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7. LAND

7.1. LEGISLATION/GUIDELINES

This Section considers the Queensland Government's *State Planning Policy 1/92: Development and the Conservation of Agricultural Land* (SPP 1/92), which is implemented under the *Sustainable Planning Act 2009* in order to protect good quality agricultural land (GQAL).

Due to the absence of Queensland or Australian guidelines for the assessment of landscape and visual impact for mining or similar developments, the *United Kingdom's Landscape Institute - Institute of Environmental Management and Assessment Guidelines* were used for this assessment. It is recognised that not all elements of these guidelines are relevant to Australia and/or the mining industry, however, the standard approach and identified landscape and visual amenity were both relevant and applicable. By using the assessment and classification tables from these guidelines, conclusions have been drawn as to the visual impacts from the South Galilee Coal Project (SGCP). The SGCP is located within the Barcaldine Regional Council Local Government Area (LGA), an amalgamation of the previous Aramac, Barcaldine and Jericho Shires. The Jericho Shire Planning Scheme (Campbell Higginson Town Planning, 2006) was consulted for any relevant visual amenity requirements. The Jericho Shire Planning Scheme stipulates that ridgelines and escarpments must be maintained in a natural state to protect rural character and landscape values. A separation distance of at least 50 metres (m) is required for all Rural Zone "buildings" and "structures" from ridgelines or escarpments.

The Jericho Shire Planning Scheme also requires that the design of lighting does not prejudice the amenity of the Rural Zone through poorly directed lighting, lighting overspill or lighting glare. To achieve this, direct lighting or lighting should not exceed 8.0 lux at 1.5 m beyond the boundary of the site.

