2-6 mm; moderate 5-10mm subangular blocky structure; no segregations; moist, firm strength; few faint slickenside cutans; few roots; moderately permeable 50-500mm/day; moderately well drained; abrupt to:		
3	B22	0.65	1	Black (10YR 2/1) moist; zero mottles; medium heavy clay; no coarse fragments; moderate 20-50mm prismatic structure; moderate 5-10mm lenticular structure; no segregations; moist, firm strength; few distinct slickenside cutans; few roots; moderately permeable 50-500mm/day; moderately well drained; gradual to:		
4	BC	1	1.1	Dark brown (10YR 3/3) moist; few 2-10% medium 5-15mm pale mottles; medium heavy clay; very few <2% subrounded basalt medium pebbles 6-20 mm; very few <2% subrounded basalt small pebbles 2-6 mm ferruginized; moderate 5-10mm angular blocky structure; common 10-20% medium 2-6mm calcareous soft segregations; moist, very firm strength; no cutans; no roots; moderately permeable 50-500mm/day; moderately well drained.		

Laboratory test results LARA9010							
				Sample	1	2	3
				Upper depth (m)	0	0.2	0.8
				Lower depth (m)	0.1	0.3	0.9
Group	Method	Code	Units	Bulked Sample	N	N	N
Profile General	pH - 1:5 water	4A1	pH		6.4	7.1	8.6
	EC - 1:5 water	3A1	dS/m		0.12	0.05	0.33
	Cl - 1:5 water - automated	5A2	mg Cl/kg		35	<20	299
	Water sol NO3 - automated	7B1	mg/kg		7	1	<1
	Coarse sand	2Z2_CS	%		15	8	8
	Fine sand	2Z2_FS	%		28	24	22
	Silt	2Z2_Silt	%		29	24	26
	Clay	2Z2_Clay	%		31	49	49
	Moisture content - air-dry	2A1	%		4.6	5.1	5.5
	Moisture content - 15 bar	2E1	%		25.5	28	27.4
	Moisture content - 1/3 bar	2E2	%		38.3	41	43.6
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1			0.55	0.62	0.76
	Dispersion ratio (R2)	2Z1_R2			0.35	0.36	0.44
	Citrate/dithionite Extr Al	13C1_Al	%			0.3	
	Citrate/dithionite Extr Fe	13C1_Fe	%			3	
Alcoholic Cations	Exch Ca - Alch NH4Cl pH8.5 pre wash	15C1_Ca	meq/100g				20
	Exch Mg - Alch NH4Cl pH8.5 pre wash	15C1_Mg	meq/100g				29.6
	Exch Na - Alch NH4Cl pH8.5 pre wash	15C1_Na	meq/100g				2.60
	Exch K - Alch NH4Cl pH8.5 pre wash	15C1_K	meq/100g				0.31
	CEC - Alch NH4Cl pH8.5 pre wash	15C1_CEC	meq/100g				53
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g		21.7	22.0	
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g		14.1	18.8	
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g		0.24	0.65	
	Exch Na - NH4Cl no wash adjusted	15A3_Na	meq/100g		0.139	0.65	
	Exch K - NH4Cl no wash	15A1_K	meq/100g		2.66	1.38	

Project LARA Site 9011					
Site characteristics					
Slope %:	0.5		Slope type:	Estimate	
Morphological type:	Flat		Landform element:	Plain	
Landform pattern:	Flood plain		Geology:	Qa-SEQ: Clay, silt, sand, gravel; flood plain alluvium	
Observation type:	Relatively undisturbed soil core		When described:	27/09/2017	
Location measurement method:	Averaging GPS		Soil name:	Hooper	
Runoff:	No runoff		Depth to water:	N/A	
Permeability:	Moderately permeable 50-500mm/day		Microrelief:	Zero or none	
Drainage:	Moderately well drained		Microrelief component:	N/A	
Rock outcrop:	No bedrock exposed		Substrate lithology:	Altered substrate materials	
Surface coarse fragments:	No coarse fragments		Surface condition:	Firm; Periodic cracking	
Disturbance:	Cultivation - Irrigated, past or present		Erosion:	N/A	
Site location					
Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-28.08144	153.0364	56	503576	6893775
Soil classification					
Australian Soil Classification			ASC confidence	Great Soil Group	Principal Profile Form
Melanic, Calcic, Black Dermosol; thick, non-gravelly, clayey, clayey, very deep.			All necessary analytical data is available	Prarie soil	Uf6.11
Vegetation					
Community name		Eucalyptus tereticornis woodland, open woodland			
Stratum		Species	Common name		
Tallest		Eucalyptus tereticornis	blue gum, forest red gum		
		Casuarina cunninghamiana	river sheoak		
		Corymbia tessellaris	carbeen, Moreton Bay ash		
Profile morphology					
No	Horizon	Upper depth (m)	Lower depth (m)	Description	
1	A1	0	0.31	Black (10YR 2/1) moist; zero mottles; silty light clay; no coarse fragments; moderate 2-5mm polyhedral structure; no segregations; moist, weak strength; no cutans; moderately permeable 50-500mm/day; moderately well drained; gradual to:	
2	B21	0.31	1.4	Black (10YR 2/1) moist; zero mottles; silty light medium clay; no coarse fragments; strong 10-20mm prismatic structure; strong 2-5mm polyhedral structure; no segregations; moist, weak strength; no cutans; moderately permeable 50-500mm/day; moderately well drained; diffuse to:	
3	D	1.4	1.8	Dark brown (10YR 3/3) moist; zero mottles; fine sandy light clay; no coarse fragments; weak 10-20mm subangular blocky structure; very few <2% coarse 6-20mm calcareous nodules; moist, weak strength; no cutans; moderately permeable 50-500mm/day; moderately well drained.	

Laboratory test results LARA 9011							
				Sample	1	2	3
				Upper depth (m)	0	0.5	1.4
				Lower depth (m)	0.1	0.6	1.5
Group	Method	Code	Units	Bulked Sample	N	N	N
Profile General	pH - 1:5 water	4A1	pH		6.5	7.4	8
	EC - 1:5 water	3A1	dS/m		0.09	0.03	0.03
	Cl - 1:5 water - automated	5A2	mg Cl/kg		<20	<20	<20
	Water sol NO3 - automated	7B1			17	1	<1
	Coarse sand	2Z2_CS	%		2	<1.0	3
	Fine sand	2Z2_FS	%		37	34	51
	Silt	2Z2_Silt	%		42	33	27
	Clay	2Z2_Clay	%		26	39	23
	Moisture content - air-dry	2A1	%		4.1	5.5	4.7
	Moisture content - 15 bar	2E1			21.5	25.7	18.3
	Moisture content - 1/3 bar	2E2			35.2	40.5	29.3
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1			0.65	0.63	0.6
	Dispersion ratio (R2)	2Z1_R2			0.27	0.35	0.27
Alcoholic Cations	Exch Ca - Alch NH4Cl pH8.5 pre wash	15C1_Ca	meq/100g			28.7	25.5
	Exch Mg - Alch NH4Cl pH8.5 pre wash	15C1_Mg	meq/100g			15.6	15.0
	Exch Na - Alch NH4Cl pH8.5 pre wash	15C1_Na	meq/100g			0.48	0.36
	Exch K - Alch NH4Cl pH8.5 pre wash	15C1_K	meq/100g			0.35	0.26
	CEC - Alch NH4Cl pH8.5 pre wash	15C1_CEC	meq/100g			46	41
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g		22.8		
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g		12.7		
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g		0.55		
	Exch Na - NH4Cl no wash adjusted	15A3_Na	meq/100g		0.55		
	Exch K - NH4Cl no wash	15A1_K	meq/100g		0.83		
Other Cations	Exchangeable Sodium Percentage (ESP)	15N1	%			1	0.9
	Base Saturation Percentage (BSP)	15L1	%			93	100
	Ca/Mg ratio	15M1_Ca/Mg				1.84	1.71
	Calcium to cation exchange capacity ratio	15M1_Ca/CEC				0.59	0.622
	Magnesium to cation exchange capacity ratio	15M1_Mg/CEC				0.321	0.364

Project LARA Site 9012					
Site characteristics					
Slope %:	0		Slope type:	Abney level or clinometer and tape	
Morphological type:	Flat		Landform element:	Plain	
Landform pattern:	Flood plain		Geology:	Qa-SEQ: Clay, silt, sand, gravel; flood plain alluvium	
Observation type:	Relatively undisturbed soil core		When described:	27/09/2017	
Location measurement method:	Averaging GPS		Soil name:	Blenheim	
Runoff:	No runoff		Depth to water:	N/A	
Permeability:	Moderately permeable 50-500mm/day		Microrelief:	Zero or none	
Drainage:	Moderately well drained		Microrelief component:	N/A	
Rock outcrop:	No bedrock exposed		Substrate lithology:	Altered substrate materials	
Surface coarse fragments:	No coarse fragments		Surface condition:	Self-mulching	
Disturbance:	Cultivation - Irrigated, past or present		Erosion:	N/A	
Site location					
Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-28.08082	153.03233	56	503176	6893844
Soil classification					
Australian Soil Classification			ASC confidence	Great Soil Group	Principal Profile Form
Endocalcareous, Self-mulching, Black Vertosol; non-gravelly, medium fine, medium fine, very deep.			All necessary analytical data is available	Black Earth	Ug5.15
Vegetation					
Community name		<i>Eucalyptus tereticornis</i> woodland, open woodland			
Stratum		Species	Common name		
Tallest		<i>Eucalyptus tereticornis</i>	blue gum, forest red gum		
Profile morphology					
No	Horizon	Upper depth (m)	Lower depth (m)	Description	
1	A1	0	0.15	Black (10YR 2/1) moist; zero mottles; fine sandy medium clay; no coarse fragments; moderate 2-5mm polyhedral structure; no segregations; moist, weak strength; no cutans; moderately permeable 50-500mm/day; moderately well drained; gradual to:	
2	B21	0.15	0.55	Very dark brown (10YR 2/2) moist; zero mottles; medium heavy clay; no coarse fragments; moderate 2-5mm lenticular structure; no segregations; moist, weak strength; common faint slickenside cutans; moderately permeable 50-500mm/day; moderately well drained; clear to:	
3	B22	0.55	1.7	Dark brown (10YR 3/3) moist; zero mottles; light medium clay; no coarse fragments; moderate 10-20mm prismatic structure; moderate 2-5mm lenticular structure; very few <2% medium 2-6mm calcareous nodules; moderately moist, weak strength; few faint slickenside cutans; moderately permeable 50-500mm/day; moderately well drained.	

Laboratory test results LARA 9012											
				Sample	1	2	3	4	5	6	7
				Upper depth (m)	0	0	0.2	0.45	0.8	1.1	1.4
				Lower depth (m)	0.1	0.1	0.3	0.55	0.9	1.2	1.5
Group	Method	Code	Units	Bulked Sample	Y	N	N	N	N	N	N
Profile General	pH - 1:5 water	4A1	pH		6.4	6.4	6.7	7.4	8.1	8.3	8.2
	EC - 1:5 water	3A1	dS/m		0.08	0.09	0.06	0.05	0.11	0.09	0.06
	Cl - 1:5 water - automated	5A2	mg Cl/kg		<20	<20	<20	<20	<20	<20	<20
	Water sol NO3 - automated	7B1	mg/kg		19	15	5	2	2	1	1
	OC - Walkley/Black	6A1	%		2.5						
	Total N - Kjeldahl, automated	7A2	%		0.292						
	Coarse sand	2Z2_CS	%			12	6	7	22	5	3
	Fine sand	2Z2_FS	%			29	21	24	32	41	47
	Silt	2Z2_Silt	%			39	41	31	17	24	26
	Clay	2Z2_Clay	%			28	33	46	32	36	32
	Total P - Kjeldahl P (KP)	9A3a	%		0.149						
	Moisture content - air-dry	2A1	%			3.7	3.8	4.9	4.7	5.1	5.1
	Moisture content - 15 bar	2E1	%			18.4	21.4	25.7	20.3	24	22.6
	Moisture content - 1/3 bar	2E2	%			30.1	31.4	36.8	28.2	31.9	31.9
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1				0.58	0.64	0.66	0.74	0.7	0.74
	Dispersion ratio (R2)	2Z1_R2				0.25	0.32	0.43	0.36	0.32	0.29
	CaPhos Extr S - ICPAES	10B3	mg/kg		6						
	P (BiCarb Extr)- automated	9B2	mg P/kg		183						
Alcoholic Cations	Exch Ca - Alch NH4Cl pH8.5 pre wash	15C1_Ca	meq/100g					24.2	23.5	27.2	28.2
	Exch Mg - Alch NH4Cl pH8.5 pre wash	15C1_Mg	meq/100g					13.4	12.9	15.4	15.6
	Exch Na - Alch NH4Cl pH8.5 pre wash	15C1_Na	meq/100g					0.72	0.94	1.25	1.53
	Exch K - Alch NH4Cl pH8.5 pre wash	15C1_K	meq/100g					1.45	0.44	0.44	0.48
	CEC - Alch NH4Cl pH8.5 pre wash	15C1_CEC	meq/100g					41	38	44	46
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g			19.7	18.2				
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g			9.58	9.86				
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g			0.25	0.43				

Laboratory test results LARA 9012 (continued)											
				Sample	1	2	3	4	5	6	7
				Upper depth (m)	0	0	0.2	0.45	0.8	1.1	1.4
				Lower depth (m)	0.1	0.1	0.3	0.55	0.9	1.2	1.5
Group	Method	Code	Units	Bulked Sample	Y	N	N	N	N	N	N
Acid Cations	Exch Na - NH4Cl no wash adjusted	15A3_Na	meq/100g			0.246	0.427				
	Exch K - NH4Cl no wash	15A1_K	meq/100g			1.88	1.29				
Other Bulk	DTPA Extr Cu	12A1_Cu	mg/kg		1.9						
	DTPA Extr Fe	12A1_Fe	mg/kg		140						
	DTPA Extr Mn	12A1_Mn	mg/kg		18.4						
	DTPA Extr Zn	12A1_Zn	mg/kg		4.0						
	Extr K - HCl	18B1	mg/kg		1.20						
	P (Acid) - automated	9G2	mg P/kg		770						



Project LARA Site 9013					
Site characteristics					
Slope %:	0.5		Slope type	Estimate	
Morphological type:	Flat		Landform element:	Plain	
Landform pattern:	Flood plain		Geology:	Qa-SEQ: Clay, silt, sand, gravel; flood plain alluvium	
Observation type:	Relatively undisturbed soil core		When described:	28/09/2017	
Location measurement method:	Averaging GPS		Soil name:	Blenheim	
Runoff:	No runoff		Depth to water:	N/A	
Permeability:	Moderately permeable 50-500mm/day		Microrelief:	Normal gilgai	
Drainage:	Moderately well drained		Microrelief component:	N/A	
Rock outcrop:	No bedrock exposed		Substrate lithology:	Altered substrate materials	
Surface coarse fragments:	No coarse fragments		Surface condition:	Self-mulching; Periodic cracking	
Disturbance:	Complete clearing - pasture - cultivation at some stage		Erosion:	Minor or present, active, rill erosion	
Site location					
Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-28.01866	152.94247	56	494344	6900729
Soil classification					
Australian Soil Classification		ASC confidence	Great Soil Group	Principal Profile Form	
Endocalcareous, Self-mulching, Black Vertosol; non-gravelly, medium fine, very fine, very deep.		All necessary analytical data is available	Black Earth	Ug5.17	
Vegetation					
Community name		Eucalyptus tereticornis woodland, open woodland			
Stratum		Species	Common name		
Tallest		Eucalyptus tereticornis	blue gum, forest red gum		
Profile morphology					
No	Horizon	Upper depth (m)	Lower depth (m)	Description	
1	A1	0	0.15	Black (10YR 2/1) moist; zero mottles; silty medium clay; no coarse fragments; moderate 2-5mm subangular blocky structure; no segregations; dry, very firm strength; no cutans; moderately permeable 50-500mm/day; moderately well drained; clear to:	
2	B21	0.15	0.5	Very dark grey (10YR 3/1) moist; zero mottles; silty medium clay; no coarse fragments; moderate 5-10mm angular blocky structure; no segregations; dry, very firm strength; no cutans; moderately permeable 50-500mm/day; moderately well drained; clear to:	
3	B22	0.5	1	Black (10YR 2/1) moist; zero mottles; medium heavy clay; no coarse fragments; moderate 2-5mm lenticular structure; no segregations; moderately moist, firm strength; few faint slickenside cutans; moderately permeable 50-500mm/day; moderately well drained; gradual to:	
4	B23	1	1.4	Very dark greyish brown (10YR 3/2) moist; zero mottles; medium heavy clay; no coarse fragments; moderate 10-20mm prismatic structure; moderate 2-5mm prismatic structure; very few <2% medium 2-6mm calcareous nodules; moderately moist, firm strength; no cutans; moderately permeable 50-500mm/day; moderately well drained;	

Laboratory test results LARA 9013							
				Sample	1	2	3
				Upper depth (m)	0	0.2	0.8
				Lower depth (m)	0.1	0.3	0.9
Group	Method	Code	Units	Bulked Sample	N	N	N
Profile General	pH - 1:5 water	4A1	pH		6.1	6.8	8.6
	EC - 1:5 water	3A1	dS/m		0.09	0.04	0.16
	Cl - 1:5 water - automated	5A2	mg Cl/kg		35	<20	161
	Water sol NO3 - automated	7B1	mg/kg		<1	<1	<1
	Coarse sand	2Z2_CS	%		7	1	<1.0
	Fine sand	2Z2_FS	%		40	30	20
	Silt	2Z2_Silt	%		31	36	24
	Clay	2Z2_Clay	%		27	40	53
	Moisture content - air-dry	2A1	%		4	4.2	5.4
	Moisture content - 15 bar	2E1	%		23.8	25.4	27.2
	Moisture content - 1/3 bar	2E2	%		35.2	32.7	38.4
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1			0.61	0.7	0.8
	Dispersion ratio (R2)	2Z1_R2			0.32	0.39	0.46
Alcoholic Cations	Exch Ca - Alch NH4Cl pH8.5 pre wash	15C1_Ca	meq/100g				25.2
	Exch Mg - Alch NH4Cl pH8.5 pre wash	15C1_Mg	meq/100g				19.1
	Exch Na - Alch NH4Cl pH8.5 pre wash	15C1_Na	meq/100g				3.77
	Exch K - Alch NH4Cl pH8.5 pre wash	15C1_K	meq/100g				0.26
	CEC - Alch NH4Cl pH8.5 pre wash	15C1_CEC	meq/100g				48
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g		17.7	20.0	
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g		11.5	13.4	
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g		0.40	1.17	
	Exch Na - NH4Cl no wash adjusted	15A3_Na	meq/100g		0.298	1.167	
	Exch K - NH4Cl no wash	15A1_K	meq/100g		1.25	0.46	

Project LARA Site 9014					
Site characteristics					
Slope %:	0		Slope type:	Estimate	
Morphological type:	Flat		Landform element:	Plain	
Landform pattern:	Flood plain		Geology:	Qa-SEQ: Clay, silt, sand, gravel; flood plain alluvium	
Observation type:	Relatively undisturbed soil core		When described:	28/09/2017	
Location measurement method:	Averaging GPS		Soil name:	Basel	
Runoff:	No runoff		Depth to water:	N/A	
Permeability:	Moderately permeable 50-500mm/day		Microrelief:	Normal gilgai	
Drainage:	Imperfectly drained		Microrelief component:	N/A	
Rock outcrop:	No bedrock exposed		Substrate lithology:	Altered substrate materials	
Surface coarse fragments:	No coarse fragments		Surface condition:	Soft; Poached	
Disturbance:	Complete clearing - pasture - cultivation at some stage		Erosion:	N/A	
Site location					
Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-28.02053	152.95348	56	495427	6900522
Soil classification					
Australian Soil Classification		ASC confidence	Great Soil Group	Principal Profile Form	
Endocalcareous, Epipedal, Grey Vertosol; non-gravelly, fine, very fine, deep.		All necessary analytical data is available	Black Earth	Ug5.16	
Vegetation					
Community name		<i>Eucalyptus tereticornis</i> woodland, open woodland			
Stratum		Species	Common name		
Tallest		<i>Eucalyptus tereticornis</i>	blue gum, forest red gum		
Profile morphology					
No	Horizon	Upper depth (m)	Lower depth (m)	Description	
1	A1	0	0.03	Black (10YR 2/1) moist; zero mottles; sapric silty light clay; no coarse fragments; moderate 2-5mm subangular blocky structure; no segregations; moist, weak strength; no cutans; moderately permeable 50-500mm/day; moderately well drained; abrupt to:	
2	B21	0.03	0.15	Very dark grey (10YR 3/1) moist; few 2-10% fine <5mm orange mottles; medium heavy clay; very few <2% rounded gravel small pebbles 2-6 mm; very few <2% rounded quartz small pebbles 2-6 mm; moderate 5-10mm subangular blocky structure; weak 2-5mm lenticular structure; no segregations; moist, firm strength; no cutans; moderately permeable 50-500mm/day; moderately well drained; clear to:	
3	B22	0.15	1.25	Dark greyish brown (2.5Y 4/2) moist; few 2-10% medium 5-15mm orange mottles; few 2-10% medium 5-15mm grey mottles; silty heavy clay; few 2-10% rounded gravel small pebbles 2-6 mm; few 2-10% rounded gravel medium pebbles 6-20 mm; moderate 20-50mm prismatic structure; moderate 2-5mm lenticular structure; few 2-10% fine <2mm manganiferous nodules; moist, very firm strength; few prominent slickenside cutans; moderately permeable 50- 500mm/ day; imperfectly drained; gradual to:	
4	BC	1.25	1.7	Grey (10YR 5/1) moist; common 10-20% medium 5-15mm orange substrate influence; sandy medium clay; no coarse fragments; massive structure; very few <2% medium 2-6mm calcareous soft segregations; very few <2% medium 2-6mm calcareous nodules; moderately moist, very firm strength; no cutans; moderately permeable 50- 500mm/ day; imperfectly drained.	

