URS Australia

ADDENDUM

Caval Ridge Project

Soil Survey and Land Resource Assessment Report

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GSS ENVIRONMENTAL
Environmental, Land and Project Management Consultants

ADDENDUM

Addendum to the Caval Ridge Project – Soil Survey and Land Resource Assessment Report 2009, prepared on behalf of URS Australia for BHP Billiton Mitsubishi Alliance.

This addendum should be read in conjunction with the report by GSSE titled Caval Ridge Project – Soil Survey and Land Resource Assessment Report 2009 and Section 4 of the Caval Ridge Environmental Impact Statement (EIS) prepared by URS Australia.

1.0 Agricultural Land Classes

The Project Area was assessed for land suitability using the *Land Suitability Assessment Techniques* (DNRW 1995). With reference to the results of the land suitability assessment, Good Quality Agricultural Land was assessed according to; *Planning Guidelines: The Identification of Good Quality Agricultural Land* (DPI & DHLGP 1993); *State Planning Policy 1/92 – Development and the Conservation of Agricultural Land* (Queensland Government 1992); and *Guidelines for Surveying Soil and Land Resources 2nd Edition* (CSIRO 2008).

The soil unit dominating the previously classed C1 land (in EIS Figure 4.16) was Uniform Clay, located in the northern section of the Project Site. During the detailed assessment of land suitability the following parameters caused this soil unit to be classed as C2 land according to Table 2.2 in Attachment 2 of *Land Suitability Assessment Techniques* (DNRW 1995):

- The area displayed signs of structural instability and potential erodibility, evidenced by emerson rating of 2(1) at site 21 (surface), and 2(1) & 2(2) at site 1 and 4 respectively sub surface. These results combined with field observations categorise Uniform Clay into Land Suitability Class 2 and 3 and therefore Agricultural Class C2.

- The plant available water capacity (PAWC) parameter for the soil type 'Uniform Clay' had an average value of 124 mm for layer 1 with range of 106-142 mm, and an average value of 66 mm for layer 2 with range of 47-87 mm. These PAWC values categorise the soil type Uniform Clay into Land Suitability class 2 for grazing and therefore Agricultural Class C2.

- Additionally, some areas located within the northern section displayed slopes of greater than 3% which categorises some of this soil into Land Suitability Class 2.

Figure 1 below shows the Agricultural Class distribution within the Project Area, and given the results above, it is dominated by Class C2 land with no land worthy of inclusion into Good Quality Agricultural Land. **Table 1** shows the PAWC for each soil type as requested by the Department of Environment and Resources Management.

Table 1: Plant Available Water Capacity for the soil types listed in Table 2.

Soil Classification	Rooting depth (m)*	Plant Available Water Capacity (PAWC) (mm)**	
		Surface layer	**Subsurface layer**
Yellow Duplex Soils	0.45	133	96
Red Brown Duplex Soils	1.0^	65#	57#
Deep Sandy Loams	1.0	76	35
Uniform Clays	0.7-1.0	124	66
Brigalow Clays	0.4	115	118
Shallow Heavy Clays	1.0^	230#	140#
Skeletal Soils#	n/a		
Shallow Sandy Soils	0.35^^	117#	67#
Dark Heavy Clays	0.45	226	167

* Depth recorded from excavated soil pits where applicable

** PAWC estimated using 'PAWCER' program (Silburn DERM pers comm., 2009; based on M. Littleboys work)

Skeletal soil – soil sampling not applicable

^ Rooting depth determined to be the full describe profile (1 m) due to vegetation type

^^ Rock at 0.35 m determined maximum rooting depth

Particle size for PAWCER analysis estimated using soil texture grade

2.0 Soil Unit Analytical data

The abovementioned EIS includes Figure 4.14 Soil Classification and Sampling Locations, which lists nine (9) Soil Classifications. The GSSE EIS appendix report describes in detail six (6) of these soils which were sampled during the fieldwork component of the study. Reference was made in the report to a study undertaken by GT Environmental Services (GTES) in 2000 titled 'Peak Downs Mine – Land Suitability and Capability Assessment of Mine Lease Areas', which contains analytical data and soil descriptions of the remaining three soil units not described in the GSSE report. This addendum includes **Table 2: Soil Unit Classification Comparison**, which correlates the soil classifications between the GSSE report and the GTES report, and the relevant exerts from the GTES report that cover the three soil units not described in the GSSE report.