7.2. EXISTING ENVIRONMENT

7.2.1. Land Use and Tenure

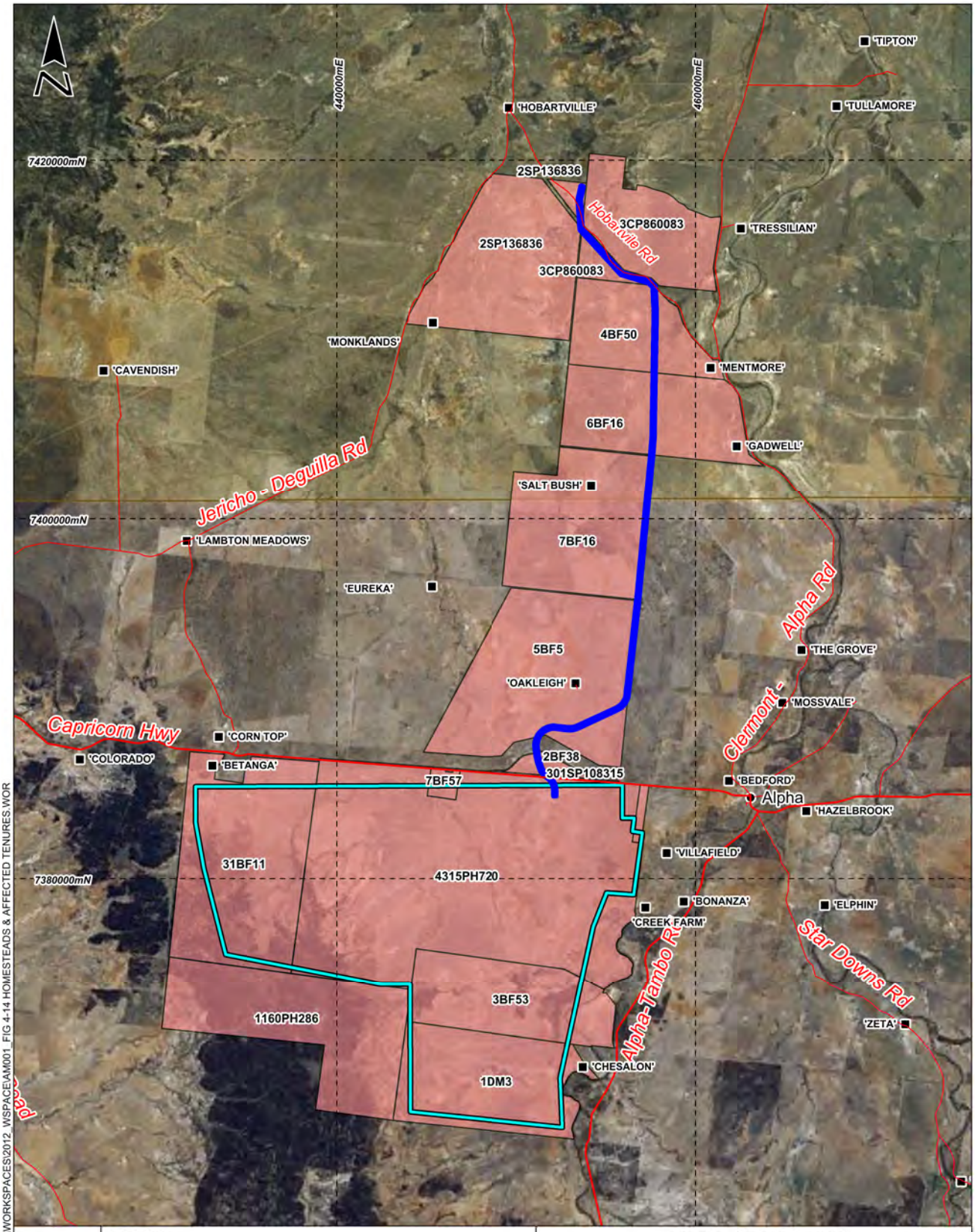
7.2.1.1. Tenure

The SGCP is situated within Mining Lease Application (MLA) 70453, approximately 12 kilometres (km) south-west of the township of Alpha in Central Queensland (refer to **Figure 7-1**). Background land tenures and tenure holders are indicated in **Table 7-1** and shown on **Figure 7-1**. The predominant tenure type is leasehold.

Surrounding mine tenements are shown on **Figure 7-2.**

7.2.1.2. Native Title

As described in **Section 15—Indigenous Cultural Heritage**, the SGCP is located within the Native Title claim of the Wangan and Jagalingou People (Tribunal Number QUD85/04) (refer to **Figure 15-1**). The claim covers an area of approximately 43,722 square kilometres (km^2) in Central Queensland (Commonwealth of Australia, 2011).



S:\PROJECTS\AM001 STH GALILEE EIS_MAPINFO\WORKSPACES\2012_WSPACE\AM001_FIG 4-14 HOMESTEADS & AFFECTED TENURES.WOR

METSERVE Mining & Energy Technical Services Pty Ltd

SouthGalilee COAL PROJECT

LEGEND

- MLA70453
- Directly affected property
- SGCP infrastructure corridor
- Roads
- Population centre
- Homestead

Data Source:
Cadastral (Barcaldine May2010)-DERM. Topo (250k raster)-Geoscience Australia.