Laboratory test results LARA 9014							
				Sample	1	2	3
				Upper depth (m)	0.03	0.2	0.8
				Lower depth (m)	0.13	0.3	0.9
Group	Method	Code	Units	Bulked Sample	N	N	N
Profile General	pH - 1:5 water	4A1	pH		5.9	6.6	7.8
	EC - 1:5 water	3A1	dS/m		0.04	0.03	0.29
	Cl - 1:5 water - automated	5A2	mg Cl/kg		<20	<20	423
	Water sol NO3 - automated	7B1	mg/kg		<1	<1	<1
	Coarse sand	2Z2_CS	%		11	10	10
	Fine sand	2Z2_FS	%		27	23	24
	Silt	2Z2_Silt	%		8	6	6
	Clay	2Z2_Clay	%		53	59	59
	Moisture content - air-dry	2A1	%		4.5	4.4	4.1
	Moisture content - 15 bar	2E1	%		24.7	25.3	24.4
	Moisture content - 1/3 bar	2E2	%		36	38.2	37.7
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1			0.59	0.72	0.83
	Dispersion ratio (R2)	2Z1_R2			0.34	0.44	0.51
Alcoholic Cations	Exch Ca - Alch NH4Cl pH8.5 pre wash	15C1_Ca	meq/100g				13.3
	Exch Mg - Alch NH4Cl pH8.5 pre wash	15C1_Mg	meq/100g				19.1
	Exch Na - Alch NH4Cl pH8.5 pre wash	15C1_Na	meq/100g				1.98
	Exch K - Alch NH4Cl pH8.5 pre wash	15C1_K	meq/100g				0.1
	CEC - Alch NH4Cl pH8.5 pre wash	15C1_CEC	meq/100g				34
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g		12.3	13.1	
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g		16.5	18.3	
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g		0.68	1.00	
	Exch Na - NH4Cl no wash adjusted	15A3_Na	meq/100g		0.684	1.00	
	Exch K - NH4Cl no wash	15A1_K	meq/100g		0.41	0.29	

Project LARA Site 9015					
Site characteristics					
Slope %:	0		Slope type:	Estimate	
Morphological type:	Flat		Landform element:	Plain	
Landform pattern:	Flood plain		Geology:	Qa-SEQ: Clay, silt, sand, gravel; flood plain alluvium	
Observation type:	Relatively undisturbed soil core		When described:	27/09/2017	
Location measurement method:	Averaging GPS		Soil name:	Blenheim	
Runoff:	No runoff		Depth to water:	N/A	
Permeability:	Moderately permeable 50-500mm/day		Microrelief:	Zero or none	
Drainage:	Moderately well drained		Microrelief component:	N/A	
Rock outcrop:	No bedrock exposed		Substrate lithology:	Basalt	
Surface coarse fragments:	No coarse fragments		Surface condition:	Self-mulching	
Disturbance:	Complete clearing - pasture - cultivation at some stage		Erosion:	N/A	
Site location					
Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-27.98938	153.06473	56	506365	6903972
Soil classification					
Australian Soil Classification			ASC confidence	Great Soil Group	Principal Profile Form
Endocalcareous, Self-mulching, Black Vertosol; non-gravelly, medium fine, very fine, very deep.			All necessary analytical data is available	Black Earth	Ug5.15
Vegetation					
Community name		<i>Eucalyptus tereticornis</i> woodland, open woodland			
Stratum		Species	Common name		
Tallest		<i>Eucalyptus tereticornis</i>	blue gum, forest red gum		
Profile morphology					
No	Horizon	Upper depth (m)	Lower depth (m)	Description	
1	A1	0	0.15	Very dark brown (10YR 2/2) moist; zero mottles; silty medium clay; no coarse fragments; moderate 5-10mm angular blocky structure; no segregations; moderately moist, very firm strength; no cutans; moderately permeable 50-500mm/day; moderately well drained; clear to:	
2	B21	0.15	0.4	Black (10YR 2/1) moist; zero mottles; medium heavy clay; no coarse fragments; moderate 5-10mm angular blocky structure; no segregations; moderately moist, firm strength; few distinct slickenside cutans; moderately permeable 50-500mm/day; moderately well drained; gradual to:	
3	B22	0.4	1.45	Black (10YR 2/1) moist; zero mottles; medium heavy clay; no coarse fragments; moderate 10-20mm prismatic structure; moderate 2-5mm lenticular structure; no segregations; moist, firm strength; common prominent slickenside cutans; moderately permeable 50-500mm/day; moderately well drained; clear to:	
4	B23	1.45	1.5	Black (10YR 2/1) moist; zero mottles; medium heavy clay; no coarse fragments; moderate 10-20mm angular blocky structure; moderate 5-10mm lenticular structure; few 2-10% medium 2-6mm calcareous nodules; moderately moist, very firm strength; common prominent slickenside cutans; moderately permeable 50-500mm/day; moderately well drained.	

Laboratory test results LARA 9015							
				Sample	1	2	3
				Upper depth (m)	0	0.2	0.8
				Lower depth (m)	0.1	0.3	0.9
Group	Method	Code	Units	Bulked Sample	N	N	N
Profile General	pH - 1:5 water	4A1	pH		6.5	7.1	8.2
	EC - 1:5 water	3A1	dS/m		0.08	0.04	0.07
	Cl - 1:5 water - automated	5A2	mg Cl/kg		33	<20	48
	Water sol NO3 - automated	7B1	mg/kg		3	<1	<1
	Coarse sand	2Z2_CS	%		4	2	2
	Fine sand	2Z2_FS	%		22	21	22
	Silt	2Z2_Silt	%		33	40	26
	Clay	2Z2_Clay	%		39	43	57
	Moisture content - air-dry	2A1	%		5.4	5.6	5.9
	Moisture content - 15 bar	2E1	%		25.3	28.8	41.6
	Moisture content - 1/3 bar	2E2	%		37.8	39.8	50.4
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1			0.72	0.74	0.85
	Dispersion ratio (R2)	2Z1_R2			0.4	0.42	0.49
Alcoholic Cations	Exch Ca - Alch NH4Cl pH8.5 pre wash	15C1_Ca	meq/100g				26.6
	Exch Mg - Alch NH4Cl pH8.5 pre wash	15C1_Mg	meq/100g				26.5
	Exch Na - Alch NH4Cl pH8.5 pre wash	15C1_Na	meq/100g				2.63
	Exch K - Alch NH4Cl pH8.5 pre wash	15C1_K	meq/100g				0.25
	CEC - Alch NH4Cl pH8.5 pre wash	15C1_CEC	meq/100g				56
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g		24.2	26.2	
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g		18.0	20.0	
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g		0.48	0.80	
	Exch Na - NH4Cl no wash adjusted	15A3_Na	meq/100g		0.389	0.797	
	Exch K - NH4Cl no wash	15A1_K	meq/100g		0.61	0.29	

Project LARA Site 9016					
Site characteristics					
Slope %:	8		Slope type:	Abney level or clinometer and tape	
Morphological type:	Upper slope		Landform element:	Fan	
Landform pattern:	Hills		Geology:	TQr-SEQ: Pediment slope wash, clay, scree, soil	
Observation type:	Relatively undisturbed soil core		When described:	27/08/2017	
Location measurement method:	Averaging GPS		Soil name:	Glenapp	
Runoff:	Slow		Depth to water:	N/A	
Permeability:	Moderately permeable 50-500mm/day		Microrelief:	Zero	
Drainage:	Moderately well drained		Microrelief component:	N/A	
Rock outcrop:	No bedrock exposed		Substrate lithology:	Basalt	
Surface coarse fragments:	No coarse fragments		Surface condition:	Self-mulching	
Disturbance:	Complete clearing - pasture - cultivation at some stage		Erosion:	N/A	
Site location					
Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-27.99195	153.07647	56	507519	6903687
Soil classification					
Australian Soil Classification		ASC confidence	Great Soil Group	Principal Profile Form	
Endocalcareous, Self-mulching, Black Vertosol; non-gravelly, very fine, very fine, very deep.		All necessary analytical data is available	Black Earth	Ug5.15	
Vegetation					
Community name		Eucalyptus tereticornis woodland, open woodland			
Stratum		Species	Common name		
Tallest		Eucalyptus tereticornis	blue gum, forest red gum		
		Eucalyptus melliodora	yellow box		
Profile morphology					
No	Horizon	Upper depth (m)	Lower depth (m)	Description	
1	A1	0	0.09	Black (10YR 2/1) moist; zero mottles; silty medium heavy clay; no coarse fragments; moderate 5-10mm angular blocky structure; no segregations; dry, very firm strength; few faint slickenside cutans; moderately permeable 50-500mm/day; moderately well drained; clear to:	
2	B21	0.09	0.5	Black (10YR 2/1) moist; zero mottles; silty medium heavy clay; no coarse fragments; moderate 5-10mm subangular blocky structure; no segregations; moderately moist, firm strength; few faint slickenside cutans; moderately permeable 50-500mm/day; moderately well drained; gradual to:	
3	B22	0.5	1	Very dark grey (10YR 3/1) moist; zero mottles; heavy clay; no coarse fragments; moderate 2-5mm lenticular structure; no segregations; moist, firm strength; common distinct slickenside cutans; moderately permeable 50- 500mm/ day; moderately well drained; clear to:	
4	B23	1	1.75	Very dark grey (10YR 3/1) moist; zero mottles; heavy clay; no coarse fragments; strong 10-20mm prismatic structure; strong 2-5mm lenticular structure; few 2-10% medium 2-6mm calcareous nodules; moist, firm strength; many prominent slickenside cutans; moderately permeable 50-500mm/day; moderately well drained.	

Laboratory test results LARA 9016							
				Sample	1	2	3
				Upper depth (m)	0	0.2	0.8
				Lower depth (m)	0.09	0.3	0.9
Group	Method	Code	Units	Bulked Sample	N	N	N
Profile General	pH - 1:5 water	4A1	pH		6.2	6.6	8.5
	EC - 1:5 water	3A1	dS/m		0.07	0.04	0.53
	Cl - 1:5 water - automated	5A2	mg Cl/kg		<20	<20	675
	Water sol NO3 - automated	7B1	mg/kg		3	<1	<1
	Coarse sand	2Z2_CS	%		7	5	2
	Fine sand	2Z2_FS	%		25	19	21
	Silt	2Z2_Silt	%		28	35	23
	Clay	2Z2_Clay	%		45	39	61
	Moisture content - air-dry	2A1	%		5.8	4.8	7.1
	Moisture content - 15 bar	2E1	%		40.9	34.8	47.3
	Moisture content - 1/3 bar	2E2	%		50	42.6	57.7
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1			0.67	0.69	0.78
	Dispersion ratio (R2)	2Z1_R2			0.43	0.4	0.47
Alcoholic Cations	Exch Ca - Alch NH4Cl pH8.5 pre wash	15C1_Ca	meq/100g				16.5
	Exch Mg - Alch NH4Cl pH8.5 pre wash	15C1_Mg	meq/100g				46.8
	Exch Na - Alch NH4Cl pH8.5 pre wash	15C1_Na	meq/100g				5.15
	Exch K - Alch NH4Cl pH8.5 pre wash	15C1_K	meq/100g				0.35
	CEC - Alch NH4Cl pH8.5 pre wash	15C1_CEC	meq/100g				69
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g		18.4	15.4	
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g		25.8	22.4	
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g		0.45	1.11	
	Exch Na - NH4Cl no wash adjusted	15A3_Na	meq/100g		0.454	1.11	
	Exch K - NH4Cl no wash	15A1_K	meq/100g		1.31	0.40	



Project LARA Site 9017						
Site characteristics						
Slope %:	2.5		Slope type:	Abney level or clinometer and tape		
Morphological type:	Upper slope		Landform element:	Hillslope		
Landform pattern:	Plain		Geology:	Beaudesert beds-Te1 (basalt): Basalt, dolerite sills, minor carbonaceous shale		
Observation type:	Relatively undisturbed soil core		When described:	28/09/2017		
Location measurement method:	Averaging GPS		Soil name:	Saville		
Runoff:	Slow		Depth to water:	N/A		
Permeability:	Slowly permeable 5-50mm/day		Microrelief:	Zero or none		
Drainage:	Imperfectly drained		Microrelief component:	N/A		
Rock outcrop:	No bedrock exposed		Substrate lithology:	Sandstone		
Surface coarse fragments:	No coarse fragments		Surface condition:	Hard setting; Firm		
Disturbance:	Complete clearing - pasture - cultivation at some stage		Erosion:	N/A		
Site location						
Datum	Latitude (dd)		Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-27.92245		152.95465	56	495538	6911387
Soil classification						
Australian Soil Classification			ASC confidence	Great Soil Group	Principal Profile Form	
Eutrophic, Mesonatric, Brown Sodosol; medium, non-gravelly, clay loamy, clayey, deep.			All necessary analytical data is available	Solodic Soil	Db1.12	
Profile morphology						
No	Horizon	Upper depth (m)	Lower depth (m)	Description		
1	A1	0	0.22	Very dark brown (10YR 2/2) moist; zero mottles; clay loam, sandy; no coarse fragments; massive structure; few 210% medium 2-6mm ferromanganiferous nodules; dry, firm strength; no cutans; moderately permeable 50-500mm/day; moderately well drained; abrupt to:		
2	B21t	0.22	0.95	Dark yellowish brown (10YR 4/4) moist; very few <2% fine <5mm grey mottles; very few <2% fine <5mm orange mottles; medium heavy clay; no coarse fragments; moderate 2-5mm subangular blocky structure; very few <2% medium 2-6mm manganiferous nodules; common 10-20% medium 2-6mm manganiferous veins; moist, firm strength; no cutans; moderately permeable 50-500mm/day; moderately well drained; clear to:		
3	B22t	0.95	1.25	Greyish brown (10YR 5/2) moist; few 2-10% medium 5-15mm orange mottles; heavy clay; no coarse fragments; moderate 2-5mm subangular blocky structure; weak 2-5mm lenticular structure; no segregations; moderately moist, very firm strength; few distinct slickenside cutans; moderately permeable 50-500mm/day; imperfectly drained; abrupt to:		
4	BC	1.25	1.3	Brownish yellow (10YR 6/6) moist; few 2-10% medium 5-15mm orange substrate influence; sandy light medium clay; no coarse fragments; weak 5-10mm subangular blocky structure; no segregations; moderately moist, firm strength; no cutans; moderately permeable 50-500mm/day; imperfectly drained.		

Laboratory test results LARA 9017							
				Sample	1	2	3
				Upper depth (m)	0	0.25	1.1
				Lower depth (m)	0.1	0.35	1.2
Group	Method	Code	Units	Bulked Sample	N	N	N
Profile General	pH - 1:5 water	4A1	pH		6.3	5.8	7.4
	EC - 1:5 water	3A1	dS/m		0.09	0.23	0.93
	Cl - 1:5 water - automated	5A2	mg Cl/kg		54	331	1507
	Water sol NO3 - automated	7B1	mg/kg		<1	<1	<1
	Coarse sand	2Z2_CS	%		38	23	11
	Fine sand	2Z2_FS	%		31	20	21
	Silt	2Z2_Silt	%		13	11	8
	Clay	2Z2_Clay	%		19	48	57
	Moisture content - air-dry	2A1	%		1.8	2.8	3.9
	Moisture content - 15 bar	2E1	%		13.8	20.6	26.8
	Moisture content - 1/3 bar	2E2	%		20.9	29.2	51.7
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1			0.54	0.86	1.1
	Dispersion ratio (R2)	2Z1_R2			0.38	0.58	1
Alcoholic Cations	Exch Ca - Alch NH4Cl pH8.5 pre wash	15C1_Ca	meq/100g				7.70
	Exch Mg - Alch NH4Cl pH8.5 pre wash	15C1_Mg	meq/100g				16.2
	Exch Na - Alch NH4Cl pH8.5 pre wash	15C1_Na	meq/100g				10.9
	Exch K - Alch NH4Cl pH8.5 pre wash	15C1_K	meq/100g				0.21
	CEC - Alch NH4Cl pH8.5 pre wash	15C1_CEC	meq/100g				35
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g		5.63	5.53	
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g		4.63	10.59	
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g		0.79	4.16	
	Exch Na - NH4Cl no wash adjusted	15A3_Na	meq/100g		0.642	3.23	
	Exch K - NH4Cl no wash	15A1_K	meq/100g		0.33	0.17	

Project LARA Site 9018					
Site characteristics					
Slope %:	0		Slope type:	Estimate	
Morphological type:	Flat		Landform element:	Plain	
Landform pattern:	Flood plain		Geology:	Qa-SEQ: Clay, silt, sand, gravel; flood plain alluvium	
Observation type:	Relatively undisturbed soil core		When described:	28/09/2017	
Location measurement method:	Averaging GPS		Soil name:	Blenheim	
Runoff:	No runoff		Depth to water:	N/A	
Permeability:	Moderately permeable 50-500mm/day		Microrelief:	Zero	
Drainage:	Moderately well drained		Microrelief component:	N/A	
Rock outcrop:	No bedrock exposed		Substrate lithology:	Altered substrate materials	
Surface coarse fragments:	No coarse fragments		Surface condition:	Self-mulching, cracking	
Disturbance:	Cultivation - Irrigated, past or present		Erosion:	N/A	
Site location					
Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-27.93923	152.96514	56	496571	6909529
Soil classification					
Australian Soil Classification			ASC confidence	Great Soil Group	Principal Profile Form
Endocalcareous, Self-mulching, Black Vertosol; non-gravelly, very fine, very fine, very deep.			All necessary analytical data is available	Black Earth	Ug5.15
Vegetation					
Community name		Eucalyptus tereticornis woodland, open woodland			
Stratum		Species	Common name		
Tallest		Eucalyptus tereticornis	blue gum, forest red gum		
Profile morphology					
No	Horizon	Upper depth (m)	Lower depth (m)	Description	
1	A1	0	0.2	Very dark brown (10YR 2/2) moist; very few <2% fine <5mm red substrate influence; medium heavy clay; no coarse fragments; moderate 2-5mm subangular blocky structure; no segregations; moderately moist, firm strength; few faint slickenside cutans; moderately permeable 50-500mm/day; moderately well drained; gradual to:	
2	B21	0.2	1.25	Black (10YR 2/1) moist; very few <2% fine <5mm red substrate influence; medium heavy clay; no coarse fragments; moderate 2-5mm lenticular structure; very few <2% medium 2-6mm calcareous nodules; moist, firm strength; few distinct slickenside cutans; moderately permeable 50-500mm/day; moderately well drained; gradual to:	
3	B22	1.25	1.5	Very dark brown (10YR 2/2) moist; zero mottles; medium heavy clay; no coarse fragments; moderate 2-5mm lenticular structure; very few <2% fine <2mm manganiferous nodules; moderately moist, firm strength; common distinct slickenside cutans; moderately permeable 50-500mm/day; moderately well drained.	

Laboratory test results LARA 9018							
				Sample	79	80	81
				Upper depth (m)	0	0.2	0.8
				Lower depth (m)	0.1	0.3	0.9
Group	Method	Code	Units	Bulked Sample	N	N	N
Profile General	pH - 1:5 water	4A1	pH		6.2	6.1	7.8
	EC - 1:5 water	3A1	dS/m		0.32	0.21	0.1
	Cl - 1:5 water - automated	5A2	mg Cl/kg		280	237	70
	Water sol NO3 - automated	7B1	mg/kg		54	8	3
	Coarse sand	2Z2_CS	%		4	2	4
	Fine sand	2Z2_FS	%		10	17	12
	Silt	2Z2_Silt	%		34	34	31
	Clay	2Z2_Clay	%		53	55	57
	Moisture content - air-dry	2A1	%		4.6	5	5.4
	Moisture content - 15 bar	2E1	%		39.3	38	42.1
	Moisture content - 1/3 bar	2E2	%		45.7	46.8	48.4
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1			0.75	0.69	0.87
	Dispersion ratio (R2)	2Z1_R2			0.46	0.41	0.58
Alcoholic Cations	Exch Ca - Alch NH4Cl pH8.5 pre wash	15C1_Ca	meq/100g				27.1
	Exch Mg - Alch NH4Cl pH8.5 pre wash	15C1_Mg	meq/100g				19.7
	Exch Na - Alch NH4Cl pH8.5 pre wash	15C1_Na	meq/100g				2.37
	Exch K - Alch NH4Cl pH8.5 pre wash	15C1_K	meq/100g				0.30
	CEC - Alch NH4Cl pH8.5 pre wash	15C1_CEC	meq/100g				49
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g		20.8	22.1	
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g		14.4	15.2	
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g		1.93	1.43	
	Exch Na - NH4Cl no wash adjusted	15A3_Na	meq/100g		1.13	0.759	
	Exch K - NH4Cl no wash	15A1_K	meq/100g		1.41	0.68	

Project SEQ Site 95 Site characteristics					
Slope %:	1		Slope type	Abney level or clinometer and tape	
Morphological type:	Flat		Landform element:	Terrace plain	
Landform pattern:	Terrace		Geology:	Qa-SEQ: Clay, silt, sand, gravel; flood plain alluvium	
Observation type:	Relatively undisturbed soil core		When described:	23/03/1995	
Location measurement method:	Orthophoto map		Soil name:	Bell (SEQ)	
Runoff:	Very slow		Depth to water:	N/A	
Permeability:	Moderately permeable 50-500mm/day		Microrelief:	N/A	
Drainage:	Poorly drained		Microrelief component:	N/A	
Rock outcrop:	N/A		Substrate lithology:	Altered substrate materials	
Surface coarse fragments:	N/A		Surface condition:	Firm	
Disturbance:	N/A		Erosion:	N/A	
Site location					
Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-27.8517	152.95187	56	495261	6919225
Soil classification					
Australian Soil Classification			ASC confidence	Great Soil Group	Principal Profile Form
Black Vertosol.			All necessary analytical data is available	Black earth	Ug5.16
Vegetation					
Community name		Mid-high woodland, <i>Eucalyptus tereticornis</i>			
Stratum		Species	Common name		
Tallest 6.01-12m		<i>Eucalyptus tereticornis</i>	blue gum, forest red gum		
Profile morphology					
No	Horizon	Upper depth (m)	Lower depth (m)	Description	
1	Ap	0	0.25	Brownish black (10YR 3/1) light clay; moderate 2-5mm granular structure; few 2-10% fine <2mm manganiferous soft segregations; dry, firm strength; dry soil water status;	
2	B21	0.25	0.7	Brownish black (10YR 3/1) medium heavy clay; moderate 10-20mm lenticular structure; dry, very firm strength; dry soil water status;	
3	B22	0.7	1	Greyish yellow-brown (10YR 4/2) medium clay; moderate 10-20mm lenticular structure; few 2-10% medium 2-6mm calcareous nodules; dry, very firm strength; dry soil water status;	
4	2B	1	1.25	Dull yellowish brown (10YR 5/3) light clay; moderate 10-20mm prismatic structure; few 2-10% medium 2-6mm calcareous nodules; dry, very firm strength; dry soil water status.	