Correlation

Table 2: Soil Unit Classification Comparison

GSSE (2009)	GTES (2000)
Yellow Duplex Soils	A1^ - Deep sandy loams and texture contrast of soils of recent alluvia
Red Brown Duplex Soils*	A2^ - Texture contrast soils on older alluvial plains and levees
Deep Sandy Loams*	A1/A2^ - As above
Uniform Clays	C1 - Non Cracking Uniform Clays of undulating plains with Brigalow / Blackbutt communities and minor texture contrast areas of Poplar Box
Brigalow Clays	C2 - Melanholed and gilgaied brigalow clays
Shallow Heavy Clays	D1 - Shallow heavy clays formed in-situ on basalt
Skeletal Soils	R1 - Rugged outcrops of rock and shallow stony ridges
Shallow Sandy Soils*	R2^ - Shallow sandy soils of tablelands
Dark Heavy Clays	T2 - Texture contrast soils with deeper A horizon (30-70cm) - Open Eucalypt woodland

* Soil unit not detailed in GSSE report

^ Soil unit described in GTES report and analytical details included in this addendum

A1 Recent alluvia associated with active alluvia. Deep loamy sands with tall river red gum, grey bloodwood and silver leafed ironbark on alluvial terraces.

Landform: Floodplains.

Soil Morphology: Deep, neutral loamy sands overlying clay loam. Well drained and whole coloured.

Representative profile description (GTES Site 16)

0 - 50 cms	Brown (7.5YR4/2) sandy loam, loose surface, pH 6.0,
50 - 100	Brown (7.5YR4/4) sandy clay loam, pH 6.0, granular,
100 +	soil continues.

Major Vegetation: E. tessellaris, E tereticornis, E populnea, with dense ground cover of buffel, heteropogan, bothriochloa, chloris.

Analytical trends: not sampled – deduced from Bourne and Tuck (1993) for the 'Isaacs Agricultural Management Unit which found that similar soils in the district had moderate to high levels of basic nutrients including P and were not restricted by sodic or saline subsoils.

Forage cropping land use
Major limiting factors and severity : flooding susceptibility 5, moisture storage 3.
Cropping suitability: Class 5
Not suitable for cropping due to flooding and poor moisture storage potential.

Grazing land use
Major limiting factors and severity: moisture storage potential 2, nutrient deficiency 2. ***Grazing suitability:*** Class 3
Good grazing land with restrictions from reduced moisture storage and flooding.

Capability Class: V

A2 Texture contrast soils associated with older alluvial plains and terraces. Moderately thick sandy A horizons to 60 cms overly well structured whole coloured B horizons.

Landform: Old alluvial plains with coarse sandy surface.

Soil Morphology: Texture contrast soils with sandy clay loam A horizons over moderately well structured and drained B horizons. No bleach is evident and mottling is not prominent. Soil reaction is neutral grading to slightly alkaline at depth

Representative profile description (GTES Site 83)

0 - 55 cms	Reddish brown (5YR3/2) fine sandy loam, hardsetting, neutral over,
55 - 100	sub-angular blocky light clay, nodular lime, reddish- yellow neutral, no mottles and some rounded quartz.
100 +	soil continues.

Major Vegetation: Tall open poplar box, Moreton Bay Ash, Silver Leaf Ironbark. Quite good grass cover.

Analytical trends: no samples taken.

Forage cropping land use
Major limiting factors and severity : flooding 3, moisture holding capacity 4, nutrients 3.
Cropping suitability: Class 4
Very marginal cropping from severe moisture limitation given sandy texture, susceptibility to flooding, loss of access and unreliable rainfall.

Grazing land use
Major limiting factors and severity: moisture availability 2, nutrient deficiency 1, flooding 2
Grazing suitability: Class 2
Good grazing land with restrictions from moisture availability and susceptibility for flooding and resultant loss of access.

Capability Class: V

R1 Rocky bluffs, valleys and footslopes

Variable skeletal shallow rocky soils – no descriptions included. Rugged outcrops of Permian rocks and remnants of the Tertiary weathered zone associated with the Cherwell Range.

Capability Class VII and VIII

R2 Shallow sandy soils associated with mesa tops.

Landform: Mesas and tableland areas associated with the Cherwell Range.

Soil Morphology: Rocky, shallow neutral sands and texture contrast soils.

Representative profile description (GTES Site 36 – on mesa top)

0 - 25 cms	Coarse sand (7.5YR4/3) loose, neutral over,
25 - 35	Coarse sand with red colour from weathering rock, neutral, no mottles, rounded quartz.
35	sandstone rock.

Major Vegetation: maleleuca, bloodwood, red ash, belah, acacias.

Analytical trends: A 25 cm surface layer of organic staining with pH of 5.5 is very low in salts, cations and fertility. A total of 83% of the soil is either fine or coarse sand with 11% clay. The soil is non-sodic with very low cation exchange capacity and cations. Below the surface layer the pH falls to 4.8 with no evidence of salt or sodium.

Forage cropping land use
Major limiting factors and severity : moisture holding capacity 5, effective rooting depth 5.
Cropping suitability: Class 5
Not suitable
Grazing land use
Major limiting factors and severity: moisture availability 4, nutrient deficiency 3, landscape complexity 2.
Grazing suitability: Class 4
Broad scale grazing land with major restrictions from moisture availability, fertility, pasture vigour and the difficult terrain.

Capability Class: VII