Alpha Coal Pty Ltd

South Galilee Coal Project

Directly Affected Land Tenure

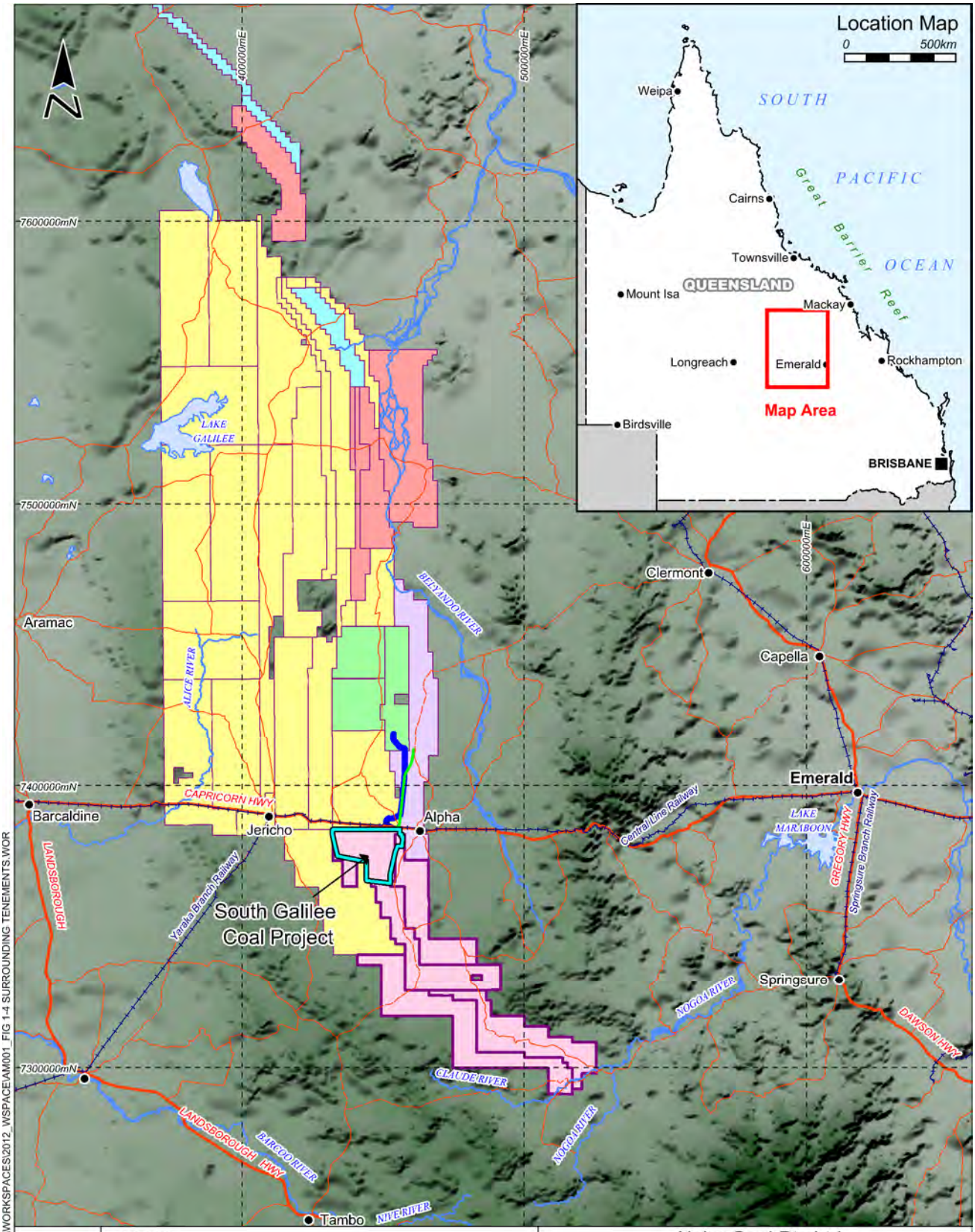
5 0 5
Kilometres

Scale: 1:300,000 (A4)

08/17/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 7-1



S:\PROJECTS\AM001 STH GALILEE EIS_MAPINFO\WORKSPACES\2012_WSPACE\AM001_FIG 1-4 SURROUNDING TENEMENTS.WOR

METSERVE
Mining & Energy Technical Services Pty Ltd

SouthGalilee

LEGEND

- MLA70453
- SGCP infrastructure corridor
- SGCP power line
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- River
- Population centre

Principal Tenement Holder

- Alpha Coal Pty Ltd
- Adani Mining Pty Ltd
- Hancock Coal Pty Ltd
- Qld Thermal Coal Pty Ltd
- Waratah Coal Pty Ltd
- Vale Exploration Pty Ltd

Data Source : Cambell Higginson Town Planning (2006)

Alpha Coal Pty Ltd

South Galilee Coal Project

Surrounding Tenements

25 0 25
Kilometres

Scale: 1:2,000,000 (A4)

05/09/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 7-2

Table 7-1 Real Property Description for Land Located Within or Partly Within MLA 70453 and Infrastructure Corridor