**Laboratory test results SEQ 95**

				Sample	1	2	3	4	5	6	7
				Upper depth (m)	0	0	0.2	0.5	0.8	1.1	1.4
				Lower depth (m)	0.1	0.1	0.3	0.6	0.9	1.2	1.5
Group	Method	Code	Units	Bulked Sample	Y	N	N	N	N	N	N
Profile General	pH - 1:5 water	4A1	pH		6.4	6.3	6.3	7.0	7.7	7.3	7.8
	EC - 1:5 water	3A1	dS/m		0.07	0.05	0.03	0.05	0.05	0.04	0.04
	Cl - 1:5 water - automated	5A2	mg Cl/kg		31	29	<20	43	48	33	25
	Water sol NO3 - automated	7B1	mg/kg		1	1	1	1	1	1	1
	OC - Walkley/Black	6A1	%		2.5						
	Total N - Kjeldahl, automated	7A2	%		0.14						
	Coarse sand	2Z2_CS	%			7	9	11	8	10	
	Fine sand	2Z2_FS	%			46	43	40	49	55	
	Silt	2Z2_Silt	%			22	24	15	13	14	
	Clay	2Z2_Clay	%			25	26	37	30	24	
	Moisture content - air-dry	2A1	%			2.6	2.1	2.1	2.8	2.0	
	Moisture content - 15 bar	2E1	%			13.9	13.0	15.8	15.0		
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1				0.56	0.55	0.44	0.57		
	Total S XRF	10A1	%			0.03	0.02	0.01	0.01	0.01	
	Total P XRF	9A1	%			0.13	0.12	0.09	0.08	0.08	
	Total K XRF	17A1	%			1.200	1.180	1.050	1.040	1.080	
	CaPhos Extr S - ICPAES	10B3	mg/kg		5						
	P (BiCarb Extr)- automated	9B2	mg P/kg		164						
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g			12.31	11.23	15.32	15.42	14.28	
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g			6.77	5.41	7.66	7.50	6.73	
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g			0.37	0.43	0.75	0.82	0.82	
	Exch K - NH4Cl no wash	15A1_K	meq/100g			0.81	0.26	0.43	0.36	0.34	
	ECEC	15J1	meq/100g			20.26	17.33	24.15	24.11	22.16	
Other Bulk	DTPA Extr Cu	12A1_Cu	mg/kg		1.0						
	DTPA Extr Fe	12A1_Fe	mg/kg		113.9						
	DTPA Extr Mn	12A1_Mn	mg/kg		19.5						
	DTPA Extr Zn	12A1_Zn	mg/kg		3.5						
	Extr K - HCl	18B1	mg/kg		1.1						
	P (Acid) - automated	9G2	mg P/kg		390						

Project SEQ Site 115					
Site characteristics					
Slope %:	0.5		Slope type:	Abney level or clinometer and tape	
Morphological type:	Flat		Landform element:	Terrace plain	
Landform pattern:	Terrace		Geology:	Qa-SEQ: Clay, silt, sand, gravel; flood plain alluvium	
Observation type:	Relatively undisturbed soil core		When described:	11/04/1995	
Location measurement method:	Orthophoto map		Soil name:	Bell (SEQ)	
Runoff:	Slow		Depth to water:	N/A	
Permeability:	Moderately permeable 50-500mm/day		Microrelief:	N/A	
Drainage:	Poorly drained		Microrelief component:	N/A	
Rock outcrop:	N/A		Substrate lithology:	N/A	
Surface coarse fragments:	N/A		Surface condition:	Firm	
Disturbance:	Complete clearing - pasture - cultivation at some stage		Erosion:	N/A	
Site location					
Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-27.84426	152.94024	56	494116	6920048
Soil classification					
Australian Soil Classification			ASC confidence	Great Soil Group	Principal Profile Form
Epipedal, Black Vertosol.			All necessary analytical data is available	Black earth	Ug5.16
Vegetation					
Community name		Mid-high woodland, <i>Eucalyptus tereticornis</i>			
Stratum		Species	Common name		
Tallest 6.01-12m		<i>Eucalyptus tereticornis</i>	blue gum, forest red gum		
Profile morphology					
No	Horizon	Upper depth (m)	Lower depth (m)	Description	
1	Ap	0	0.2	Brownish black (7.5YR 3/1) medium clay; moderate 2-5mm granular structure; dry, firm strength; dry soil water status; clear to:	
2	B21	0.2	0.63	Brownish black (10YR 3/1) medium heavy clay; moderate 10-20mm angular blocky structure; moderate 5-10mm lenticular structure; moderately moist, very firm strength; moderately moist soil water status; gradual to:	
3	B22	0.63	1.4	Brownish black (10YR 3/2) medium heavy clay; moderate 10-20mm angular blocky structure; moderate 5-10mm lenticular structure; moderately moist, very firm strength; moderately moist soil water status; gradual to:	
4	B3	1.4	1.7	Greyish yellow-brown (10YR 4/2) sandy light medium clay; moderate 10-20mm angular blocky structure; moderately moist, very firm strength; moderately moist soil water status.	

Laboratory test results SEQ 115											
				Sample	1	2	3	4	5	6	7
				Upper depth (m)	0	0	0.2	0.3	0.8	1.1	1.4
				Lower depth (m)	0.1	0.1	0.3	0.6	0.9	1.3	1.5
Group	Method	Code	Units	Bulked Sample	Y	N	N	N	N	N	N
Profile General	pH - 1:5 water	4A1	pH		5.6	5.4	6.2	7.6	8.0		8.0
	EC - 1:5 water	3A1	dS/m		0.1	0.17	0.16	0.57	0.79		0.9
	Cl - 1:5 water - automated	5A2	mg Cl/kg		48	125	186	821	1238		1509
	Water sol NO3 - automated	7B1	mg/kg		15	31	1	1	1		1
	OC - Walkley/Black	6A1	%		2.4						
	Total N - Kjeldahl, automated	7A2	%		0.17						
	Coarse sand	2Z2_CS	%			3	2	1	1	2	
	Fine sand	2Z2_FS	%			12	12	8	4	6	
	Silt	2Z2_Silt	%			32	25	21	16	21	
	Clay	2Z2_Clay	%			51	61	70	78	71	
	Moisture content - air-dry	2A1	%			3.4	3.8	4.8	5.8	5.7	
	Moisture content - 15 bar	2E1	%			20.6	24.5	29.0	31.8		
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1				0.45	0.57	0.68	0.73		
	Total S XRF	10A1	%			0.04	0.02	0.01	0.01	0.01	
	Total P XRF	9A1	%			0.06	0.03	0.02	0.03	0.04	
	Total K XRF	17A1	%			0.620	0.390	0.360	0.400	0.670	
	CaPhos Extr S - ICPAES	10B3	mg/kg		25						
	P (BiCarb Extr)- automated	9B2	mg P/kg		29						
	pH - 1:5 0.01M CaCl2	4B1	pH		4.9	4.8	5.3	6.9	7.5	7.6	7.5
Alcoholic Cations	Exch Ca - Alch NH4Cl pH8.5 pre wash	15C1_Ca	meq/100g			9.0	10.38	13.62	15.87	14.88	
	Exch Mg - Alch NH4Cl pH8.5 pre wash	15C1_Mg	meq/100g			12.41	16.61	26.20	31.74	29.76	
	Exch Na - Alch NH4Cl pH8.5 pre wash	15C1_Na	meq/100g			0.75	2.39	5.66	8.04	7.76	
	Exch K - Alch NH4Cl pH8.5 pre wash	15C1_K	meq/100g			0.81	0.30	0.21	0.19	0.27	
	CEC - Alch NH4Cl pH8.5 pre wash	15C1_CEC	meq/100g			42	45	52	58	51	
Other Bulk	DTPA Extr Cu	12A1_Cu	mg/kg		1.7						
	DTPA Extr Fe	12A1_Fe	mg/kg		97.0						
	DTPA Extr Mn	12A1_Mn	mg/kg		63.0						
	DTPA Extr Zn	12A1_Zn	mg/kg		1.9						
	Extr K - HCl	18B1	mg/kg		1.0						
	P (Acid) - automated	9G2	mg P/kg		24						



**Project SEQ Site 152**  
**Site characteristics**

<b>Slope %:</b>	2	<b>Slope type:</b>	Abney level or clinometer and tape
<b>Morphological type:</b>	Flat	<b>Landform element:</b>	Terrace plain
<b>Landform pattern:</b>	Terrace	<b>Geology:</b>	Gatton Sandstone: Lithic labile and feldspathic labile sandstone
<b>Observation type:</b>	N/A	<b>When described:</b>	29/03/1995
<b>Location measurement method:</b>	Orthophoto map	<b>Soil name:</b>	<b>Koukandowie</b>
<b>Runoff:</b>	Slow	<b>Depth to water:</b>	N/A
<b>Permeability:</b>	Slowly permeable 5-50mm/day	<b>Microrelief:</b>	Zero
<b>Drainage:</b>	Imperfectly drained	<b>Microrelief component:</b>	N/A
<b>Rock outcrop:</b>	N/A	<b>Substrate lithology:</b>	N/A
<b>Surface coarse fragments:</b>	No coarse fragments	<b>Surface condition:</b>	Hard setting
<b>Disturbance:</b>	Complete clearing - pasture - but never cultivated	<b>Erosion:</b>	No erosion

**Site location**

<b>Datum</b>	<b>Latitude (dd)</b>	<b>Longitude (dd)</b>	<b>Zone</b>	<b>Easting (m)</b>	<b>Northing (m)</b>
GDA94	-27.80698	153.01262	56	501243	6924179

**Soil classification**

<b>Australian Soil Classification</b>	<b>ASC confidence</b>	<b>Great Soil Group</b>	<b>Principal Profile Form</b>
Mottled, Eutrophic, Brown Chromosol.	All necessary analytical data is available	Gleyed podzolic soil	Dy3.11

**Profile morphology**

No	Horizon	Upper depth (m)	Lower depth (m)	Description
1	Ap	0	0.2	Dark brown (10YR 3/3) fine sandy loam; no coarse fragments; weak structure; moist, weak strength; moist soil water status; clear to:
2	B21t	0.2	0.45	Dull yellowish brown (10YR 5/4) common 10-20% fine <5mm; fine sandy medium clay; moderate angular blocky structure; few 2-10% medium 2-6mm manganiferous concretions; moist, firm strength; moist soil water status;
3	B22t	0.45	0.9	Greyish yellow-brown (10YR 5/2) common 10-20% fine <5mm; fine sandy medium clay; moderate angular blocky structure; moist soil water status;
4	B23t	0.9	1.3	Brownish grey (10YR 6/1) common 10-20% fine <5mm; fine sandy light medium clay; moderate angular blocky structure; moist soil water status.

**Laboratory test results SEQ 152**

				Sample	1	2	3	4	5	6
				Upper depth (m)	0	0	0.2	0.5	0.8	1.1
				Lower depth (m)	0.1	0.1	0.3	0.6	0.9	1.2
				Bulked Sample	Y	N	N	N	N	N
Group	Method	Code	Units							
Profile General	pH - 1:5 water	4A1	pH		5.5	5.5	6.0	5.4	5.1	5.1
	EC - 1:5 water	3A1	dS/m		0.12	0.18	0.34	0.59	0.38	0.79
	Cl - 1:5 water - automated	5A2	mg Cl/kg		63	81	369	756	1228	320
	Water sol NO3 - automated	7B1	mg/kg		10	27	4	1	1	1
	OC - Walkley/Black	6A1	%		4.4					
	Total N - Kjeldahl, automated	7A2	%		0.29					
	Coarse sand	2Z2_CS	%			24	19	18	15	18
	Fine sand	2Z2_FS	%			55	37	38	36	37
	Silt	2Z2_Silt	%			8	8	8	10	7
	Clay	2Z2_Clay	%			12	37	36	41	37
	Moisture content - air-dry	2A1	%			.8	3.3	3.0	3.2	3.4
	Moisture content - 15 bar	2E1	%			6.1	15.2	16.3	18.5	
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1				0.35	0.79	0.98	0.99	
	Total S XRF	10A1	%			0.04	0.03	0.02	0.02	0.01
	Total P XRF	9A1	%			0.06	0.01	0.01	0.01	0.01
	Total K XRF	17A1	%			0.55	0.51	0.49	0.6	0.66
	CaPhos Extr S - ICPAES	10B3	mg/kg		12					
	P (BiCarb Extr)- automated	9B2	mg P/kg		240					
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g			2.62	3.92	2.88	3.30	3.21
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g			1.81	9.71	9.48	11.35	11.37
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g			0.22	3.02	6.18	9.39	8.89
	Exch K - NH4Cl no wash	15A1_K	meq/100g			1.21	1.14	0.35	0.30	0.28
	Exchangeable Al – KCl	15G1_Al	meq/100g				0.1	0.3	0.4	0.3
	Exchange acidity (H + Al)	15G1_H	meq/100g				0.1	0.4	0.6	0.4
	ECEC	15J1	meq/100g			5.87	17.9	18.89	24.34	23.75
Other Bulk	DTPA Extr Cu	12A1_Cu	mg/kg		0.8					
	DTPA Extr Fe	12A1_Fe	mg/kg		335.0					
	DTPA Extr Mn	12A1_Mn	mg/kg		99.0					
	DTPA Extr Zn	12A1_Zn	mg/kg		26.0					
	Extr K - HCl	18B1	mg/kg		1.2					
	P (Acid) - automated	9G2	mg P/kg		222					

Project SEQ Site 162					
Site characteristics					
Slope %:	3		Slope type:	Abney level or clinometer and tape	
Morphological type:	Flat		Landform element:	Terrace plain	
Landform pattern:	Terrace		Geology:	Qpa/1-9543: Stranded river terrace (above floodplain); clay, silt, sand, gravel	
Observation type:	N/A		When described:	30/03/1995	
Location measurement method:	Orthophoto map		Soil name:	Kilmoylar	
Runoff:	Slow		Depth to water:	N/A	
Permeability:	Moderately permeable 50-500mm/day		Microrelief:	N/A	
Drainage:	Imperfectly drained		Microrelief component:	N/A	
Rock outcrop:	N/A		Substrate lithology:	N/A	
Surface coarse fragments:	No coarse fragments		Surface condition:	Firm	
Disturbance:	Complete clearing - pasture - but never cultivated		Erosion:	No erosion	
Site location					
Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-27.79115	153.00063	56	500062	6925933
Soil classification					
Australian Soil Classification			ASC confidence	Great Soil Group	Principal Profile Form
Mottled, Eutrophic, Brown Chromosol.			All necessary analytical data is available	Soloth	Dy3.32
Profile morphology					
No	Horizon	Upper depth (m)	Lower depth (m)	Description	
1	A1	0	0.12	Brownish black (10YR 3/2) fine sandy clay loam; no coarse fragments; weak structure; moderately moist, weak strength; moderately moist soil water status; clear to:	
2	A2j	0.12	0.2	Greyish yellow-brown (10YR 4/2) Light grey (10YR 7/1) dry; common 10-20% fine <5mm; fine sandy clay loam; weak structure; many 20-50% medium 2-6mm manganiferous concretions; dry, weak strength; dry soil water status; clear to:	
3	B21	0.2	0.3	Common 10-20% fine <5mm; medium clay; moderate angular blocky structure; many 20-50% medium 2-6mm; manganiferous concretions; dry soil water status;	
4	B22	0.3	0.7	Dull yellowish brown (10YR 5/3) medium clay; moderate lenticular structure; few 2-10% medium 2-6mm; manganiferous concretions; dry soil water status;	
5	B23	0.7	1.2	Yellowish brown (2.5Y 5/3) medium heavy clay; strong lenticular structure; dry soil water status.	

Laboratory test results SEQ 162											
				Sample	1	2	3	4	5	6	7
				Upper depth (m)	0	0	0.2	0.5	0.8	1.1	1.4
				Lower depth (m)	0.1	0.1	0.3	0.6	0.9	1.2	1.5
				Bulked Sample	Y	N	N	N	N	N	N
Group	Method	Code	Units								
Profile General	pH - 1:5 water	4A1	pH		5.7	7.0	5.9	7.5	7.0	5.7	5.8
	EC - 1:5 water	3A1	dS/m		0.05	0.1	0.04	0.65	0.36	0.91	0.39
	Cl - 1:5 water - automated	5A2	mg Cl/kg		20	99	24	1030	473	1492	420
	Water sol NO3 - automated	7B1	mg/kg		1	1	1	1	1	1	1
	OC - Walkley/Black	6A1	%		3.2						
	Total N - Kjeldahl, automated	7A2	%		0.2						
	Coarse sand	2Z2_CS	%			10	7	7	7	8	
	Fine sand	2Z2_FS	%			42	53	20	16	14	
	Silt	2Z2_Silt	%			17	18	15	17	17	
	Clay	2Z2_Clay	%			34	22	59	62	64	
	Moisture content - air-dry	2A1	%			2.0	1.5	4.0	3.7	3.6	
	Moisture content - 15 bar	2E1	%			15.1	10.5	22.7	24.4		
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1				0.65	0.31	0.94	0.94		
	Total S XRF	10A1	%			0.02	0.03	0.01	0.01	0.01	
	Total P XRF	9A1	%			0.02	0.04	0.01	0.01	0.01	
	Total K XRF	17A1	%			0.600	0.870	0.310	0.290	0.310	
	CaPhos Extr S - ICPAES	10B3	mg/kg		11						
	P (BiCarb Extr)- automated	9B2	mg P/kg		41						
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g			6.53	6.09	6.55	5.81	5.08	
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g			8.77	4.47	13.52	13.48	13.47	
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g			2.65	.63	8.53	10.37	10.36	
	Exch K - NH4Cl no wash	15A1_K	meq/100g			0.19	0.25	0.23	0.26	0.29	
	Exchangeable Al – KCl	15G1_Al	meq/100g				0.1			0.1	
	Exchange acidity (H + Al)	15G1_H	meq/100g				0.1			0.1	
	ECEC	15J1	meq/100g			18.14	11.44	28.27	29.92	29.19	
Other Bulk	DTPA Extr Cu	12A1_Cu	mg/kg		.9						
	DTPA Extr Fe	12A1_Fe	mg/kg		185.6						
	DTPA Extr Mn	12A1_Mn	mg/kg		42.8						
	DTPA Extr Zn	12A1_Zn	mg/kg		5.5						
	Extr K - HCl	18B1	mg/kg		0.6						
	P (Acid) - automated	9G2	mg P/kg		48						

Project SEQ Site 317					
Site characteristics					
Slope %:	0.5		Slope type	Abney level or clinometer and tape	
Morphological type:	Flat		Landform element:	Terrace plain	
Landform pattern:	Terrace		Geology:	Qa-SEQ: Clay, silt, sand, gravel; flood plain alluvium	
Observation type:	N/A		When described:	8/05/1995	
Location measurement method:	Orthophoto map		Soil name:	Waterford	
Runoff:	Very slow		Depth to water:	N/A	
Permeability:	Slowly permeable 5-50mm/day		Microrelief:	Normal gilgai	
Drainage:	Poorly drained		Microrelief component:	N/A	
Rock outcrop:	N/A		Substrate lithology:	N/A	
Surface coarse fragments:	N/A		Surface condition:	Periodic cracking	
Disturbance:	Complete clearing - pasture - but never cultivated		Erosion:	N/A	
Site location					
Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-27.87329	152.95267	56	495341	6916833
Soil classification					
Australian Soil Classification			ASC confidence	Great Soil Group	Principal Profile Form
Enoacidic, Epipedal, Black Vertosol.			All necessary analytical data is available	Grey clay	Ug5.16
Profile morphology					
No	Horizon	Upper depth (m)	Lower depth (m)	Description	
1	A1	0	0.1	Brownish black (10YR 3/2) very few <2% medium 5-15mm; medium clay; moderate 2-5mm granular structure; moderately moist, weak strength; moderately moist soil water status;	
2	B1	0.1	0.3	Brownish black (10YR 3/2) common 10-20% medium 5-15mm; medium clay; moderate 2-5mm subangular blocky structure; few 2-10% medium 2-6mm manganiferous nodules; moderately moist, weak strength; moderately moist soil water status;	
3	B21	0.3	1.4	Greyish yellow-brown (10YR 5/2) medium heavy clay; moderate 10-20mm lenticular structure; moist, weak strength; moist soil water status;	
4	B22	1.4	1.8	Brownish grey (10YR 5/1) medium heavy clay; moderate 2-5mm subangular blocky structure; moist, weak strength; moist soil water status.	