Tenure/Tenement[1]	Real Property Description	Property Name	Landholder
MLA 70453			
EPC 1049, EPC 1180, EPC 1040 and EPP 668	Lot 4315 PH720[2]	Creek Farm	A
EPC 1049, EPC 1180 and EPP 668	Lot 1 DM3	Chesalon	B
EPC 1049, EPC 1040 and EPP 668	Lot 7 BF57	Tallarenha	C
EPC 1049, EPC 1040, EPC 1155 and EPP 668	Lot 31 BF11	Betanga	D
EPC 1049, EPC 1155 and EPP 668	Lot 1160 PH286	Armagh	E
EPC 1049, EPC 1180, EPC 1155 and EPP 668	Lot 3 BF53	Sapling Creek	F
Infrastructure Corridor			
EPC 1040, EPC 1263 and EPP 668	Lot 5 BF5	Oakleigh	G
EPC 1210, EPC 1263 and EPP 668	Lot 3 CP860083	Tresillian	H
EPC 1210, EPC 1040 and EPP 668	Lot 2 SP136836	Monklands	I
EPC 1210, EPC 1263 and EPP 668	Lot 4 BF50	Mentmore	J
EPC 1263 and EPP 668	Lot 6 BF16	Gadwell	J
EPC 1263 and EPP 668	Lot 7 BF16	Saltbush	K
EPC 1040 and EPP 668	Lot 301 SP108315	N/A	L
EPC 1049, EPC 1180, EPC 1040 and EPP 668	Lot 4315 PH720[2]	Creek Farm	A
EPC 1040 and EPP 668	Lot 2 BF38	Leased Reserve	A

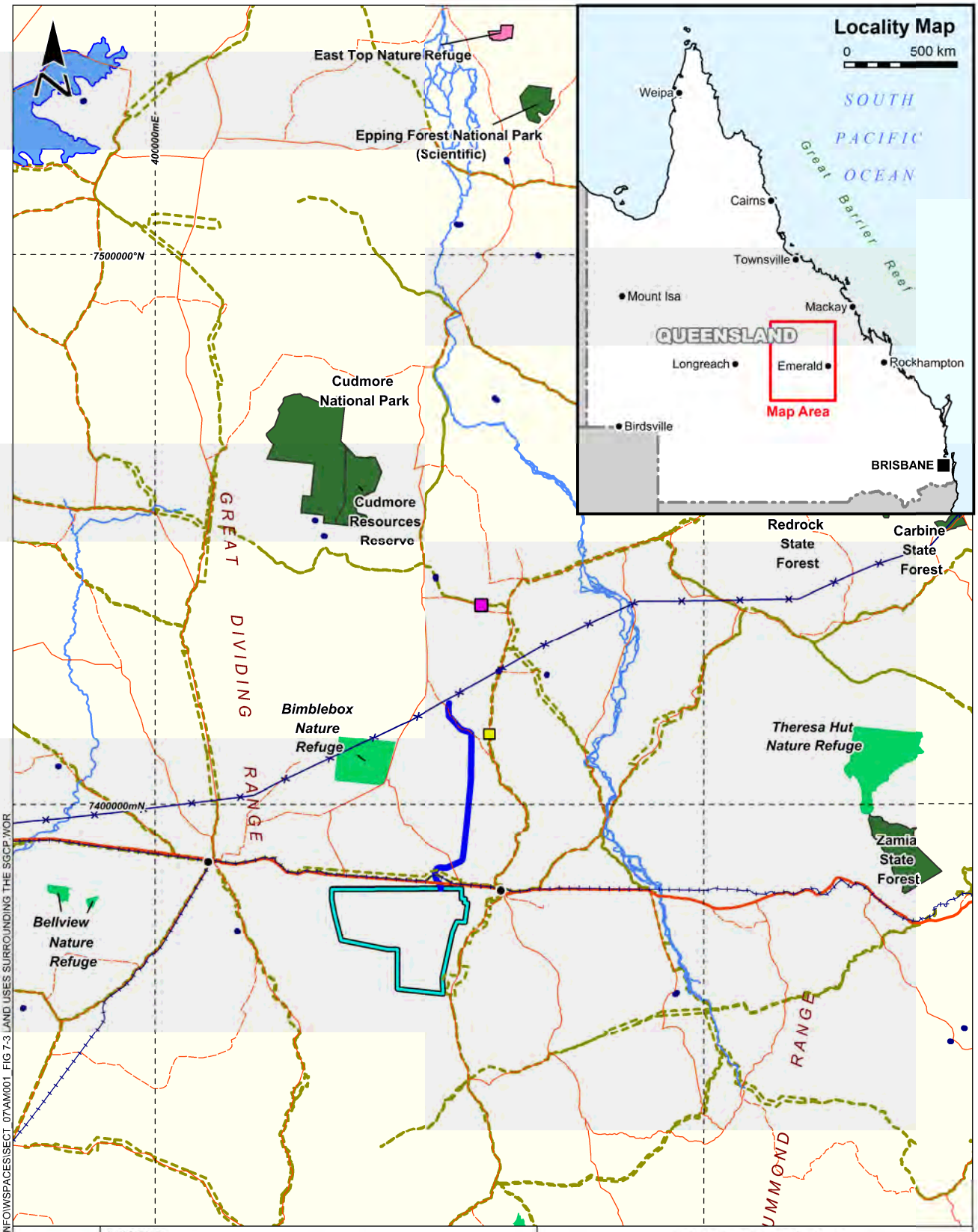
[1] EPC 1040 is held by Waratah Coal Pty Ltd
EPC 1155 is held by Waratah Coal Pty Ltd
EPC 1210 is held by the GVK Group
EPC 1263 is held by Queensland Thermal Coal Pty Ltd
EPP 668 is held by Australia Pacific LNG Pty Limited

[2] 4315PH720 is affected by MLA 70453 as well as the infrastructure corridor

7.2.1.3. Land Use

Land within the SGCP area is primarily used for low intensity beef cattle grazing. The majority of the area has been cleared for improved pasture. There is no evidence of any cropping in the area.

As shown on **Figure 7-3**, there are no protected areas (e.g. National Park, State Forest, Reserve, Conservation Park, Nature Refuge etc.) within the SGCP area.



S:\PROJECTS\AM001_STHGALILEE_EIS\GIS_MAP\INFO\WSPACE\SSECT_07\AM001_FIG 7-3_LAND USES SURROUNDING THE SGCP.WOR

LEGEND

- MLA70453
- SGCP infrastructure corridor
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- Powerline
- River
- Dam
- Stockroute
- Population centre
- Proposed Waratah/SGCP substation
- Proposed Powerlink/SGCP substation
- Nature Refuge
- Protected Area (National Park, State Forest, Reserve, Conservation Park etc)

Data Source: Tenement - DEEDI. Topography (250k) - Geoscience Australia. Protected Areas, Nature Refuges, Stockroutes - QGIS

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SouthGalilee

Alpha Coal Pty Ltd

South Galilee Coal Project

Landuses Surrounding the SGCP

20 0 20

Kilometres

Scale: 1:1,000,000 (A4)

24/08/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 7-3

The SGCP is located adjacent to the Capricorn Highway and the Central Line Railway, which run parallel in an east-west direction to the north of MLA 70453. A number of unsealed access roads are located within MLA 70453. A detailed description of the local road network is provided in **Section 14—Transport** and **Appendix K—Transport Technical Report**.

No water, gas or high voltage electricity services have been identified within MLA 70453. An existing high voltage powerline runs in a south-west to north-easterly direction north of the SGCP (refer to **Figure 7-3**). The proposed regional infrastructure is shown on **Figure 4-20**.

The Alpha Aerodrome, owned and operated by the Barcaldine Regional Council is located east of MLA 70453.

The SGCP infrastructure corridor intersects a stock route which runs parallel and to the north of the Central Line Railway. A stock route is also present to the east of MLA 70453 (refer to **Figure 7-3**).

The SGCP is not located within any declared water storage catchment area administered by the Department of Environment and Heritage Protection (DEHP), (DERM, 2010).

Land clearing, grazing and track construction have affected the vegetation communities at the SGCP site. The levels of disturbance vary across the area. No Category A, B or C Environmentally Sensitive Areas (ESAs), as designated in DEHP-certified mapping, are located within the SGCP area, with the exception of regional ecosystems with an Endangered biodiversity status. **Figure 7-4** shows the location of ESAs within and nearby the SGCP. Endangered regional ecosystems are discussed in further detail in **Section 8—Nature Conservation** and **Section 20—Matters of National Environmental Significance**.

7.2.1.3.1. Land Use Suitability

The *Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland – Land Suitability Techniques* (DME, 1995) provide criteria for the assessment of land use suitability. Land use suitability is described according to a five rank class system, including:

- Class 1 – suitable land with negligible limitations
- Class 2 – suitable land with minor limitations – land which is suited to a proposed use but which may require minor changes to management to sustain use
- Class 3 – suitable land with moderate limitations – land which is moderately suited to a proposed use but which requires significant inputs to ensure sustainable use
- Class 4 – land which is marginally suited for a proposed use and would require major inputs to ensure sustainability; these inputs may not be justified by the benefits to be obtained in using the land for the particular purpose and is hence considered presently unsuited
- Class 5 – unsuitable land with extreme limitations – land which is unsuited and cannot be sustainably used for a proposed use.