Laboratory test results SEQ 317				Sample	1	2	3	4	5	6	7
				Upper depth (m)	0	0	0.2	0.5	0.8	1.1	1.4
				Lower depth (m)	0.1	0.1	0.3	0.6	0.9	1.2	1.5
Group	Method	Code	Units	Bulked Sample	Y	N	N	N	N	N	N
Profile General	pH - 1:5 water	4A1	pH		5.5	5.7	5.0	4.9	5.0	5.3	5.8
	EC - 1:5 water	3A1	dS/m		0.16	0.04	0.02	0.11	0.24	0.37	0.51
	Cl - 1:5 water - automated	5A2	mg Cl/kg		80	27	29	163	334	542	709
	Water sol NO3 - automated	7B1	mg/kg		33	1	1	1	1	1	1
	OC - Walkley/Black	6A1	%		3.1						
	Total N - Kjeldahl, automated	7A2	%		0.24						
	Coarse sand	2Z2_CS	%			7	6	2	3	1	
	Fine sand	2Z2_FS	%			21	13	9	11	11	
	Silt	2Z2_Silt	%			30	18	17	22	21	
	Clay	2Z2_Clay	%			43	64	72	66	68	
	Moisture content - air-dry	2A1	%			2.5	4.3	5.7	4.0	6.4	
	Moisture content - 15 bar	2E1	%			18.1	23.9	27.1	25.2		
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1				0.41	0.46	0.42	0.36		
	Total S XRF	10A1	%			0.03	0.02	0.01	0.01	0.01	
	Total P XRF	9A1	%			0.05	0.03	0.02	0.01	0.01	
	Total K XRF	17A1	%			0.27	0.18	0.15	0.17	0.41	
	CaPhos Extr S - ICPAES	10B3	mg/kg		27						
	P (BiCarb Extr)- automated	9B2	mg P/kg		33						
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g			6.36	8.24	10.46	12.48	15.96	
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g			2.56	7.82	13.74	16.64	19.15	
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g			0.42	0.54	1.69	2.60	3.83	
	Exch K - NH4Cl no wash	15A1_K	meq/100g			1.95	0.29	0.24	0.27	0.39	
	Exchangeable Al - KCl	15G1_Al	meq/100g			0.2	0.6	1.8	0.7	0.3	
	Exchange acidity (H + Al)	15G1_H	meq/100g			0.2	0.9	2.8	1.1	0.4	
	ECEC	15J1	meq/100g			11.29	16.9	26.14	31.99	39.34	
Other Bulk	DTPA Extr Cu	12A1_Cu	mg/kg		1.9						
	DTPA Extr Fe	12A1_Fe	mg/kg		179.4						
	DTPA Extr Mn	12A1_Mn	mg/kg		116.9						
	DTPA Extr Zn	12A1_Zn	mg/kg		2.2						
	Extr K - HCl	18B1	mg/kg		0.9						
	P (Acid) - automated	9G2	mg P/kg		12						

Project SEQ Site 383					
Site characteristics					
Slope %:	0.5		Slope type:	Abney level or clinometer and tape	
Morphological type:	Flat		Landform element:	Terrace plain	
Landform pattern:	Terrace		Geology:	Qa-SEQ: Clay, silt, sand, gravel; flood plain alluvium	
Observation type:	N/A		When described:	11/07/1995	
Location measurement method:	Orthophoto map		Soil name:	Bell (SEQ)	
Runoff:	Very slow		Depth to water:	N/A	
Permeability:	Moderately permeable 50-500mm/day		Microrelief:	Normal gilgai	
Drainage:	Moderately well drained		Microrelief component:	N/A	
Rock outcrop:	N/A		Substrate lithology:	N/A	
Surface coarse fragments:	N/A		Surface condition:	Firm	
Disturbance:	Complete clearing - pasture - but never cultivated		Erosion:	N/A	
Site location					
Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-27.89332	153.10628	56	510460	6914611
Soil classification					
Australian Soil Classification			ASC confidence	Great Soil Group	Principal Profile Form
Very deep, Epipedal, Haplic, Black Vertosol.			All necessary analytical data is available	Black earth	Ug5.15
Vegetation					
Community name		Mid-high woodland, <i>Eucalyptus tereticornis</i>			
Stratum		Species	Common name		
Tallest 6.01-12m		<i>Eucalyptus tereticornis</i>	blue gum, forest red gum		
Profile morphology					
No	Horizon	Upper depth (m)	Lower depth (m)	Description	
1	A1	0	0.1	Brownish black (10YR 3/1) medium clay; moderate 2-5mm granular structure;	
2	B21	0.1	0.9	Black (10YR 2/1) medium heavy clay; moderate 5-10mm subangular blocky structure; moderate 5-10mm lenticular structure;	
3	B22	0.9	1.4	Brownish black (10YR 3/2) medium heavy clay; moderate 10-20mm lenticular structure; moderate 5-10mm subangular blocky structure; few 2-10% coarse 6-20mm calcareous nodules;	
4	B23	1.4	1.55	Yellowish brown (10YR 5/6) medium heavy clay; few 2-10% medium 2-6mm ferromanganiferous nodules.	

Laboratory test results SEQ 383				Sample	1	2	3	4	5	6
				Upper depth (m)	0	0	0.2	0.5	0.8	1.1
				Lower depth (m)	0.1	0.1	0.3	0.6	0.9	1.2
Group	Method	Code	Units	Bulked Sample	Y	N	N	N	N	N
Profile General	pH - 1:5 water	4A1	pH		5.8	6.2	7.5	8.3	8.7	9.0
	EC - 1:5 water	3A1	dS/m		0.13	0.08	0.06	0.19	0.61	0.75
	Cl - 1:5 water - automated	5A2	mg Cl/kg		81	47	<20	208	804	854
	Water sol NO3 - automated	7B1	mg/kg		2	1	1	1	1	1
	OC - Walkley/Black	6A1	%		8.3					
	Total N - Kjeldahl, automated	7A2	%		0.59					
	Coarse sand	2Z2_CS	%			6	4	6	9	24
	Fine sand	2Z2_FS	%			12	11	11	12	17
	Silt	2Z2_Silt	%			35	32	31	25	16
	Clay	2Z2_Clay	%			44	52	54	54	43
	Moisture content - air-dry	2A1	%			8.3	6.3	7.1	6.3	6.7
	Moisture content - 15 bar	2E1	%			29.6	26.0	26.2	27.6	
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1						-	0.67	
	Total S XRF	10A1	%			0.07	0.03	0.02	0.01	0.01
	Total P XRF	9A1	%			0.23	0.15	0.09	0.07	0.09
	Total K XRF	17A1	%			0.88	0.82	0.72	0.63	0.56
	CaPhos Extr S - ICPAES	10B3	mg/kg		17					
	P (BiCarb Extr)- automated	9B2	mg P/kg		212					
	pH - 1:5 0.01M CaCl2	4B1	pH		5.1	5.4	6.2	7.3	7.9	8.1
Alcoholic Cations	Exch Ca - Alch NH4Cl pH8.5 pre wash	15C1_Ca	meq/100g			14.08	17.01	16.07	11.69	8.43
	Exch Mg - Alch NH4Cl pH8.5 pre wash	15C1_Mg	meq/100g			16.24	22.32	25.70	27.64	25.61
	Exch Na - Alch NH4Cl pH8.5 pre wash	15C1_Na	meq/100g			0.75	1.91	3.86	5.63	5.76
	Exch K - Alch NH4Cl pH8.5 pre wash	15C1_K	meq/100g			0.85	0.26	0.18	0.16	0.11
	CEC - Alch NH4Cl pH8.5 pre wash	15C1_CEC	meq/100g			62	55	54	50	44
Other Bulk	DTPA Extr Cu	12A1_Cu	mg/kg		4.3					
	DTPA Extr Fe	12A1_Fe	mg/kg		490.6					
	DTPA Extr Mn	12A1_Mn	mg/kg		71.5					
	DTPA Extr Zn	12A1_Zn	mg/kg		20.6					
	Extr K - HCl	18B1	mg/kg		0.9					
	P (Acid) - automated	9G2	mg P/kg		452					



Project SEQ Site 393					
Site characteristics					
Slope %:	2.5		Slope type:	Abney level or clinometer and tape	
Morphological type:	Flat		Landform element:	Terrace plain	
Landform pattern:	Terrace		Geology:	Qa-SEQ: Clay, silt, sand, gravel; flood plain alluvium	
Observation type:	Relatively undisturbed soil core		When described:	12/07/1995	
Location measurement method:	Orthophoto map		Soil name:	Bell (SEQ)	
Runoff:	Very slow		Depth to water:	N/A	
Permeability:	Moderately permeable 50-500mm/day		Microrelief:	Normal gilgai	
Drainage:	Moderately well drained		Microrelief component:	N/A	
Rock outcrop:	N/A		Substrate lithology:	N/A	
Surface coarse fragments:	N/A		Surface condition:	Periodic cracking	
Disturbance:	N/A		Erosion:	N/A	
Site location					
Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-27.92053	153.11468	56	511284	6911596
Soil classification					
Australian Soil Classification			ASC confidence	Great Soil Group	Principal Profile Form
Very deep, Haplic, Epipedal, Black Vertosol.			All necessary analytical data is available	Black earth	Ug5.15
Vegetation					
Community name		Mid-high woodland, <i>Eucalyptus tereticornis</i>			
Stratum		Species	Common name		
Tallest 6.01-12m		<i>Eucalyptus tereticornis</i>	blue gum, forest red gum		
Profile morphology					
No	Horizon	Upper depth (m)	Lower depth (m)	Description	
1	A1	0	0.1	Brownish black (10YR 3/1) medium clay; moderate 2-5mm granular structure;	
2	B21	0.1	1	Black (10YR 2/1) medium heavy clay; moderate 5-10mm subangular blocky structure; moderate 2-5mm subangular blocky structure;	
3	B22	1	1.4	Black (10YR 2/1) few 2-10% fine <5mm; medium heavy clay; moderate 10-20mm lenticular structure; moderate 5-10mm subangular blocky structure; few 2-10% medium 2-6mm ferromanganiferous nodules;	
4	B23	1.4	1.7	Brown (10YR 4/4) many 20-50% coarse 15-30mm; medium clay; moderate 2-5mm subangular blocky structure; few 210% coarse 6-20mm ferromanganiferous nodules.	

Laboratory test results SEQ 393											
				Sample	1	2	3	4	5	6	7
				Upper depth (m)	0	0	0.2	0.5	0.8	1.1	1.4
				Lower depth (m)	0.1	0.1	0.3	0.6	0.9	1.2	1.5
Group	Method	Code	Units	Bulked Sample	Y	N	N	N	N	N	N
Profile General	pH - 1:5 water	4A1	pH		6.0	6.3	6.9	7.7	7.8	8.2	8.2
	EC - 1:5 water	3A1	dS/m		0.15	0.11	0.08	0.19	0.29	0.33	0.38
	Cl - 1:5 water - automated	5A2	mg Cl/kg		91	53	65	205	314	404	439
	Water sol NO3 - automated	7B1	mg/kg		2	1	1	1	1	1	1
	OC - Walkley/Black	6A1	%		5.6						
	Total N - Kjeldahl, automated	7A2	%		0.41						
	Coarse sand	2Z2_CS	%			5	4	3	3	2	
	Fine sand	2Z2_FS	%			12	15	9	11	16	
	Silt	2Z2_Silt	%			30	35	24	28	30	
	Clay	2Z2_Clay	%			54	48	64	60	52	
	Moisture content - air-dry	2A1	%			5.9	6.9	8.0	8.5	8.4	
	Moisture content - 15 bar	2E1	%			27.9	27.1	33.2	31.4		
	Total S XRF	10A1	%			0.05	0.02	0.01	0.01	0.01	
	Total P XRF	9A1	%			0.17	0.18	0.07	0.12	0.12	
	Total K XRF	17A1	%			0.72	0.78	0.54	0.64	0.70	
	CaPhos Extr S - ICPAES	10B3	mg/kg		34						
	P (BiCarb Extr)- automated	9B2	mg P/kg		379						
	pH - 1:5 0.01M CaCl2	4B1	pH		5.2	5.3	5.8	6.8	6.9	7.3	7.4
Alcoholic Cations	Exch Ca - Alch NH4Cl pH8.5 pre wash	15C1_Ca	meq/100g			17.94	20.31	28.08	28.21	26.02	
	Exch Mg - Alch NH4Cl pH8.5 pre wash	15C1_Mg	meq/100g			18.00	18.17	25.92	23.87	23.85	
	Exch Na - Alch NH4Cl pH8.5 pre wash	15C1_Na	meq/100g			1.27	1.60	3.35	4.23	4.88	
	Exch K - Alch NH4Cl pH8.5 pre wash	15C1_K	meq/100g			0.48	0.24	0.16	0.14	0.13	
	CEC - Alch NH4Cl pH8.5 pre wash	15C1_CEC	meq/100g			63	58	65	64	61	
Other Bulk	DTPA Extr Cu	12A1_Cu	mg/kg		2.0						
	DTPA Extr Fe	12A1_Fe	mg/kg		367.5						
	DTPA Extr Mn	12A1_Mn	mg/kg		16.9						
	DTPA Extr Zn	12A1_Zn	mg/kg		2.7						
	Extr K - HCl	18B1	mg/kg		0.9						
	P (Acid) - automated	9G2	mg P/kg		308						

Project SEQ Site 402					
Site characteristics					
Slope %:	0.5		Slope type:	Abney level or clinometer and tape	
Morphological type:	Flat		Landform element:	Plain	
Landform pattern:	Alluvial plain		Geology:	Qa-SEQ: Clay, silt, sand, gravel; flood plain alluvium	
Observation type:	Relatively undisturbed soil core		When described:	18/07/1995	
Location measurement method:	Orthophoto map		Soil name:	Basel	
Runoff:	Very slow		Depth to water:	N/A	
Permeability:	Moderately permeable 50-500mm/day		Microrelief:	N/A	
Drainage:	Imperfectly drained		Microrelief component:	N/A	
Rock outcrop:	N/A		Substrate lithology:	N/A	
Surface coarse fragments:	N/A		Surface condition:	Firm	
Disturbance:	Complete clearing - pasture - but never cultivated		Erosion:	N/A	
Site location					
Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-27.93479	153.07898	56	507770	6910019
Soil classification					
Australian Soil Classification			ASC confidence	Great Soil Group	Principal Profile Form
All necessary analytical data is available			All necessary analytical data is available	Grey clay	Ug5.28
Vegetation					
Community name		Mid-high woodland, <i>Eucalyptus tereticornis</i>			
Stratum		Species	Common name		
Tallest 6.01-12m		<i>Eucalyptus tereticornis</i> ; <i>Eucalyptus moluccana</i>	blue gum, forest red gum; gum-topped box, grey box		
Profile morphology					
No	Horizon	Upper depth (m)	Lower depth (m)	Description	
1	A11	0	0.1	Brownish black (10YR 3/1) light medium clay; moderate 2-5mm granular structure; moderately moist, weak strength; moderately moist soil water status;	
2	A12	0.1	0.25	Brownish black (10YR 3/2) light medium clay; moderate 2-5mm granular structure; moderately moist, weak strength; moderately moist soil water status;	
3	B21	0.25	0.8	Dark greyish yellow (2.5Y 4/2) medium heavy clay; moderate 10-20mm lenticular structure; moderate 2-5mm subangular blocky structure; moderately moist, firm strength; moderately moist soil water status;	
4	B22	0.8	1.2	Yellowish grey (2.5Y 4/1) medium heavy clay; moderate 5-10mm lenticular structure; moderate 2-5mm subangular blocky structure; moderately moist, firm strength; moderately moist soil water status;	
5	B23	1.2	1.8	Yellowish grey (2.5Y 5/1) common 10-20% medium 5-15mm; medium heavy clay; moderate 5-10mm subangular blocky structure; moderate 2-5mm subangular blocky structure; moderately moist soil water status.	

Laboratory test results SEQ 402				Sample	1	2	3	4	5	6	7
				Upper depth (m)	0	0	0.2	0.5	0.8	1.1	1.4
				Lower depth (m)	0.1	0.1	0.3	0.6	0.9	1.2	1.5
Group	Method	Code	Units	Bulked Sample	Y	N	N	N	N	N	N
Profile General	pH - 1:5 water	4A1	pH		5.9	6.1	7.0	7.7	8.5	8.8	8.8
	EC - 1:5 water	3A1	dS/m		0.13	0.07	0.04	0.07	0.13	0.17	0.22
	Cl - 1:5 water - automated	5A2	mg Cl/kg		57	25	<20	<20	38	100	184
	Water sol NO3 - automated	7B1	mg/kg		37	15	1	1	1	1	1
	OC - Walkley/Black	6A1	%		3.1						
	Total N - Kjeldahl, automated	7A2	%		0.23						
	Coarse sand	2Z2_CS	%			3	2	2	1	1	
	Fine sand	2Z2_FS	%			23	20	20	23	22	
	Silt	2Z2_Silt	%			35	33	30	30	30	
	Clay	2Z2_Clay	%			40	49	52	52	49	
	Moisture content - air-dry	2A1	%			5.4	7.3	8.1	11.0	11.0	
	Moisture content - 15 bar	2E1	%			22.6	28.9	28.9	29.3		
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1				0.49	0.6		0.81		
	Total S XRF	10A1	%			0.04	0.02	0.01	0.01	0.01	
	Total P XRF	9A1	%			0.23	0.16	0.12	0.1	0.1	
	Total K XRF	17A1	%			0.96	0.82	0.78	0.74	0.76	
	CaPhos Extr S - ICPAES	10B3	mg/kg		18						
	P (BiCarb Extr)- automated	9B2	mg P/kg		209						
	pH - 1:5 0.01M CaCl2	4B1	pH		5.2	5.2	5.8	6.4	7.3	7.6	7.7
Alcoholic Cations	Exch Ca - Alch NH4Cl pH8.5 pre wash	15C1_Ca	meq/100g			13.70	18.24	19.46	19.98	16.65	
	Exch Mg - Alch NH4Cl pH8.5 pre wash	15C1_Mg	meq/100g			12.65	19.31	25.94	28.86	29.97	
	Exch Na - Alch NH4Cl pH8.5 pre wash	15C1_Na	meq/100g			0.43	1.07	2.05	3.44	3.89	
	Exch K - Alch NH4Cl pH8.5 pre wash	15C1_K	meq/100g			0.61	0.25	0.21	0.13	0.10	
	CEC - Alch NH4Cl pH8.5 pre wash	15C1_CEC	meq/100g			53	58	61	63	59	
Other Bulk	DTPA Extr Cu	12A1_Cu	mg/kg		1.8						
	DTPA Extr Fe	12A1_Fe	mg/kg		184.5						
	DTPA Extr Mn	12A1_Mn	mg/kg		26.4						
	DTPA Extr Zn	12A1_Zn	mg/kg		4.0						
	Extr K - HCl	18B1	mg/kg		1.0						
	P (Acid) - automated	9G2	mg P/kg		597						

Project MFM Site 425					
Site characteristics					
Slope %:	N/A		Slope type:	Not recorded	
Morphological type:	Flat		Landform element:	Terrace plain	
Landform pattern:	Terrace		Geology:	Not recorded	
Observation type:	Existing vertical exposure		When described:	10/02/1993	
Location measurement method:	N/A		Soil name:	Gould	
Runoff:	Very slow		Depth to water:	N/A	
Permeability:	Slowly permeable 5-50mm/day		Microrelief:	Normal gilgai	
Drainage:	Poorly drained		Microrelief component:	N/A	
Rock outcrop:	N/A		Substrate lithology:	N/A	
Surface coarse fragments:	N/A		Surface condition:	Self-mulching	
Disturbance:	Extensive clearing		Erosion:	N/A	
Site location					
Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)
GDA94	-27.88173	152.96754	56	496805	6915887
Soil classification					
Australian Soil Classification			ASC confidence	Great Soil Group	Principal Profile Form
Endoacidic-Mottled, Self-mulching, Brown Vertosol; non- gravelly, fine, very fine, very deep.			All necessary analytical data is available	Brown clay	Ug3.2
Vegetation					
Community name		<i>Eucalyptus tereticornis</i> , woodland open woodland			
Stratum		Species	Common name		
Tallest 12.01-20m		<i>Eucalyptus tereticornis</i>	blue gum, forest red gum		
		<i>Corymbia tessellaris</i>	carbeen, Moreton Bay ash		
		<i>Eucalyptus moluccana</i>	gum-topped box, grey box		
Profile morphology					
No	Horizon	Upper depth (m)	Lower depth (m)	Description	
1	A1	0	0.1	Very dark greyish brown (10YR 3/2) moist; light clay; strong 5-10mm subangular blocky structure; rough-ped fabric; dry, firm strength; clear to:	
2	A2j	0.1	0.25	Dark brown (10YR 3/3) moist; light medium clay; strong 10-20mm subangular blocky structure; rough-ped fabric; few 2-10% medium 2-6mm ferruginous nodules; clear to:	
3	B21	0.25	0.65	Brown (10YR 5/3) moist; common 10-20% fine <5mm orange mottles; medium clay; moderate 50-100mm angular blocky structure; very few <2% fine <2mm ferruginous nodules; moist, firm strength; gradual to:	
4	B22	0.65	1.4	Brown (10YR 5/3) moist; many 20-50% coarse 15-30mm orange mottles; medium heavy clay; moderate 50-100mm lenticular structure; moist, weak strength.	
Laboratory test results MFM 425					

				Sample	1	2	3	4	5	6	7
				Upper depth (m)	0	0	0.2	0.5	0.8	1.1	1.4
				Lower depth (m)	0.1	0.1	0.3	0.6	0.9	1.2	1.5
Group	Method	Code	Units	Bulked Sample	Y	N	N	N	N	N	N
Profile General	pH - 1:5 water	4A1	pH		5.6	5.6	5.9	5.2	5.0	5.1	5.1
	EC - 1:5 water	3A1	dS/m		0.07	0.07	0.03	0.57	1.03	1.27	1.36
	Cl - 1:5 water - automated	5A2	mg Cl/kg		29	25	<20	937	1569	2009	2080
	Water sol NO3 - automated	7B1	mg/kg		8	15	2	2	2	2	2
	OC - Walkley/Black	6A1	%		2.8						
	Total N - Kjeldahl, automated	7A2	%		0.2						
	Coarse sand	2Z2_CS	%			21	18	9	5	1	
	Fine sand	2Z2_FS	%			32	26	15	13	8	
	Silt	2Z2_Silt	%			16	11	8	10	10	
	Clay	2Z2_Clay	%			33	43	65	70	77	
	Moisture content - air-dry	2A1	%			2.3	3.0	4.5	4.6	5.2	
	Moisture content - 15 bar	2E1	%			14.0	17.0	27.0	31.0		
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1				0.37	0.44	0.69	0.95		
	Total S XRF	10A1	%			0.05	0.03	0.03	0.03	0.02	
	Total P XRF	9A1	%			0.067	0.053	0.034	0.028	0.028	
	Total K XRF	17A1	%			0.21	0.17	0.16	0.19	0.22	
	P (BiCarb Extr)- automated	9B2	mg P/kg		37						
	pH - 1:5 0.01M CaCl2	4B1	pH		4.7	4.5	4.3	4.5	4.5	4.6	4.6
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g			4.91	4.02	8.15	9.41	10.52	
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g			6.04	9.48	19.86	23.01	26.30	
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g			0.36	0.86	5.64	9.62	12.62	
	Exch K - NH4Cl no wash	15A1_K	meq/100g			0.27	0.17	0.22	0.29	0.36	
	ECEC	15J1	meq/100g			11	14	33	42	49	
Other Bulk	DTPA Extr Cu	12A1_Cu	mg/kg		1.7						
	DTPA Extr Fe	12A1_Fe	mg/kg		207.7						
	DTPA Extr Mn	12A1_Mn	mg/kg		146.3						
	DTPA Extr Zn	12A1_Zn	mg/kg		3.8						
	Extr K - HCl	18B1	mg/kg		0.3						

Project SOC Site 11 Site characteristics			
<b>Slope %:</b>	14	<b>Slope type</b>	Abney level or clinometer and tape
<b>Morphological type:</b>	Mid-slope	<b>Landform element:</b>	Hillslope
<b>Landform pattern:</b>	Low hills	<b>Geology:</b>	Not recorded
<b>Observation type:</b>	Relatively undisturbed soil core	<b>When described:</b>	4/11/1999
<b>Location measurement method:</b>	Differential GPS	<b>Soil name:</b>	<b>Tamborine</b>
<b>Runoff:</b>	Moderately rapid	<b>Depth to water:</b>	N/A
<b>Permeability:</b>	Highly permeable >500mm/day	<b>Microrelief:</b>	N/A
<b>Drainage:</b>	Well drained	<b>Microrelief component:</b>	N/A
<b>Rock outcrop:</b>	Very slightly rocky <2% bedrock exposed, Basalt	<b>Substrate lithology:</b>	N/A
<b>Surface coarse fragments:</b>	Very few <2%, Cobbles 60-200 mm, Subrounded, Basalt	<b>Surface condition:</b>	Firm
<b>Disturbance:</b>	Complete clearing - pasture - but never cultivated	<b>Erosion:</b>	N/A

Site location					
<b>Datum</b>	<b>Latitude (dd)</b>	<b>Longitude (dd)</b>	<b>Zone</b>	<b>Easting (m)</b>	<b>Northing (m)</b>
GDA94	-28.21547	153.1166	56	511442	6878922

Soil classification			
<b>Australian Soil Classification</b>	<b>ASC confidence</b>	<b>Great Soil Group</b>	<b>Principal Profile Form</b>
Acidic, Dystrophic, Red Ferrosol; thin, non-gravelly, clay loamy, clayey, very deep.	All necessary analytical data is available	Krasnozern	Gn3.11

Profile morphology				
No	Horizon	Upper depth (m)	Lower depth (m)	Description
1	A1	0	0.05	Reddish brown (5YR 4/3) moist; clay loam; strong 5-10mm subangular blocky structure; moist, weak strength; clear to:
2	B1	0.05	0.15	Dark reddish brown (5YR 3/4) moist; light clay; moderate 5-10mm subangular blocky structure; moist, weak strength;
3	B21	0.15	0.75	Reddish brown (2.5YR 4/4) moist; medium clay; strong 5-10mm polyhedral structure; moist, weak strength;
4	B22	0.75	0.95	Reddish brown (2.5YR 4/4) moist; medium clay; many 20-50% subangular basalt large pebbles 20-60 mm; strong 2-5mm polyhedral structure; moist, weak strength;
5	B23	0.95	1.6	Red (10R 4/6) moist; medium heavy clay; strong 5-10mm polyhedral structure; moist, firm strength.

Laboratory test results SOC 11
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				Sample	1	2	3	4	5	6	7	8
				Upper depth (m)	0	0.05	0.1	0.2	0.5	0.8	1.1	1.4
				Lower depth (m)	0.05	0.1	0.2	0.3	0.6	0.9	1.2	1.5
Group	Method	Code	Units	Bulked Sample	N	N	N	N	N	N	N	N
Profile General	pH - 1:5 water	4A1	pH		5.6	5.6	5.8	6.0	6.0	4.8	4.5	4.5
	EC - 1:5 water	3A1	dS/m		0.18	0.08	0.04	0.02	0.02	0.03	0.04	0.04
	Cl - 1:5 water - automated	5A2	mg Cl/kg		94	71	35	29	20	24	38	47
	Water sol NO3 - automated	7B1	mg/kg		2.5	0.452	0.452	0.451	0.93	0.447	0.447	0.447
	OC - Walkley/Black	6A1	%			6.9	3.8	2.8	2.1	1.2	0.8	0.5
	Coarse sand	2Z2_CS	%			34	17	7	1	10	1	2
	Fine sand	2Z2_FS	%			1	1	1	4	9	9	15
	Silt	2Z2_Silt	%			19	18	15	14	14	20	25
	Clay	2Z2_Clay	%			40	58	71	81	71	74	62
	Moisture content - air-dry	2A1	%		5.3	3.6	3.6	3.5	2.9	2.5	2.6	2.6
	Moisture content - 15 bar	2E1	%		49.0	34.0	30.5	30.0	30.6	20.0	13.0	40.7
	CaPhos Extr S - ICPAES	10B3	mg/kg				23.6	19.90	49.61	322.54	350.18	374.57
	Citrate/dithionite Extr Fe	13C1_Fe	%					8.82	8.91			
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g		0.05	9.53	7.56	6.83	4.94	0.66	0.37	0.31
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g		0.03	2.69	1.66	1.24	1.34	0.36	0.55	0.51
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g		0.007	0.08	0.05	0.03	0.05	0.04	0.05	0.06
	Exch K - NH4Cl no wash	15A1_K	meq/100g		0.03	0.43	0.20	0.11	0.06	0.06	0.07	0.06
	Exchangeable Al – KCl	15G1_Al	meq/100g			0.2	0.2			3.1	7.1	8.4
	Exchange acidity (H + Al)	15G1_H	meq/100g			0.2	0.2			3.1	7.3	8.7
	ECEC	15J1	meq/100g			12.9	9.68	8.22	6.39	4.19	8.34	9.67



Project SPFD Site 108					
Site characteristics					
Slope %:		0		Slope type:	
Morphological type:		Flat		Landform element:	
Landform pattern:		Flood plain		Geology:	
Observation type:		Soil pit (>0.3m deep)		When described:	
Location measurement method:		N/A		Soil name:	
Runoff:		N/A		Depth to water:	
Permeability:		N/A		Microrelief:	
Drainage:		N/A		Microrelief component:	
Rock outcrop:		N/A		Substrate lithology:	
Surface coarse fragments:		N/A		Surface condition:	
Disturbance:		Cultivation - Irrigated, past or present		Erosion:	
Site location					
Datum		Latitude (dd)		Longitude (dd)	
GDA94		-28.25087		152.74504	
				Zone	
				56	
				Easting (m)	
				474990	
				Northing (m)	
				6874980	
Soil classification					
Australian Soil Classification				ASC confidence	
Very deep, Haplic, Eutrophic, Brown Dermosol.				All necessary analytical data is available	
				Great Soil Group	
				Prarie Soil	
				Principal Profile Form	
				Gn4.32	
Profile morphology					
No	Horizon	Upper depth (m)	Lower depth (m)	Description	
1	A	0	0.35	Dark brown (10YR 3/3) moist; sandy loam; gradual to:	
2	B21	0.35	0.7	Dark brown (10YR 3/3) moist; clay loam; gradual to:	
3	B22	0.7	1.3	Brown (10YR 5/3) moist; light clay; gradual to:	
4	B23	1.3	1.5	Light yellowish brown (10YR 6/4) moist; light medium clay.	

Laboratory test results Project SPFD Site 108											
				Sample	1	2	3	4	5	6	7
				Upper depth (m)	0	0	0.2	0.5	0.8	1.1	1.4
				Lower depth (m)	0.1	0.1	0.3	0.6	0.9	1.2	1.5
Group	Method	Code	Units	Bulked Sample	Y	N	N	N	N	N	N
Profile General	pH - 1:5 water	4A1	pH		6.0	5.8	6.2	6.5	6.7	6.8	6.9
	EC - 1:5 water	3A1	dS/m		0.03	0.06	0.02	0.01	0.01	0.02	0.01
	Cl - 1:5 water - automated	5A2	mg Cl/kg		21	<20	<20	<20	<20	<20	<20
	Water sol NO3 - automated	7B1	mg/kg		1.5	16	0.2	0.2	0.3	0.3	0.3
	OC - Walkley/Black	6A1	%		1.5	1.2	0.8	0.7	0.6	0.5	0.5
	Total N - Kjeldahl, automated	7A2	%		0.08						
	Coarse sand	2Z2_CS	%			31	28	15	8	9	7
	Fine sand	2Z2_FS	%			48	49	54	59	57	57
	Silt	2Z2_Silt	%			11	13	11	14	13	14
	Clay	2Z2_Clay	%			13	13	23	23	26	24
	Moisture content - air-dry	2A1	%			0.8	0.8	1.1	1.3	1.2	1.2
	Moisture content - 15 bar	2E1	%			23.5	11.3	21.4	26.2	6.4	18.3
	Silt+Clay/Total Silt+Clay (R1)	2Z1_R1				0.675	0.645	0.691	0.679	0.719	0.769
	CaPhos Extr S - ICPAES	10B3	mg/kg		4.22	6.564	2.810	2.940	2.824	2.700	1.727
	P (BiCarb Extr)- automated	9B2	mg P/kg		7						
Acid Cations	Exch Ca - NH4Cl no wash	15A1_Ca	meq/100g		4.54	4.53	5.34	6.67	7.90	6.68	6.98
	Exch Mg - NH4Cl no wash	15A1_Mg	meq/100g		1.71	1.92	1.71	2.32	3.14	3.04	3.14
	Exch Na - NH4Cl no wash	15A1_Na	meq/100g		0.03	0.02	0.04	0.16	0.25	0.24	0.23
	Exch K - NH4Cl no wash	15A1_K	meq/100g		0.50	0.52	0.17	0.21	0.26	0.24	0.25
	ECEC	15J1	meq/100g		6.78	6.992	7.266	9.37	11.56	10.20	10.61
Other Cations	Exchangeable Sodium Percentage (ESP)	15N1	%			-	-	1.7	2.1	2.3	2.2
Other Bulk	DTPA Extr Cu	12A1_Cu	mg/kg		.7						
	DTPA Extr Fe	12A1_Fe	mg/kg		110.9						
	DTPA Extr Mn	12A1_Mn	mg/kg		19.2						
	DTPA Extr Zn	12A1_Zn	mg/kg		3.6						

## **Appendix 4: LARA Land Suitability Classification Scheme**

The land suitability framework for the LARA project was based on the Regional Land Suitability Frameworks for Queensland (Department of Natural Resources and Mines & Department of Science Information Technology, Innovation and the Arts 2013), for the Inland SEQ framework area. The framework was modified and updated as part of the SEQE project to be consistent with the peculiarities of the Brisbane River catchment and has been adopted here also. Where possible, some of the Land Use Requirements and Limitations names were updated to be consistent with the Queensland Agricultural Land Evaluation Guidelines (Department of Science Information Technology and Innovation & Department of Natural Resources and Mines 2015).

## Limitations and Land Management Options

The following 16 limitations were used to assess land suitability in the SEQE project.

Land use requirements	Limitations	Soil and land attributes used to assess each limitation
Frost-free	Frost (Cf)	Frequency, timing and severity of damaging frosts, landform and landscape position.
Minimise soil loss due to water erosion	Water erosion (E)	Slope/soil erodibility (USLE K factor), soil stability groups.
Minimise soil loss and land degradation from subsoil erosion	Subsoil erosion (Es)	Soil classification, depth to B horizon, B horizon dispersion, Exchangeable sodium percentage of B horizon, electrical conductivity, CEC and Ca/Mg ratio of B horizon.
Minimal impact of damaging floods	Flooding (F)	Frequency and depth of flooding based on position in landscape and historic flood levels.
Adequate water storage in the soil profile to maintain plant growth	Soil water availability (M)	PAWC and effective rooting depth.
Adequate nutrient supply	Nutrient deficiency (Nd)	Levels of Phosphorus (P) in top 0.3m.
Absence of toxic levels of elements	Element toxicity (Nt)	Soil pH in the surface soil (<0.3 m) and at 0.6 m depth.
Ability to harvest underground crops	Soil adhesiveness (Pa)	Texture, structure, consistence and clay mineralogy of the surface soil (<0.3 m).
Soil depth to a physical root barrier	Soil depth (Pd)	Depth to hard rock or other impermeable layer or chemical barrier.
Ease of seedbed preparation, no restriction to germination	Soil surface condition (Ps)	Surface condition, surface soil texture and structure (<0.3 m), susceptibility to compaction.
Minimal impact from gravel, stone and rock at the soil surface	Rockiness (R)	Size and content (%) of coarse fragments, % rock outcrop.
Low levels of soluble salts in the soil profile	Soil salinity (Sa)	Saturated extract conductivity (dS/m ECse) of the top 0 -0.1 m of soil.
Level land surface	Microrelief (Tm)	Vertical interval of microrelief.
Safe and efficient use of machinery	Slope (Ts)	Slope (%) variation in slope length and direction.
Adequate soil aeration	Wetness (W)	Soil drainage and permeability, depth to and degree of mottling, soil colour, ESP, native vegetation, redox, time period of water saturation, soil structure and texture.
Adequate size of uniform production areas and ability to access them	Landscape complexity (X)	Minimum area of contiguous suitable soil available for crop production, level of topographic dissection.

The following land management options were considered in the compilation of the SEQE land suitability framework:

Asian Vegetables *(a, w, sp)	Green panic	Potato (a, w, sp)
Avocado	Green bean (s)	Onion (w, sp, s)
Barley	Gympie messmate ( <i>E. cloeziana</i> )	Rhodes grass
Beetroot (a, w, sp)	Hoop pine	Rye grass
Blackbutt ( <i>E. pilularis</i> )	Improved pasture legumes	Sorghum (forage)
Brassica (cabbage, cauliflowers, etc.) (a, w, sp)	Kikuyu	Soybean
Broccoli	Lettuce (a, w, sp)	Soybean (irrigated)
Carrot (a, w, sp)	Leucaena	Spotted gum
Capsicum (s)	Lucerne (irrigated)	Sweet corn (s)
Chickpea	Mungbean	Tomato (s)
Citrus (lime, lemon)	Native pastures	Turf
Cucurbits (melons, pumpkins, zucchini) (s)	Navy bean	Wheat
Dunn's white gum ( <i>E. dunnii</i> )	Oats	

\*a = autumn, w = winter, sp = spring, s = summer.



**Area covered by the Inland SEQ suitability framework**

## **Frost (Cf)**

Frosts may kill plants, suppress growth and reduce yield, particularly if their occurrence coincides with frost sensitive periods in plant growth cycles.

### **Limitation category determination**

Crop tolerance and local experience have been used to determine the incidence and severity of frosts.

### **Additional Notes:**

- In general, the incidence and severity of frost is determined by the landscape position. Hill slopes and rises tend to experience fewer and less severe frosts, while lower lying areas may experience more regular frost. The frequency and severity of frost differs over the project area and is more intense in the upper reaches of the Logan and Albert Rivers catchment.
- All frost sensitive crops (including green beans, cucurbits, capsicums, tomatoes and spotted gum) are highly susceptible to frost and careful management is required in frost prone areas to avoid the effects of all but occasional, very light frosts.
- Horticultural cropping is carried out at times of the year which substantially avoids the effects of frosts. Irrigation strategies are used to mitigate frost risk (e.g. potato).
- “Summer” vegetables (which are frost sensitive), are planted after the risks of frost are over in the late spring. Consecutive plantings are made over the summer, and the final harvests are made in the autumn before the risk of frosts affects quality. Consequently, frost is not considered a limitation for the summer vegetable crops. This includes green beans, cucurbits, capsicums, tomatoes and sweet corn.

## Cf - Frost

Limitation		Suitability subclasses for various land management options											
Value	Description	Group A	Group B	Group C	Group D	Group E	Group F	Group G	Group H	Group I	Group J	Group K	Group L
Cf1	Frost free or occasional light frost >-1°C (<3 events per year)	1	1	1	1	1	1	1	1	1	1	1	1
Cf2	Regular light frosts (≥ 3 events per year) over winter months only (>-1°C)	1	1	1	1	1	1	1	1	2	2	3	4
Cf3	Regular light frosts over late autumn and early spring (>-1°C)	1	1	1	1	1	2	2	2	2	2	3	4
Cf4	Regular moderate frosts (≥ 3 events per year) over winter months only (-1°C to -4°C)	1	1	2	2	3	2	3	5	2	3	4	5
Cf5	Regular severe frosts (≥3 events per year) over winter months only (<-4°C)	1	2	2	3	4	3	4	5	4	4	5	5

Group A	Group B	Group C	Group D	Group E	Group F	Group G	Group H	Group I	Group J	Group K	Group L
Native pasture	Dunn's white gum-dryland	Green panic-dryland	Forage sorghum-dryland	Turf-irrigated	Brassicas-irrigated	Broccoli-irrigated	Potatoes -irrigated	Beetroot-irrigated	Barley-dryland	Avocados-irrigated	Asian vegetables-irrigated
	Hoop pine-dryland	Kikuyu-dryland	Leucaena-dryland		Carrots-irrigated				Chickpeas-dryland	Gympie messmate-dryland	Blackbutt-dryland
	Improved pasture legumes-dryland	Lucerne-irrigated	Maize-dryland						Citrus-irrigated		Spotted -um-dryland
		Rhodes grass-dryland	Onions-irrigated						Oats-dryland		Lettuce
		Rye grass-dryland	Sorghum-dryland Soybeans-irrigated Summer pulses-dryland						Wheat-dryland		



## Water erosion (E)

Land degradation and long-term productivity decline will occur on unprotected arable land due to excessive soil erosion. Qualitative features have been linked to K factor ranges used by USLE. Four soil stability categories (from very stable to very unstable) were recognised.

Very stable soils: K factor  $\leq 0.02$

Strongly structured surface soils high in free iron (Ferrosols). Profiles are highly permeable throughout.

Stable soils: K factor 0.02-0.05

Friable surface soils with moderate to strong surface structure (granular or blocky); or surface soils with a soft, firm or weakly hard setting, medium to coarse sandy surface (sands, sandy loam, sandy clay loam); or surface soils very high in organic matter. Profiles are moderately to highly permeable throughout.

Unstable soils: K factor 0.05-0.07

Hard setting surface soils with weak (granular, blocky) to massive surface structure and fine sandy textures (fine sandy clay loam to fine sandy light clay). Surface horizons are moderately to slowly permeable. Slowly permeable, sodic subsoils are often developed within 1.0m of the surface in lower landscape positions.

Very unstable soils: K factor  $> 0.07$

Hard setting surface soils with weak (granular, blocky) to massive surface structure and silty textures (silty loam to silty light clay). Surface horizons are low in organic matter, slowly permeable and typically overlie slowly to very slowly permeable, sodic subsoils within 0.5m of the surface.

### Limitation category determination

Slope limits are determined in consultation with soil conservation extension and research personnel, and extension and research agronomists.

The slope component for the E limitation relied on LiDAR DEM.

### Additional Notes:

- Perennial tree and vine orchards typically practice grass/cover crop sward management and represent relatively stable land uses (i.e. suitable on slopes between  $>5-20\%$  depending on soil type. Slopes limits have been reduced for more erodible soil types).
- Turf is regularly stripped back to a completely bare surface but with a significant root mass and without regular tillage. Rilling and deposition following erosion events is a potential problem because uneven surface contours can present problems with harvesting. Standard management practices such as topdressing and levelling would largely overcome such erosion effects.
- Most field crops/vegetable crops require seedbed preparation on an annual basis. Tillage during summer to prepare for the winter cropping period leaves paddocks exposed and subject to potentially erosive rainfall events through the summer and autumn months. Tillage is usually aggressive, surface soils very loose and paddocks laid out in straight rows. Land uses in this category are considered most at risk from erosion and slope limits are therefore more robust.
- Soil loss on alluvial soils is exacerbated by channel deviation across cultivation resulting in loss and deposition processes.
- Slope limits described for forestry situations assume land is already cleared and pastured and broadscale clearing is not required. These limits assume minimal soil disturbance is practiced during land preparation for planting. Lower limits would apply were significant soil disturbance involved.
- Appropriately designed and maintained contour banks and waterways can be used to reduce the risk of water erosion.
- Grazing management and resultant groundcover levels are the most critical factors affecting soil erosion in grazing landscapes.
- Irrigation is assuming spray or drip irrigation, but not furrow irrigation.