The SGCP area comprises of land suitability Class 4, which correlates to Class C GQAL (**Section 7.2.1.3.2**).

7.2.1.3.2. Agricultural Land Class

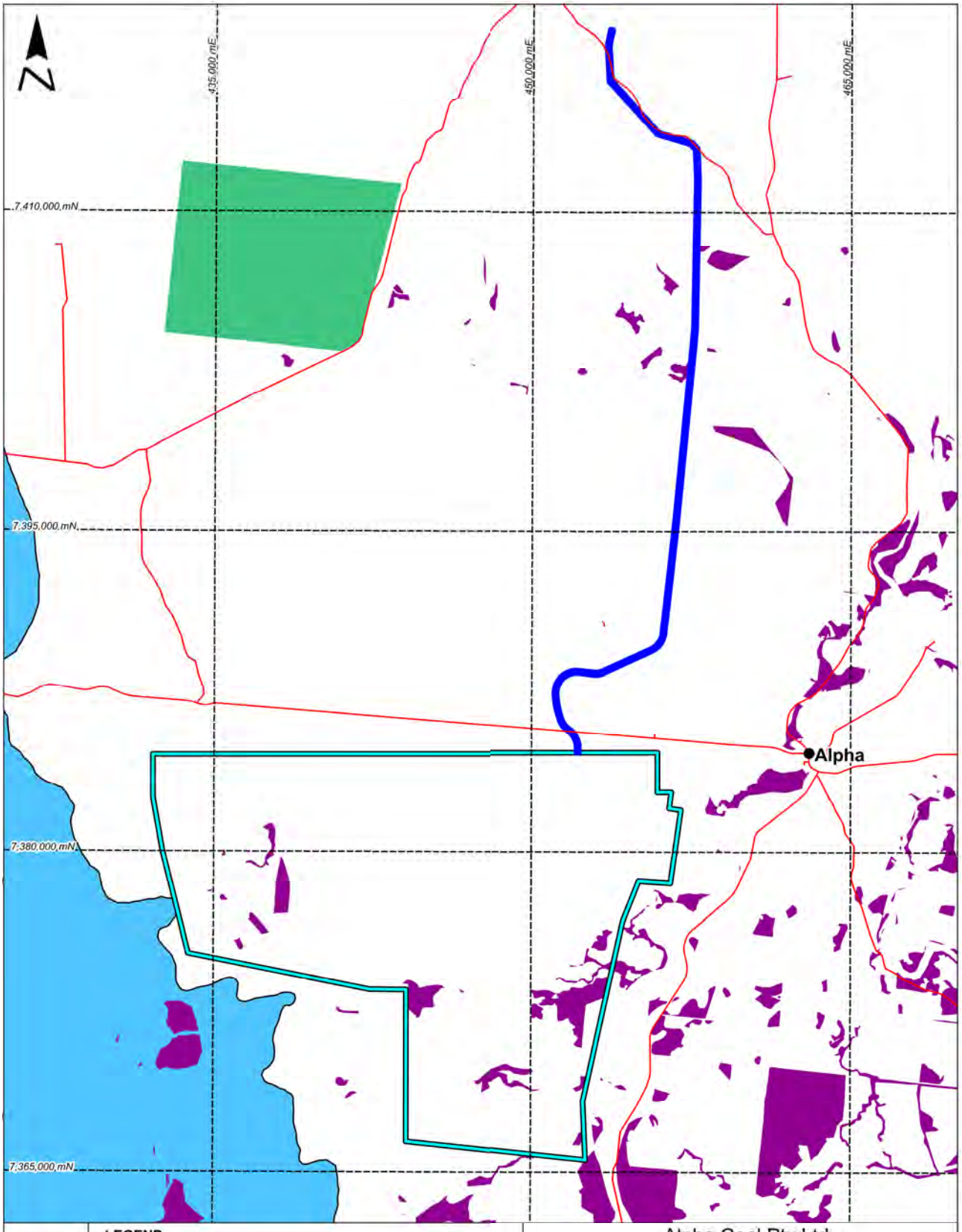
SPP 1/92 defines four classes of agricultural land for Queensland. Class A land in all areas is considered to be GQAL. In some areas, Class B land (where agricultural land is scarce) and better quality Class C land (where pastoral industries predominate) may also be considered GQAL. The description of the classes is as follows:

- Class A: Crop Land – land that is suitable for current and potential crops with limitations to production which range from none to moderate levels
- Class B: Limited Crop Land – land that is marginal for current and potential crops due to severe limitations and suitable for pastures. Engineering and/or agronomic improvements may be required before the land is considered suitable for cropping
- Class C: Pasture Land – land that is suitable only for improved or native pastures due to limitations which preclude continuous cultivation for crop production, but some areas may tolerate a short period of ground disturbance for pasture establishment
- Class D: Non-agricultural Land – land not suitable for agricultural uses due to extreme limitations. This may be undisturbed land with significant habitat, conservation and/or catchment values or land that may be unsuitable because of very steep slopes, shallow soils, rock outcrop or poor drainage.

The land suitability assessment undertaken by Land Resources Assessment and Management Pty Ltd (LRAM) in July 2011 (refer to **Appendix J—Soils and Land Suitability Technical Report**) found that the SGCP area is comprised of approximately 97.5 % Class C2 pasture land and 2.5 % Class C1 land. These two subclasses of pasture land are described below:

- Class C1 – higher productivity pasture land based on high quality native pastures or on pastures that can be readily improved (represents GQAL)
- Class C2 – lower productivity pasture land based on low quality native pastures on which pasture improvement is not economically viable (does not constitute GQAL).

Approximately 780 hectares (ha) of GQAL are located within the SGCP area. The distribution of GQAL within the SGCP area is shown on **Figure 7-5**.



LEGEND

- MLA70453
- SGCP infrastructure corridor
- Principal road
- Nature Refuge
- Endangered Regional Ecosystems (Biodiversity Status)
- Wild River Preservation Areas
- Population centre

Data Source : DERM (2012)

Alpha Coal Pty Ltd

South Galilee Coal Project

Environmentally Sensitive Areas

5 0 5

Kilometres

Scale: 1:250,000 (A4)

23/08/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 7-4

In the former Jericho Shire, DEHP mapping identified the presence of GQAL in the SGCP area. According to this DEHP mapping, approximately 929 ha of GQAL are located within the SGCP. However, this classification is not consistent with the land suitability findings of the soil survey and could be the result of the mapping scale used by the DEHP. The more detailed scale of the mapping developed by the soil survey indicates that the classification described by LRAM is more accurate.

The Queensland Government's Strategic Cropping Land (SCL) framework identifies five nominated cropping zones (DERM, 2011). As the SGCP is located outside of all five zones, the SCL framework does not apply and the SGCP does not need to be assessed under the SCL policy.

7.2.2. Topography

The natural topography is dominated by very gently undulating plains and rises of low relief, as shown on **Figure 4-2** to **Figure 4-13**. The plains in the east and north-east generally decline from more elevated low hills located along the western portion of MLA 70453. The topography of the region ranges from 350 to 600 m Australian Height Datum (AHD) on the eastern flanks of Great Dividing Range.

The major topographical features in the broader landscape are the Drummond Range located approximately 60 km to the east of the SGCP and the Great Dividing Range, located approximately 10 km to the west of the SGCP.