## E - Water erosion

Limitation		Suitability subclasses for various land management options									
Value	Description	Group A	Group B	Group C	Group D	Group E	Group F	Group G	Group H	Group I	Group J
E1A	Very stable soils; K factor <0.02 & slope range ≤2%	1	1	1	1	1	1	1	1	1	1
E2A	Very stable soils; K factor <0.02 & slope range >2-5%	1	1	1	1	1	1	1	2	2	2
E3A	Very stable soils; K factor <0.02 & slope range 5–8%	1	1	1	2	2	2	2	2	3	3
E4A	Very stable soils; K factor <0.02 & slope range 8-10%	1	1	2	2	3	3	3	3	4	4
E5A	Very stable soils; K factor <0.02 & slope range 10-15%	1	2	3	3	3	5	5	5	4	4
E6A	Very stable soils; K factor <0.02 & slope range 15-20%	2	3	3	3	4	5	5	5	5	5
E7A	Very stable soils; K factor <0.02 & slope range >20-25%	3	3	4	5	5	5	5	5	5	5
E8A	Very stable soils; K factor <0.02 & slope range >25%	4	3	5	5	5	5	5	5	5	5
E1B	Stable soils; K factor 0.02-0.05 & slope range <2%	1	1	1	1	1	1	1	1	1	1
E2B	Stable soils; K factor 0.02-0.05 & slope range >2-5 %	1	1	1	1	1	2	2	2	2	2
E3B	Stable soils; K factor 0.02-0.05 & slope range 5–8%	1	1	1	2	2	3	3	3	3	3
E4B	Stable soils; K factor 0.02-0.05 & slope range 8-10%	1	2	2	3	3	3	3	4	4	4
E5B	Stable soils; K factor 0.02-0.05 & slope range 10-15% slope	2	2	3	3	3	5	5	5	5	5
E6B	Stable soils; K factor 0.02-0.05 & slope range 15-20%	3	3	3	4	4	5	5	5	5	5
E7B	Stable soils; K factor 0.02-0.05 & slope range >20-25%	4	3	4	5	5	5	5	5	5	5
E8B	Stable soils; K factor 0.02-0.05 & slope range >25%	4	3	5	5	5	5	5	5	5	5
E1C	Unstable soils; K factor 0.05-0.07 & slope range <2%	1	1	1	1	1	2	2	1	1	1
E2C	Unstable soils; K factor 0.05-0.07 & slope range >2-5%	1	1	1	2	1	3	3	3	3	3
E3C	Unstable soils; K factor 0.05-0.07 & slope range 5–8%	1	2	2	2	2	3	3	4	4	4

Limitation		Suitability subclasses for various land management options									
Value	Description	Group A	Group B	Group C	Group D	Group E	Group F	Group G	Group H	Group I	Group J
E4C	Unstable soils; K factor 0.05 – 0.07 & slope range 8-10%	2	3	3	3	3	4	4	5	5	5
E5C	Unstable soils; K factor 0.05 – 0.07 & slope range 10-15%	3	3	3	4	3	5	5	5	5	5
E6C	Unstable soils; K factor 0.05 – 0.07 & slope range 15-20%	4	3	4	4	4	5	5	5	5	5
E7C	Unstable soils; K factor 0.05 – 0.07 & slope range 20-25%	5	3	5	5	5	5	5	5	5	5
E8C	Unstable soils; K factor 0.05 – 0.07 & slope range >25%	5	4	5	5	5	5	5	5	5	5
E1D	Very unstable soils; K factor > 0.07 & slope range <2%	1	1	1	1	1	2	2	2	2	2
E2D	Very unstable soils; K factor > 0.07 & slope range >2-5%	2	2	2	2	2	3	3	3	3	3
E3D	Very unstable soils; K factor > 0.07 & slope range 5-8%	2	3	3	3	3	4	4	4	4	4
E4D	Very unstable soils; K factor > 0.07 & slope range 8-10%	3	3	4	3	4	5	5	5	5	5
E5D	Very unstable soils; K factor > 0.07 & slope range 10-15%	4	3	4	4	4	5	5	5	5	5
E6D	Very unstable soils; K factor > 0.07 & slope range 15-20%	5	3	5	5	5	5	5	5	5	5
E7D	Very unstable soils; K factor > 0.07 & slope range 20-25%	5	4	5	5	5	5	5	5	5	5
E8D	Very unstable soils; K factor > 0.07 & slope range >25%	5	5	5	5	5	5	5	5	5	5

Group A	Group B	Group C	Group D	Group E	Group F	Group G	Group H	Group I	Group J
Blackbutt-dryland	Native pasture	Kikuyu-dryland	Avocados-irrigated	Green Panic-dryland	Summer pulses-dryland	Barley-dryland	Turf-irrigated	Asian vegetables-irrigated	Broccoli-irrigated
			Citrus-irrigated	Improved Pasture legumes-dryland		Chickpeas-dryland		Beetroot-irrigated	
			Dunn's white gum-dryland	Leucaena-dryland		Forage Sorghum-dryland		Brassicas-irrigated	

Gympie  
messmate-  
dryland  
Hoop pine-  
dryland  
Spotted gum-  
dryland

Rhodes  
grass-dryland  
Rye grass-  
dryland

Lucerne-  
irrigated  
Maize-  
dryland  
Oats-dryland  
  
Sorghum-  
dryland  
Soybeans-  
irrigated  
Wheat-  
dryland

Capsicum-  
irrigated  
Carrots-  
irrigated  
Cucurbits-  
irrigated  
Green  
Beans-  
irrigated  
Lettuce-  
irrigated  
Onions-  
irrigated  
Potatoes-  
irrigated  
Sweet corn-  
irrigated  
Tomato-  
irrigated

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## Subsoil erosion (Es)

Subsoil instability caused by high sodicity, high salt fraction and/or a very low calcium/magnesium ratio can lead to reduced infiltration and drainage, increased erosion and loss of structural integrity. The proportion of sodium in relation to other cations is expressed as exchangeable sodium percentage (ESP).

Limitation category determination is via laboratory measured cations where available.

### Es - Subsoil erosion

Limitation		Suitability subclasses for various land management options				
Value	Description	Group A	Group B	Group C	Group D	Group E
Es0	No subsoil sodicity (ESP <6)	1	1	1	1	1
Es1	Subsoil sodic (ESP 6-15) and clay content >15%	1	1	2	2	3
Es2	Subsoil strongly sodic (ESP >15%) and clay content >15% and/or Ca/Mg <0.1	1	2	2	4	4

Group A	Group B	Group B cont.	Group C	Group D	Group E
Native pasture	Avocados-irrigated	Lucerne-irrigated	Asian vegetables-irrigated	Turf-irrigated	Potatoes-irrigated
	Barley-dryland	Maize-dryland	Beetroot-irrigated		
	Blackbutt-dryland	Oats-dryland	Brassicas-irrigated		
	Chickpeas-dryland	Rhodes grass-dryland	Broccoli-irrigated		
	Citrus-irrigated	Rye grass-dryland	Capsicum-irrigated		
	Dunn's white gum-dryland	Sorghum-dryland	Carrots-irrigated		
	Forage sorghum-dryland	Soybeans-irrigated	Cucurbits-irrigated		
	Gympie messmate-dryland	Spotted gum-dryland	Green beans-irrigated		
	Hoop pine-dryland	Summer pulses-dryland	Green panic-dryland		
	Improved pasture	Sweet corn-irrigated	Lettuce-irrigated		
	Legumes-dryland				
	Kikuyu-dryland	Wheat-dryland	Onions-irrigated		
	Leucaena-dryland		Tomato-irrigated		

## **Flooding (F)**

Flood events typically involve inundation from overbank stream flows. Effects of flooding include yield reduction or plant death. Other effects include physical removal of or damage to the crop by flowing water, floodplain erosion and damage to irrigation infrastructure.

### **Limitation class determination**

- Consultation with local authorities, state agencies, community groups and local landholders.
- Published flood maps and flood modelling outputs.
- Terrain covariates derived from the 1-arc second resolution DEM, available from the CSIRO's Data Access Portal and the TERN Data Discovery Portal, were used in conjunction with site data to model some of the limitations used in the suitability assessment. The flooding limitation was refined using an assessment of Multi Resolution Valley Bottom Flatness (MRVBF) and Topographic Wetness Index (TWI).

### **Additional Notes:**

- Flooding is generally not considered a limitation for winter grown vegetable crops because the main growing season coincides with the dry season, allowing the majority of plantings to be timed to avoid most seasonal flooding. Notwithstanding flooding does irregularly occur in the months of April and May causing substantial damage.
- Some tree crops (e.g. citrus,) tolerate inundation for periods of about 1 day or so. This assumes low velocity floodwaters, relatively low silt loads, reasonable water temperatures and rapid internal soil drainage once floodwaters recede.
- While loss of trees due to flooding represents a severe financial loss, most orchard enterprises work towards a return on their investment after about 10 years. Floods less frequent than 1 in 10 years (i.e. 1:20 to 1:50 years or less frequent) are statistically beyond the productive life of the trees and areas subject to such floods are classed as marginal for production rather than unsuitable.
- Avocados are highly sensitive to flooding and suffer significant fruit damage, root rot and financial loss following an event. Losses in avocados are more significant than other orchards.

## F- Flooding

Limitation		Suitability subclasses for various land management options						
Value	Description	Group A	Group B	Group C	Group D	Group E	Group F	Group G
F0	No flooding.	1	1	1	1	1	1	1
F1	Flooding less frequent than 1 in 10 years	1	1	1	1	2	3	5
F2	Flooding frequency between 1 in 2 and 1 in 10 years	2	2	3	3	3	5	5
F3	Flooding frequency approaches annual occurrence	3	4	4	5	4	5	5

Group A	Group B	Group C	Group D	Group E	Group F	Group G
Green panic-dryland	Blackbutt-dryland	Improved pasture legumes-dryland	Asian vegetables-irrigated	Barley-dryland	Citrus-irrigated	Avocados-irrigated
Kikuyu-dryland	Dunn's white gum-dryland		Beetroot-irrigated	Chickpeas-dryland		
Leucaena-dryland	Gympie messmate-dryland		Brassicas-irrigated	Forage sorghum-dryland		
Native pasture	Hoop pine-dryland		Broccoli-irrigated	Lucerne-irrigated		
Rhodes grass-dryland	Spotted gum-dryland		Capsicum-irrigated	Maize-dryland		
Rye grass-dryland			Carrots-irrigated	Oats-dryland		
turf-irrigated			Cucurbits-irrigated	Sorghum-dryland		
			Green beans-irrigated	Soybeans-irrigated		
			Lettuce-irrigated	Summer pulses-dryland		
			Onions-irrigated	Wheat-dryland		
			Potatoes-irrigated			
			Sweet corn-irrigated			
			Tomato-irrigated			

## Soil water availability (M)

Plant yield can be severely affected by periods of water stress, particularly during critical growth periods.

### Limitation class determination

PAWC was used to determine soil water availability. Soil water availability was based on a calculation of soil water storage, expressed as millimeters (mm) of water over a specified depth of soil or to the effective rooting depth (ERD). PAWC was then estimated for each SPC using the look-up table for soil water storage from the *Regional Planning Interests Act Guideline 08/14* (DILGP 2015) (Table 1). Field textures for each horizon, were correlated with Table 5. Alternatively PAWC can be estimated by specifically designed computer models where required laboratory analysis is available.

### Additional Notes

- PAWC is less critical for irrigated crops than for rain fed crops and in irrigated situations is used largely to estimate the required irrigation frequency.
- All crops were considered irrigated except where indicated as rain fed/dryland. Forestry species and sown pastures are rain fed.
- Soil drainage may modify PAWC for a particular soil. For example, a shallow watertable within the effective rooting depth for 2–3 months or longer (see W limitation) can provide water to plants for extended periods.
- All horticultural crops are irrigated, so soil water availability is not a significant limitation to production.
- Native hardwood eucalypt species have the ability to penetrate weathered/fractured rock and many impermeable layers and the PAWC boundary between suitable and marginal/unsuitable classes has been relaxed accordingly (when compared with cropping).
- A maximum specified depth of 1.5 m was used for the strongly structured non-sodic soils on the floodplain. Elsewhere, the effective rooting depth was the depth to any physical root barrier, to impermeable or sodic layers should they exist, or to 1 m.
- Soils with greater than 10% coarse fragments required a reduction in their soil water storage values to reflect the reduction in soil material.

**Table 1 Soil texture look up table to estimate plant available water capacity**

Soil texture	Soil water storage
Sand; clayey sand; loamy sand	4 mm/100 mm
Sandy loam	5 mm/100 mm
Loam; silty loam; sandy clay loam	6 mm/100 mm
Clay loam; clay loam sandy; silty clay loam	8 mm/100 mm
Silty clays; clays with <45 % clay fraction	10 mm/100 mm
Clays with > 45 % clay fraction	12 mm/100 mm



## M – Soil water availability

Limitation		Suitability subclasses for various land management options							
Value	Description	Group A	Group B	Group C	Group D	Group E	Group F	Group G	Group H
M1	>150mm PAWC	1	1	1	1	1	1	1	1
M2	125-150mm PAWC	1	1	1	1	1	2	2	2
M3	100-125mm PAWC	1	1	1	2	2	2	2	3
M4	75-100mm PAWC	1	1	2	2	3	3	3	3
M5	50-75mm PAWC	1	2	3	4	3	3	4	4
M6	<50mm PAWC	2	3	4	4	4	3	5	5

Group A	Group B	Group C	Group D	Group E	Group F	Group G	Group H
Asian vegetables-irrigated	Hoop pine-dryland	Blackbutt-dryland	Lucerne-irrigated	Avocados-irrigated	Native pasture	Green panic-dryland	Barley-dryland
Beetroot-irrigated	Spotted gum-dryland	Dunn's white gum-dryland	Soybeans-irrigated	Citrus-irrigated		Improved pasture legumes-dryland	Chickpeas-dryland
Brassicas-irrigated		Gympie messmate-dryland				Kikuyu-dryland	Forage sorghum-dryland
Broccoli-irrigated						Leucaena-dryland	Maize-dryland
Capsicum-irrigated						Rhodes grass-dryland	Oats-dryland
Carrots-irrigated						Rye grass-dryland	Sorghum-dryland
Cucurbits-irrigated							Summer pulses-dryland
Green beans-irrigated							Wheat-dryland
Lettuce-irrigated							
Onions-irrigated							
Potatoes-irrigated							
Tomato-irrigated							
Turf-irrigated							
Sweet corn-irrigated							

## **Nutrient deficiency (Nd)**

Reduced crop growth may be associated with nutrient deficiencies in many soils. Livestock production may also be affected as a result of reduced pasture yield and/or pasture quality and/or lowered nutrient intake in animals.

For coastal south-east Queensland, it was determined that Phosphorus (P) is the only limiting nutrient that cannot easily be added in sufficient quantities to meet crop demands, therefore Nd assessment was based on the level of P within the surface soil (0 to 0.3 m).

### **Limitation class determination**

Nutrient deficient soils require additional P applications over and above standard management practices.

#### **Additional Notes:**

- Because fertiliser use is considered a standard management practice associated with intensive cropping systems, nutrient deficiency is only recognised as a minor limitation. This limitation is of more relevance to the pasture lands.

## Nd – Nutrient deficiency

Limitation		Suitability subclasses for various land management options					
Value	Description	Group A	Group B	Group C	Group D	Group E	Group F
Nd1	Phosphorus (P) >20 mg/kg	1	1	1	1	1	1
Nd2	Phosphorus (P) 10-20 mg/kg	1	1	2	2	2	2
Nd3	Phosphorus (P) 5-10 mg/kg	1	2	2	2	3	3
Nd4	Phosphorus (P) <5 mg/kg	2	3	2	3	3	4

Group A	Group B	Group C	Group D	Group E	Group F
Asian vegetables-irrigated	Barley-dryland	Avocados-irrigated	Blackbutt-dryland	Improved pasture legumes-dryland	Green panic-dryland
Beetroot-irrigated	Leucaena-dryland	Citrus-irrigated	Dunn's white gum-dryland	Rhodes grass-dryland	Kikuyu-dryland
Brassicas-irrigated	Native pasture		Forage sorghum-dryland	Rye grass-dryland	Oats-dryland
Broccoli-irrigated			Gympie messmate-dryland		Wheat-dryland
Capsicum-irrigated			Hoop pine-dryland		
Carrots-irrigated			Lucerne-irrigated		
Chickpeas-dryland			Maize-dryland		
Cucurbits-irrigated			Sorghum-dryland		
Green beans-irrigated			Soybeans-irrigated		
Lettuce-irrigated			Spotted gum-dryland		
Onions-irrigated			Summer pulses-dryland		
Potatoes-irrigated					
Sweet corn-irrigated					
Tomato-irrigated					
Turf-irrigated					

## **Nutrient toxicity (Nt)**

Reduced crop growth may be associated with the oversupply or toxicity (i.e. excessive levels) of some mineral nutrients, particularly where soil pH is very low. Livestock production may be also be affected under such conditions as a result of reduced pasture yield and/or pasture quality.

### **Limitation class determination**

Field or laboratory pH data were assessed against published research relating low pH to crop tolerance and element toxicity.

### **Additional Notes:**

- While high pH values (greater than 8.5) are not common in inland SEQ, where they exist, nutrient availability may be reduced.
- Forestry crops are able to tolerate soils with a surface pH of 5.5, with subsoil pH values of 4.5 to 5.

## Nt – Nutrient Toxicity

Limitation		Suitability subclasses for various land management options		
Value	Description	Group A	Group B	Group C
Nt1	Surface soil (0-0.3m) pH >5.0.	1	1	1
Nt2	Soil pH at 0.6m >5.0.	1	1	1
Nt3	Surface soil (0-0.3m) pH <5.0.	2	2	3
Nt4	Soil pH at 0.6m <5.0.	1	3	3

Group A	Group B	Group C
Asian vegetables-irrigated	Avocados-irrigated	Barley-dryland
Beetroot-irrigated	Citrus-irrigated	Chickpeas-dryland
Brassicas-irrigated		Forage sorghum-dryland
Broccoli-irrigated		Green panic-dryland
Capsicum-irrigated		Improved pasture legumes-dryland
Carrots-irrigated		Kikuyu-dryland
Cucurbits-irrigated		Leucaena-dryland
Green beans-irrigated		Lucerne-irrigated
Lettuce-irrigated		Maize-dryland
Onions-irrigated		Native pasture
Potatoes-irrigated		Oats-dryland
Sweet corn-irrigated		Rhodes grass-dryland
Tomato-irrigated		Rye grass-dryland
Turf-irrigated		Sorghum-dryland
		Soybeans-irrigated
		Summer pulses-dryland
		Wheat-dryland
		Blackbutt-dryland
		Dunn's white gum-dryland
		Gympie messmate-dryland
		Hoop pine-dryland
		Spotted gum-dryland

## Soil adhesiveness (Pa)

Harvesting root crops can be difficult in soils that adhere to the harvested product or machinery, and can affect the quality and post-harvest treatment of harvest material. Adhesive soils are prone to significant levels of soil disturbance during harvest and may be subject to increased compaction and declining structural stability.

Soil adhesiveness categories		Inherent soil morphological properties affecting adhesiveness	
		structure and texture characteristics	surface condition
Pa0	No restrictions	Strongly structured (granular, polyhedral) surface soils high in free iron (Ferrosols) Sandy textured surface soils (<SL) low in organic matter Humic surface soils very high in organic matter	soft or firm  loose, soft or firm soft or firm
Pa1	Slightly adhesive soils	Moderately to strongly structured (granular, blocky) surface soils (>SL) (friable Dermosols).	weakly hardsetting
Pa2	Moderately adhesive soils	Massive to weakly structured (granular, blocky), silty or fine sandy textured surface soils	moderately to strongly hard setting
Pa3	Strongly adhesive soils	Sticky and/or sodic clay within 0.3m of the surface (within the plough zone) (Dermosols, Vertosols, thin surfaced Sodosols)	firm to hard setting or self-mulching

### Additional Notes:

- This limitation only applied to carrots, potatoes and beetroot. This issue is generally overcome by post-harvest washing.

## Pa – Soil adhesiveness

Limitation		Suitability subclasses for various land management options
Value	Description	Group A
Pa0	No restrictions	1
Pa1	Slightly adhesive	1
Pa2	Moderately adhesive	2
Pa3	Strongly adhesive	2

### Group A

Beetroot - irrigated

Carrots-irrigated

Potatoes-Irrigated

## **Soil depth (Pd)**

Shallow soils limit root proliferation and anchorage. Plants in shallow soils may lodge or become uprooted during strong winds.

### **Limitation class determination**

Consultation with agronomic extension staff and local landholder experience.

### **Additional Notes:**

- Native hardwood eucalypt species have a rooting depth requirement >0.6 m, but have the ability to penetrate weathered/fractured rock and many impermeable layers. Therefore, the 'suitable' soil depth limit to impermeable layers has been decreased from 0.6 m to 0.4 m.
- Some vegetable crops (e.g. tomatoes) are normally trellised and lodging due to shallow soil depth is not considered an issue. As such, these crops have been treated in the same way as shallow rooted, vegetable crops of low height.



## Pd – Soil depth

Limitation		Suitability subclasses for various land management options				
Value	Description	Group A	Group B	Group C	Group D	Group E
Pd1	>1.0m	1	1	1	1	1
Pd2	0.5-1.0m (minimum for tree crops)	1	1	2	2	4
Pd3	0.3-0.5m	1	1	3	4	5
Pd4	<0.3m	3	5	4	5	5

Group A	Group B	Group C	Group D	Group E
Green panic-dryland	Asian vegetables-irrigated	Blackbutt-dryland	Barley-dryland	Avocados-irrigated
Improved pasture legumes-dryland	Beetroot-irrigated	Gympie messmate-dryland	Chickpeas-dryland	
Kikuyu-dryland	Brassicas-irrigated	Hoop pine-dryland	Citrus-irrigated	
Native pasture	Broccoli-irrigated	Leucaena-dryland	Dunn's white gum-dryland	
Rhodes grass-dryland	Capsicum-irrigated	Spotted gum-dryland	Forage Sorghum-dryland	
Rye grass-dryland	Carrots-irrigated		Lucerne-irrigated	
	Cucurbits-irrigated		Maize-dryland	
	Green beans-irrigated		Oats-dryland	
	Lettuce-irrigated		Sorghum-dryland	
	Onions-Irrigated		Wheat-dryland	
	Potatoes-Irrigated			
	Soybeans-irrigated			
	Summer pulses-dryland			
	Sweet corn-Irrigated			
	Tomato-irrigated			
	Turf-irrigated			

## **Soil surface condition (Ps)**

Problems with germination and seedling development during crop establishment are typically associated with adverse physical conditions in the surface soil, such as hard setting behaviour, coarse aggregates and crusting.

### **Limitation class determination**

Plant tolerance limits and requirements in relation to germination were matched with soil properties and supported by agronomic experience.

### **Additional Notes:**

- Crops planted from seed (particularly small seeded vegetables, grasses or pasture species) are most affected by this limitation. Vegetable crops such as lettuce, brassicas, tomatoes, capsicum and cucurbits, which are in the main planted as seedlings, are less affected. Tree and vine crops, which are planted as large tree seedlings, and also crops planted using vegetative material are least affected.
- Irrigated crops are able to overcome limitations associated with crusting and hard setting soils.

## Ps – Soil surface condition

Limitation Value	Description	Suitability subclasses for various land management options					
		Group A	Group B	Group C	Group D	Group E	Group F
Ps0	No restrictions.	1	1	1	1	1	1
Ps1	Hard setting soils with SL to CL surface textures and dry firm consistency.	1	2	2	3	3	3
Ps2	Hard setting massive soils with FSL to CLFS surface textures and dry firm consistency.	2	2	2	3	3	3
Ps3	Surface crusts present.	2	2	2	3	3	3
Ps4	Large soil aggregate size on surface (>20mm)	2	2	3	3	4	5

Group A	Group B	Group C	Group D	Group E	Group F
Asian vegetables-irrigated	Beetroot-irrigated	Soybeans-irrigated	Chickpeas-dryland	Barley-dryland	Sorghum-dryland
Brassicas-irrigated	Carrots-irrigated		Forage sorghum-dryland	Maize-dryland	
Broccoli-irrigated	Green beans-irrigated		Green panic-dryland	Oats-dryland	
Capsicum-irrigated	Lucerne-irrigated		Improved pasture legumes-dryland	Wheat-dryland	
Cucurbits-irrigated	Sweet corn-irrigated		Kikuyu-dryland		
Lettuce-irrigated			Leucaena-dryland		
Onions-Irrigated			Native pasture		
Potatoes-Irrigated			Rhodes grass-dryland		
Tomato-irrigated			Rye grass-dryland		
Turf-irrigated			Summer pulses-dryland		

## **Rockiness (R)**

Coarse fragments (e.g. pebbles, gravel, cobbles, stones and boulders) and rock in the plough zone can damage and/or interfere with the efficient use of agricultural machinery. Surface gravel, stone and rock are particularly important and can interfere significantly with planting, cultivation and harvesting machinery used for root crops, macadamias, small crops, annual forage crops and sugar cane.

### **Limitation class determination**

Consultation with landholders and machinery operators were used to establish accepted tolerances to rockiness.

### **Additional Notes:**

- Surface gravel, stone and rock are particularly important and can interfere significantly with planting, cultivation and harvesting machinery used for root crops, other vegetable crops, annual forage crops.
- Surface rock in particular interferes with harvest machinery for sub-surface and ground crops such as carrots and potatoes. The presence of rocks also affects plant available moisture (considered under the **M** limitation).

## R - Rockiness

Limitation		Suitability subclasses for various land management options													
Value	Description	Group A	Group B	Group C	Group D	Group E	Group F	Group G	Group H	Group I	Group J	Group K	Group L	Group M	Group N
R0	No rock.	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RF2	2-6mm (fine gravel) 2-10%.	1	1	1	1	1	1	1	1	1	1	1	2	2	1
RF3	2-6mm (fine gravel) 10-20%.	1	1	1	2	2	2	2	2	2	2	3	2	4	2
RF4	2-6mm (fine gravel) 20-50%.	1	1	1	3	3	3	3	3	3	3	3	3	5	3
RF5	2-6mm (fine gravel) >50%.	1	2	2	3	4	4	4	3	3	4	4	4	5	3
RM2	6-20mm (medium gravel) 2-10%.	1	1	1	2	1	2	2	2	2	3	3	1	5	3
RM3	6-20mm (medium gravel) 10-20%.	1	1	1	2	2	2	3	3	4	4	4	2	5	4
RM4	6-20mm (medium gravel) 20-50%.	1	1	2	3	3	3	4	4	5	5	5	3	5	5
RM5	6-20mm (medium gravel) >50%.	2	2	3	4	4	4	5	5	5	5	5	4	5	5
RG1	20-60mm (coarse gravel) <2%.	1	1	1	2	1	1	1	2	3	3	3	1	4	2
RG2	20-60mm (coarse gravel) 2-10%.	1	1	1	2	2	2	3	3	4	4	4	2	5	3
RG3	20-60mm (coarse gravel) 10-20%.	1	1	2	3	3	3	4	4	5	5	5	3	5	4
RG4	20-60mm (coarse gravel) 20-50%.	2	2	3	4	4	4	5	5	5	5	5	4	5	5
RG5	20-60mm (coarse gravel) >50%.	2	3	4	5	5	5	5	5	5	5	5	5	5	5
RC1	60-200mm (cobble) <2%.	1	1	1	1	2	2	2	2	3	3	3	1	5	2
RC2	60-200mm (cobble) 2-10%.	1	1	2	2	3	3	3	3	4	4	4	2	5	3
RC3	60-200mm (cobble) 10-20%.	2	2	3	2	4	4	4	4	5	5	5	3	5	4
RC4	60-200mm (cobble) 20-50%.	2	2	4	3	4	5	5	5	5	5	5	4	5	5
RC5	60-200mm (cobble) >50%.	3	3	5	4	5	5	5	5	5	5	5	5	5	5
RS1	200-600mm (stones) <2%.	1	1	2	2	3	3	2	2	4	4	4	3	5	2
RS2	200-600mm (stones) 2-10%.	2	2	3	3	4	4	4	4	5	5	5	4	5	4
RS3	200-600mm (stones) 10-20%.	2	3	4	4	5	5	5	5	5	5	5	5	5	5
RS4	200-600mm (stones) 20-50%.	3	4	5	5	5	5	5	5	5	5	5	5	5	5
RS5	200-600mm (stones) >50%.	4	4	5	5	5	5	5	5	5	5	5	5	5	5
RO1	>600mm or rock outcrop (boulders) <2%.	1	2	2	2	3	3	2	2	3	3	3	3	5	2
RO2	>600mm or rock outcrop (boulders) 2-10%.	2	3	4	3	4	4	4	4	4	4	4	4	5	4
RO3	>600mm or rock outcrop (boulders) 10-20%.	3	4	4	4	5	5	5	5	5	5	5	5	5	5
RO4	>600mm or rock outcrop (boulders) 20-50%.	3	5	5	5	5	5	5	5	5	5	5	5	5	5
RO5	>600mm or rock outcrop (boulders) >50%.	4	5	5	5	5	5	5	5	5	5	5	5	5	5

Group A	Group B	Group C	Group D	Group E	Group F	Group G	Group H	Group I	Group J	Group K	Group L	Group M	Group N
Native pasture	Blackbutt-dryland	Green panic-dryland	Avocados-irrigated	Barley-dryland	Lucerne-irrigated	Lettuce-irrigated	Asian vegetables-irrigated	Beetroot-irrigated	Carrots-irrigated	Potatoes-Irrigated	Summer pulses-dryland	Turf-irrigated	Onions-Irrigated
	Dunn's white gum-dryland	Improved pasture legumes-dryland	Citrus-irrigated	Chickpeas-dryland			Brassicas-irrigated						
	Gympie messmate-dryland	Kikuyu-dryland		Forage Sorghum-dryland			Broccoli-irrigated						
	Hoop pine-dryland	Leucaena-dryland		Maize-dryland			Capsicum-irrigated						
	Spotted gum-dryland	Rhodes grass-dryland		Oats-dryland			Cucurbits-irrigated						
		Rye grass-dryland		Sorghum-dryland			Green beans-irrigated						
				Soybeans-irrigated			Sweet corn-irrigated						
				Wheat-dryland			Tomato-irrigated						

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## Soil salinity (Sa)

High levels of soluble salts within the root zone can limit water uptake, result in toxicity effects and restrict root development.

### Limitation class determination

Subclass determination was based on salinity (EC<sub>se</sub> dS/m) combined with the productivity decrease guides in Table 46 of the Salinity Management Handbook (Salcon 1997). Sub-classes were assigned based on:

Limitation sub-class	Predicted yield reduction as a result of root zone salinity
Class 1	0 to 10% yield reduction
Class 2	10 to 20% yield reduction
Class 3	20 to 35% yield reduction
Class 4	35 to 50% yield reduction
Class 5	>50% yield reduction

Spatial representation of surface salt expression data for south-east Queensland is available from the Queensland Department of Natural Resources, Mines and Energy.

### Additional Notes:

- Salinity is a significant limitation for plantation timber species, particularly blackbutt, spotted gum and gympie messmate.

## Sa - Salinity

Limitation		Suitability subclasses for various land management options															
Value	Description	Grp A	Grp B	Grp C	Grp D	Grp E	Grp F	Grp G	Grp H	Grp I	Grp J	Grp K	Grp L	Grp M	Grp N	Grp O	Grp P
Sa1	No salinity or salinity <2dS/m ECse	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2
Sa2	Dominantly slightly saline (2-4 dS/m ECse)	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	4
Sa3	Dominantly moderately saline (4-8 dS/m ECse)	1	1	2	2	3	4	2	3	3	4	5	4	5	4	5	5
Sa4	Dominantly severely saline (>8 dS/m ECse)	2	3	3	4	4	4	3	4	5	5	5	5	5	5	5	5

Grp A	Grp B	Grp C	Grp D	Grp E	Grp F	Grp G	Grp H	Grp I	Grp J	Grp K	Grp L	Grp M	Grp N	Grp O	Grp P
Barley-dryland	Rhodes grass-dryland	Leucaena-dryland	Forage Sorghum-dryland	Beetroot-irrigated	Oats-dryland	Kikuyu-dryland	Green panic-dryland	Asian vegetables-irrigated	Turf-irrigated	Carrots-irrigated	Dunn's white gum-dryland	Capsicum-irrigated	Improved pasture legumes-dryland	Citrus-irrigated	Avocados-irrigated
		Native pasture	Sorghum-dryland	Chickpeas-dryland			Rye grass-dryland	Brassicas-irrigated		Cucurbits-irrigated	Hoop pine-dryland	Green beans-irrigated			Blackbutt-dryland
			Wheat-dryland	Lucerne-irrigated				Broccoli-irrigated		Lettuce-irrigated	Maize-dryland				Gympie messmate-dryland
				Soybeans-irrigated						Onions-irrigated					Spotted gum-dryland
				Summer pulses-dryland						Potatoes-irrigated					
										Sweet corn-irrigated					
										Tomato-irrigated					



## **Microrelief (Tm)**

Microrelief such as melon holes, swamp hummock, rills and small gullies cause irregular and reduced crop productivity. This is mainly as a result of uneven water distribution (e.g. water ponding in depressions), irregular cultivation and impeded trafficability. Effects associated with the presence of microrelief such as temporary waterlogging and poor surface condition are covered in the wetness (W) and soil physical (Ps) limitations respectively.

The vertical interval (VI) of the microrelief typically dictates the amount of levelling required and/or the potential for reduced productivity. Therefore VI was used to determine the severity of the limitation.

### **Limitation class determination**

Land resource surveys, consultation with agronomic extension staff and local landholder experience.

## Tm – Microrelief

Limitation		Suitability subclasses for various land management options			
Value	Description	Group A	Group B	Group C	Group D
Tm0	No microrelief.	1	1	1	1
Tm1	Microrelief with a vertical interval <0.3m.	2	1	1	3
Tm2	Microrelief with a vertical interval 0.3-0.5m.	3	2	2	4
Tm3	Microrelief with a vertical interval >0.5m.	4	2	3	5

Group A	Group B	Group C	Group D
Lettuce-irrigated	Green panic-dryland	Blackbutt-dryland	Asian vegetables-irrigated
Avocados-irrigated	Improved pasture legumes-dryland	Dunn's white gum-dryland	Beetroot-irrigated
Chickpeas-dryland	Kikuyu-dryland	Gympie messmate-dryland	Brassicas-irrigated
Citrus-irrigated	Leucaena-dryland	Hoop pine-dryland	Broccoli-irrigated
Forage sorghum-dryland	Native pasture	Spotted gum-dryland	Capsicum-irrigated
Lucerne-irrigated	Rhodes grass-dryland		Carrots-irrigated
Maize-dryland	Rye grass-dryland		Cucurbits-irrigated
Oats-dryland			Green beans-irrigated
Sorghum-dryland			Onions-irrigated
Soybeans-irrigated			Potatoes-irrigated
Summer pulses-dryland			Sweet corn-irrigated
Wheat-dryland			Tomato-irrigated
Barley			Turf-irrigated

## Slope (Ts)

The safety and/or efficiency of farm vehicle/machinery operation are affected by:

- steep gradients, specifically rolling and side-slip hazards; and
- erosion control layouts on land with significant variability in the degree and direction of slopes (e.g. complex slopes). It is particularly important with row crops where final layouts on such lands would necessitate impractical short rows and sharp curves.

### Limitation class determination

Consultation with Workplace, Health and Safety guidelines and landholder experience were used to determine the upper slope limit for safe machinery operation over a range of land uses. Farmer tolerance to short row length and the inability of trailing implements to effectively negotiate curves with less than 30m radius were also considered.

Terrain covariates derived from the 1-arc second resolution DEM, available from the CSIRO's Data Access Portal and the TERN Data Discovery Portal, were used in conjunction with site data to model some of the limitations used in the suitability assessment. The Ts limitation relied on the SRTM DEM.

### Additional Notes:

- Where tillage forms part of normal management within the crop cycle, a slope limit of 15% was recognised as the upper limit for acceptable machinery use.
- However, where contour based or cross slope sward management is practiced in horticultural situations (e.g. tree and vine orchards) slopes of 20% were considered manageable.
- In commercial hardwood timber production, most plantations are on slopes <25%. However, steeper slopes can be utilised with hand planting and specialised machinery for harvesting operations (e.g. cable logging) allowing steeper slope limits up to 35%.
- Where spraying and harvesting operations in horticultural tree and vine crops can be carried out directly up and down slopes, a maximum slope limit of 25% is considered manageable for safe machinery operation.

## Ts – Slope

Limitation Value	Description	Suitability subclasses for various land management options								
		Group A	Group B	Group C	Group D	Group E	Group F	Group G	Group H	Group I
Ts1	Slope <5%	1	1	1	1	1	1	1	1	1
Ts2	Slope 5-8%	1	1	1	1	1	1	2	3	3
Ts3	Slope 8-12%	1	1	1	1	2	3	3	4	4
Ts4	Slope 12-15%	1	2	2	2	3	4	4	4	5
Ts5	Slope 15-20%	2	2	3	3	3	5	5	5	5
Ts6	Slope 20-30%	3	3	4	5	4	5	5	5	5
Ts7	Slope >30%	4	4	5	5	5	5	5	5	5

Group A	Group B	Group C	Group D	Group E	Group F	Group G	Group H	Group I
Native pasture	Blackbutt-dryland	Kikuyu-dryland	Green panic-dryland	Avocados-irrigated	Chickpeas-dryland	Turf-irrigated	Asian vegetables-irrigated	Sweet corn-irrigated
	Dunn's white gum-dryland		Improved pasture legumes-dryland	Citrus-irrigated	Forage sorghum-dryland		Beetroot-irrigated	
	Gympie messmate-dryland		Leucaena-dryland		Lucerne-irrigated		Brassicas-irrigated	
	Hoop pine-dryland		Rhodes grass-dryland		Maize-dryland		Broccoli-irrigated	
	Spotted gum-dryland		Rye grass-dryland		Oats-dryland		Capsicum-irrigated	
					Sorghum-dryland		Carrots-irrigated	
					Soybeans-irrigated		Cucurbits-irrigated	
					Summer pulses-dryland		Green beans-irrigated	
					Wheat-dryland		Lettuce-irrigated	
					Barley		Onions-Irrigated	
							Potatoes-Irrigated	
							Tomato-irrigated	

## Wetness (W)

Waterlogged soils reduce plant growth and delay effective machinery operations.

### Limitation category determination

Crop tolerance information, consultation with agronomic extension staff and local landholder experience were used in determining the severity of this limitation. The effects of delayed machinery operations have also been considered.

### Additional Notes:

- Imperfectly drained soils (3H, 3M, 3S, 3V) significantly affect plant growth for many crops and are usually the soils where mounding is important. Mounding is a common management practice for tree crops.
- Crops requiring a minimum drained soil depth of **1.5m** are restricted to: Avocados.
- Crops requiring a minimum drained soil depth of **1.0m** are restricted to: Citrus.
- All remaining crops require a minimum drained soil depth of **0.5m**.

### W1 wetness to 1.0m

Limitation		Suitability subclasses for various land management options
Value	Description	Group A
W16	Rapidly drained	1
W15	Well drained	1
W14H	Moderately well drained and highly permeable	1
W14M	Moderately well drained and moderately permeable	2
W14S	Moderately well drained and slowly permeable	3
W14V	Moderately well drained and very slowly permeable	3
W13H	Imperfectly drained and highly permeable	3
W13M	Imperfectly drained and moderately permeable	4
W13S	Imperfectly drained and slowly permeable	4
W13V	Imperfectly drained and very slowly permeable	4
W10	Poorly to very poorly drained	5

Group A

Citrus-Irrigated

## W2 wetness to 0.5m

Limitation		Suitability subclasses for various land management options													
Value	Description	Grp A	Grp B	Grp C	Grp D	Grp E	Grp F	Grp G	Grp H	Grp I	Grp J	Grp K	Grp L	Grp M	Grp N
W26	Rapidly drained	1	1	1	1	1	1	1	1	1	1	2	2	1	2
W25	Well drained	1	1	1	1	1	1	1	1	1	1	1	1	1	1
W24H	Moderately well drained and highly permeable	1	1	1	1	1	2	2	2	2	2	1	1	3	2
W24M	Moderately well drained and moderately permeable	1	1	1	2	2	2	2	2	2	3	2	2	3	3
W24S	Moderately well drained and slowly permeable	1	1	2	2	3	2	2	2	3	3	2	2	3	3
W24V	Moderately well drained and very slowly permeable	1	1	2	3	3	2	2	2	3	3	3	2	3	3
W23H	Imperfectly drained and highly permeable	2	2	2	3	3	2	2	3	3	3	3	3	4	3
W23M	Imperfectly drained and moderately permeable	2	2	3	3	3	3	3	3	3	4	3	3	4	4
W23S	Imperfectly drained and slowly permeable	2	2	3	3	4	3	3	3	4	4	3	3	4	4
W23V	Imperfectly drained and very slowly permeable	2	2	4	4	4	4	4	4	4	5	4	4	4	5
W22H	Poorly drained and highly permeable	3	3	3	4	5	3	4	4	4	4	4	4	4	4
W22M	Poorly drained and moderately permeable	3	3	3	4	5	4	4	4	5	5	4	4	4	5
W22S	Poorly drained and slowly permeable	3	3	4	5	5	5	4	5	5	5	5	5	5	5
W22V	Poorly drained and very slowly permeable	3	4	5	5	5	5	5	5	5	5	5	5	5	5
W21H	Very poorly drained and highly permeable	4	3	4	5	5	5	4	5	5	5	5	5	5	5
W21M	Very poorly drained and moderately permeable	4	3	4	5	5	5	5	5	5	5	5	5	5	5
W21S	Very poorly drained and slowly permeable	4	4	5	5	5	5	5	5	5	5	5	5	5	5
W21V	Very poorly drained and very slowly permeable	4	5	5	5	5	5	5	5	5	5	5	5	5	5

Grp A	Grp B	Grp C	Grp D	Grp E	Grp F	Grp G	Grp H	Grp I	Grp J	Grp K	Grp L	Grp M	Grp N
Leucaena-dryland	Native pasture	Rye grass-dryland	Forage Sorghum-dryland	Asian vegetables-irrigated	Kikuyu-dryland	Improved pasture legumes-dryland	Green panic-dryland	Barley-dryland	Chickpeas-dryland	Summer pulses-dryland	Lucerne-irrigated	Soybeans-irrigated	Blackbutt-dryland
		Dunn's white gum-dryland	Maize-dryland	Beetroot-irrigated	Rhodes grass-dryland			Oats-dryland					Gympie messmate-dryland
			Sorghum-dryland	Brassicas-irrigated				Wheat-dryland					Hoop pine-dryland
				Broccoli-irrigated									Spotted gum-dryland
				Capsicum-irrigated									
				Carrots-irrigated									
				Cucurbits-irrigated									
				Green beans-irrigated									
				Lettuce-irrigated									
				Onions-Irrigated									
				Potatoes-Irrigated									
				Sweet Corn-Irrigated									
				Tomato-irrigated									
				Turf-irrigated									

### W3 wetness to 1.5m

Limitation		Suitability subclasses for various land management options
Value	Description	Group A
W36	Rapidly drained	1
W35	Well drained	1
W34H	Moderately well drained and highly permeable	2
W34M	Moderately well drained and moderately permeable	2
W34S	Moderately well drained and slowly permeable	3
W34V	Moderately well drained and very slowly permeable	4
W33H	Imperfectly drained and highly permeable	4
W33M	Imperfectly drained and moderately permeable	4
W33S	Imperfectly drained and slowly permeable	5
W33V	Imperfectly drained and very slowly permeable	5
W30	Poorly to very poorly drained	5

Group A

Avocados-irrigated



## **Landscape complexity (X)**

This limitation assessed the effect soil complexity and/or topographic dissection may have on the size or shape of an area of suitable land. A 'minimum production area' is defined as the minimum area of land that is practicable to utilise for a particular land use.

### **Limitation class determination**

The minimum production area for each land use was determined by consultation with agronomic extension staff and landholders. The suitability may be modified according to the proximity and extent of surrounding non-contiguous suitable land.

### **Additional Notes:**

- The minimum practical area for forestry has been assessed for economic purposes, and not for amenity or environmental values (e.g. salinity, wind breaks, noise barriers).

Landscape complexity has most effect on broad acre crops that require large paddock sizes for efficiency (e.g. forage crops, commercial timber). Lot size is not considered.

## X – Landscape complexity

Limitation		Suitability subclasses for various land management options										
Value	Description	Grp A	Grp B	Grp C	Grp D	Grp E	Grp F	Grp G	Grp H	Grp I	Grp J	Grp K
X1	Minimal practical production area >10ha	1	1	1	1	1	1	1	1	1	1	1
X2	Minimal practical production area 5-10ha	1	1	1	1	1	1	1	1	4	3	1
X3	Minimal practical production area 2.5-5ha	1	1	1	1	2	2	4	1	5	4	1
X4	Minimal practical production area 1.5-2.5ha	1	2	2	3	3	4	5	3	5	4	4
X5	Minimal practical production area <1.5ha	1	4	3	4	4	5	5	5	5	5	4

Group A	Group B	Group C	Group D	Group E	Group F	Group G	Group H	Group I	Group J	Group K
Asian vegetables-irrigated	Green panic-dryland	Beetroot-irrigated	Onions-Irrigated	Avocados-irrigated	Green beans-irrigated	Lucerne-irrigated	Potatoes-irrigated	Barley-dryland	Blackbutt-dryland	Carrots-irrigated
	Improved pasture legumes-dryland	Brassicas-irrigated		Citrus-irrigated	Sweet corn-irrigated			Chickpeas-dryland	Dunn's white gum-dryland	
	Kikuyu-dryland	Broccoli-irrigated						Forage Sorghum-dryland	Gympie messmate-dryland	
	Leucaena-dryland	Capsicum-irrigated						Maize-dryland	Hoop pine-dryland	
	Rhodes grass-dryland	Cucurbits-irrigated						Oats-dryland	Spotted gum-dryland	
	Rye grass-dryland	Lettuce-irrigated						Sorghum-dryland		
	Turf-irrigated	Tomato-irrigated						Soybeans-irrigated		
		Native pasture						Summer pulses-dryland		
								Wheat-dryland		



## **Appendix 5: Land Suitability Classes**

Five land suitability classes have been defined for use in Queensland, with land suitability decreasing progressively from class 1 to class 5 (Department of Natural Resources and Mines & Department of Science, Information Technology Innovation and the Arts 2015). These classes are used to describe an area of land in terms of its suitability for a **particular land use** which allows optimum, sustainable production using current technology while minimising degradation to the land resource in the short, medium or long term. Land is considered less suitable as the severity of limitations for a specified land use increase, reflecting:

- reduced potential for production
- increased inputs required to achieve an acceptable level of production
- increased inputs required to prepare the land for successful production
- increased inputs required to prevent land degradation.

The five land suitability classes are explained below in Table A1.

**Table A2. Land suitability classes**

Class	Suitability	Limitations	Description
1	Suitable	Negligible	Highly productive land requiring only simple management practices to maintain economic production.
2	Suitable	Minor	Limitations that either constrain production, or require more than the simple management practices of Class 1 land to maintain economic production.
3	Suitable	Moderate	Limitations that either further constrain production, or require more than those management practices of Class 2 land to maintain economic production.
4	Unsuitable	Severe	Currently unsuitable land. The limitations are so severe that the sustainable use of the land in the proposed manner is precluded. In some circumstances, the limitations may be surmountable with changes to knowledge, economics or technology.
5	Unsuitable	Extreme	Land with extreme limitations that preclude any possibility of successful sustained use of the land in the proposed manner.

The first three classes of land (classes 1 to 3) are considered **suitable** for the specified land use, as the benefits obtained from that land use in the long-term should outweigh the inputs required to initiate and maintain production. Class 3 land may be as productive as class 1 or 2 land; however increased inputs (e.g. fertiliser, land preparation and maintenance operations) would generally be required. It is not uncommon to find in a land resource survey that there is no land assessed as suitability class 1 for a particular land use.

Class 4 land is considered **currently unsuitable** for the specified land use, due to the severity of one or a number of limiting factors. It is implied that the inputs required to achieve and maintain production outweigh the benefits of production in the long-term. This land may be upgraded to a suitable class if future agronomic, edaphic or engineering studies show it to be economically viable

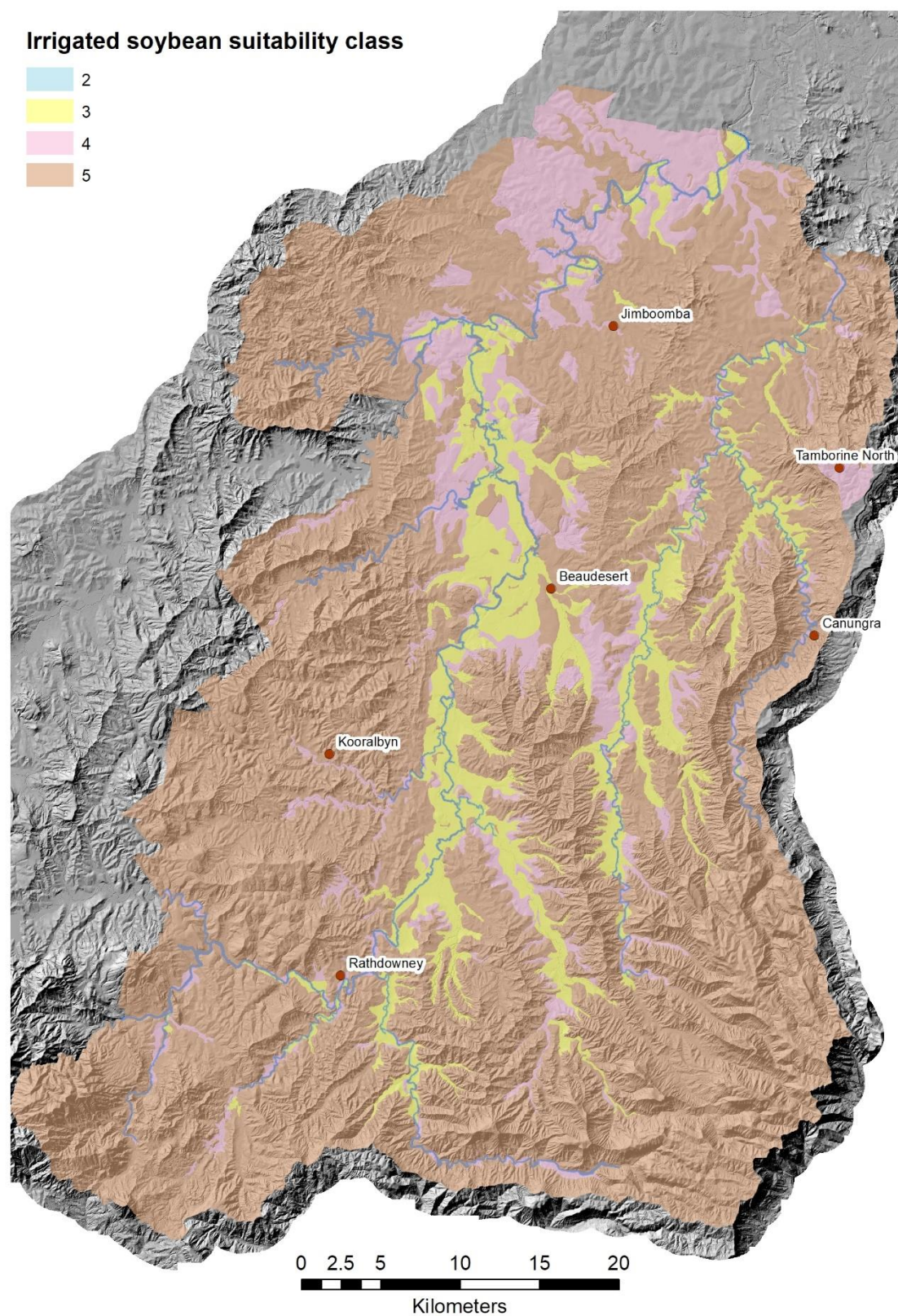
and environmentally sustainable. Changes in climate, economic conditions, or technology may alter the level of management inputs required to achieve satisfactory long-term productivity.

Class 5 land is considered **unsuitable** for the specified land use, as it has limitations that singly or in aggregate are so severe that the benefits would not justify the inputs required to initiate and maintain sustainable production in the long term. Such land is unlikely to ever be suitable for the specified land use.



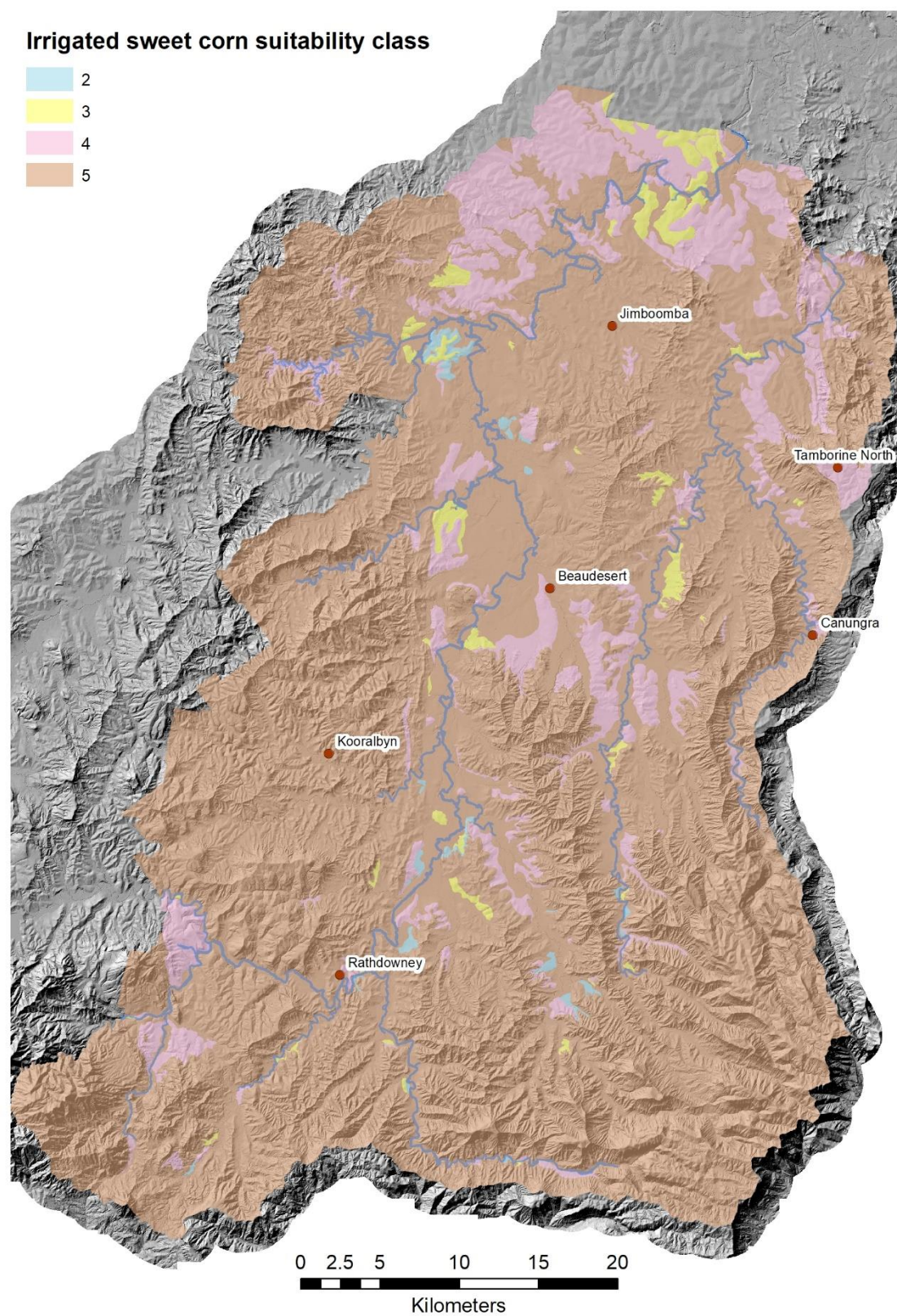
## **Appendix 6: Additional land use suitability maps**





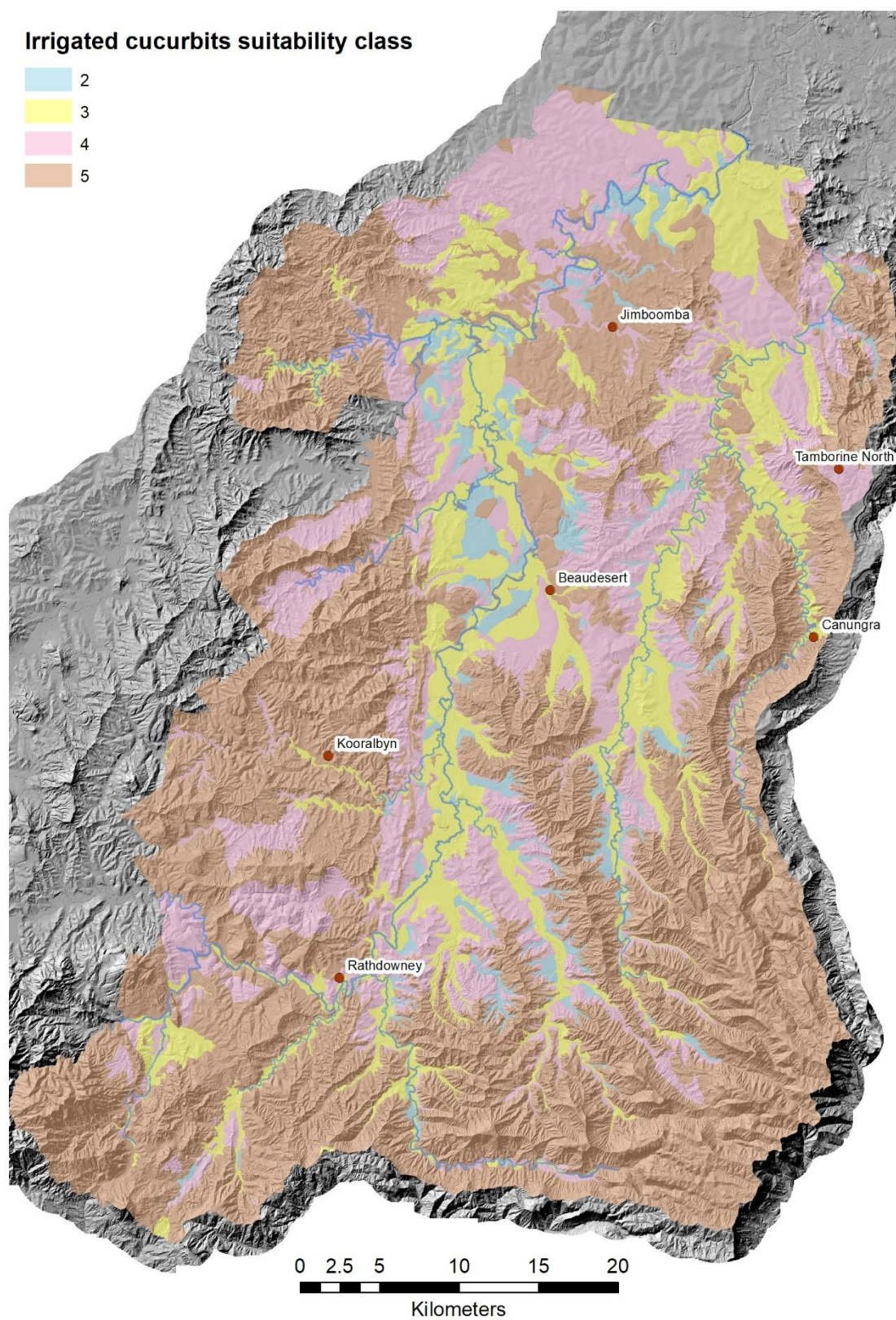
**Figure A6.1. Land use suitability map for Soya Beans**





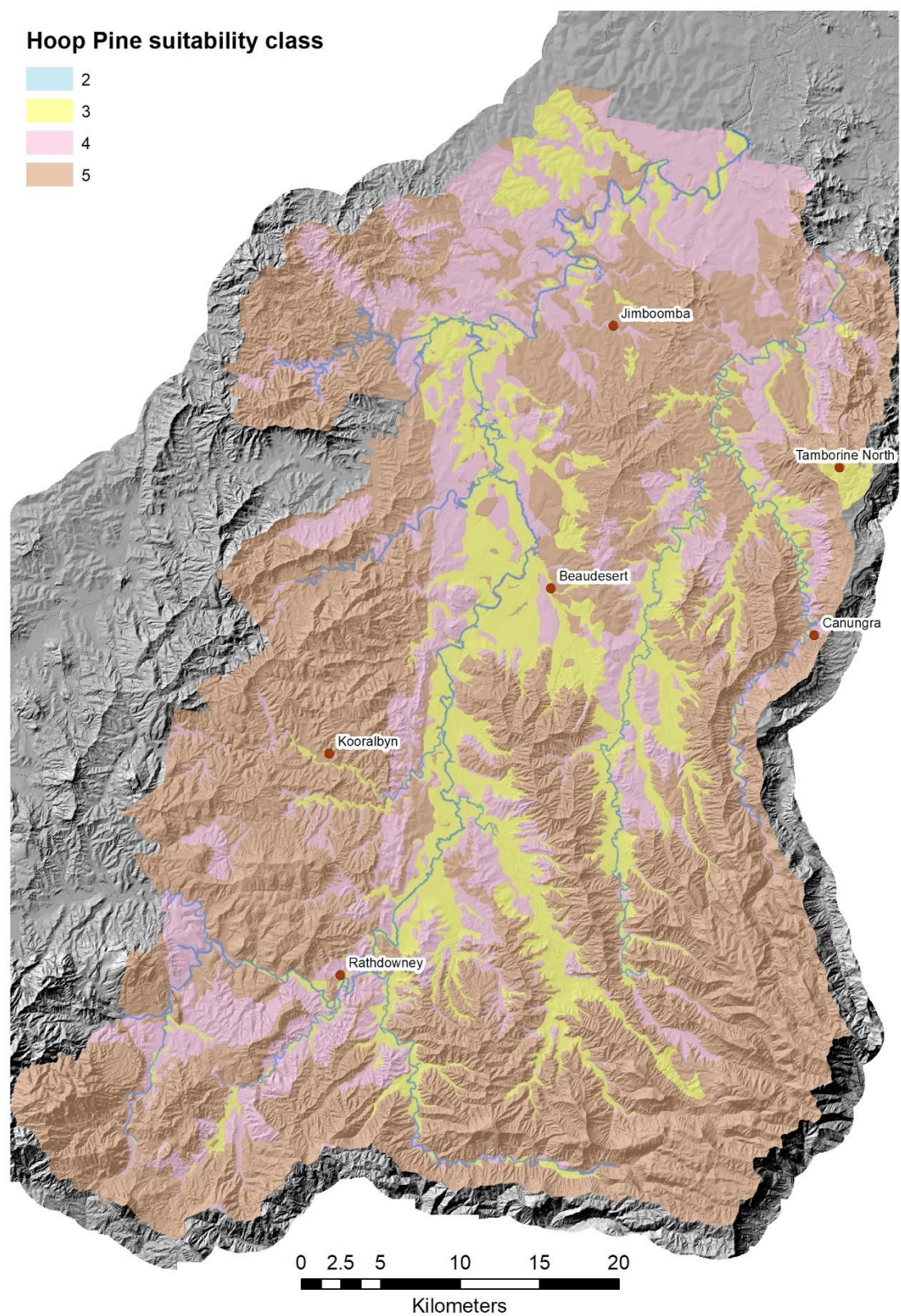
**Figure A6.2. Land use suitability map for Sweet Corn**





**Figure A6.3. Land use suitability map for Cucurbits**





**Figure A6.4. Land use suitability map for Hoop Pine**



## **Appendix 7: Definition of Agricultural Land Classes**

ALC	ALC Description
<b>A</b>	<b>Crop land</b> Land that is suitable for a wide range <sup>1</sup> of current and potential crops with nil to moderate limitations to production.
A1	Suitable for a wide range of current and potential broadacre and horticultural <sup>2</sup> crops.
A2	Suitable for a wide range of current and potential horticultural crops only.
<b>B</b>	<b>Limited crop land</b> Land that is suitable for a narrow range <sup>3</sup> of crops. The land is suitable for sown pastures and may be suitable for a wider range of crops with changes to knowledge, economics or technology.
<b>C</b>	<b>Pasture land</b> Land that is suitable only for improved or Native pastures due to limitations that preclude continuous cultivation for crop production. Some areas may tolerate a short period of ground disturbance for pasture establishment.
C1	Suitable for grazing sown pastures requiring ground disturbance for establishment; or Native pastures on higher fertility soils.
C2	Suitable for grazing Native pastures, with or without the introduction of pasture species, and with lower fertility soils than C1.
C3	Suitable for light grazing of Native pastures in accessible areas, and includes steep land more suited to forestry or catchment protection.
<b>D</b>	<b>Non-agricultural land<sup>4</sup></b> Land not suitable for agricultural use, including land alienated from agricultural use.
A/C A/D B/C C/D	Land that is a complex of class A, B, C or D land where it is not possible to delineate the land class at the map scale. The dominant class is the first code in the sequence and is assumed to be >50% of the area, but <70% <sup>5</sup> .

Agricultural Land Classes (from Department of Natural Resources and Mines & Department of Science, Information Technology and Innovation 2015)

<sup>1</sup> A wide range of crops is four or more crop types of local commercial significance

<sup>2</sup> Horticulture includes intensively grown small crops (e.g. vegetables) as well as tree crops (e.g. grown for nuts, seeds or fruit). Silviculture (plantation forestry) is not included.

<sup>3</sup> A narrow range of crops is three or fewer crop types (broadacre or horticulture) of local commercial significance. Silviculture (plantation forestry) may be included. Crops with similar agronomic requirements e.g. maize and corn, peaches and nectarines; are not generally regarded as different crop types. Different management regimes (including irrigation strategies) for the same crop does not increase the number of crops.

<sup>4</sup> Non-agricultural land includes land that cannot be placed in any of the other land classes and includes land such as urban areas and stream channels.

<sup>5</sup> In cases where two or more land classes are equally dominant and none are greater than 50%, judgement will be used to identify the most appropriate agricultural land class(es) for the unit.

## **Appendix 8: Project validation**



## Validation of LARA project accuracy

In field validation of the LARA project was undertaken to assess the accuracy of mapping and polygon attribution. This was done within the subsequent, and spatially overlapping, Department of Environment and Science LASER (Logan and Albert soil erodibility and nutrient mapping) project field work. The validation sites are therefore found in the departmental soil database (SALI) under LASER not LARA. Eight additional SEQ project sites were located following the completion of this project, these were also used for validation.

A total of 82 sites were used for validation-LASER 2, 4, 5, 12-14, 16-22, 24, 27, 36, 44, 102, 105-109, 111, 115-119, 122, 127, 129, 132, 134, 135, 139, 142, 143, 150, 151, 153, 155-163, 168, 170-181, 183, 185, 188, 189, 191, 192, 194-200; SEQ 167, 182, 187, 192, 198, 204, 207, 348.

Validation sites were deemed valid if:

- The validation site had a soil profile class (SPC) matching one of the entities assigned to the polygon in which it was located or was within 100m of one that did
- The area likely occupied by the validation site SPC was large enough to meet minimum mapping area requirements e.g. at 1:50 000 scale this is 4 hectares
- A1 and B21 horizon field texture of the validation site soil fell within the range of A1 and B21 horizon field textures found across the SPC entities assigned to the polygon in which it was located
- Profile permeability and drainage at the validation site soil fell within the range of permeabilities and drainages found across the SPC entities assigned to the polygon in which it was located
- A1 and B21 horizon pH at the validation site soil fell within the range of A1 and B21 horizon pH's found across the SPC entities assigned to the polygon in which it was located
- Soil depth of the validation site soil fell within the range of soil depths found across the SPC entities assigned to the polygon in which it was located.

The following are the results of the validation process.

Validation parameter	% correlation
SPC	80
Field texture-A1	85
Field texture-B21	93
Permeability	97
Drainage	88
pH-A1	97
pH-B21	87
Soil depth	96