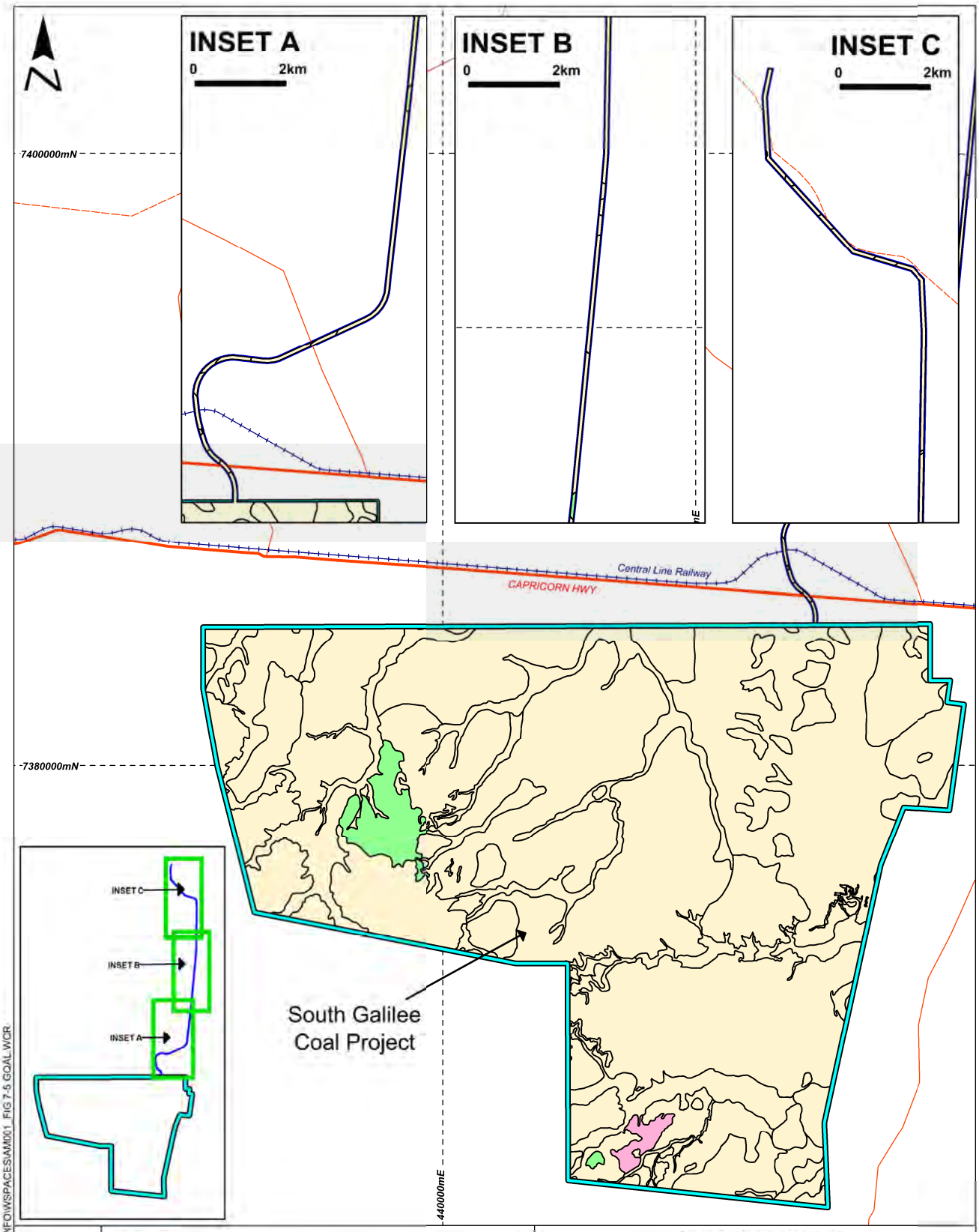
7.2.3. Geology

The Late Carboniferous-Middle Triassic Galilee Basin is a large scale intracratonic basin with predominantly fluvial sediment infill. The Galilee Basin has an area of approximately 247,000 km^2. It can be divided into northern and southern regions with a boundary in the vicinity of the Barcaldine Ridge extension of the Maneroo Platform.

The northern Galilee Basin is divided into two depositional environments. The Koburra Trough is located on the eastern side of the northern region of the Galilee Basin, and overlies the Drummond Basin. The Koburra Basin is also the Galilee Basin's thickest recorded sequence, with up to 2,818 m of strata recorded. On the western side of the northern Galilee Basin is the Lovelle Depression.

The southern Galilee Basin is divided by the Pleasant Creek Arch into two depositional centres; the Powell Depression to the west and the Springsure Shelf to the east.

The regional geology surrounding the SGCP is presented in **Figure 7-6**. **Figure 7-7** provides a stratigraphic section for the northern and southern regions of the Galilee Basin. A summary of the regional stratigraphic sequence (from oldest to youngest) in the southern Galilee Basin is provided in **Section 7.2.3.1** to **Section 7.2.3.5**.



LEGEND

- MLA70453
- SGCP infrastructure corridor
- Principal road

Agricultural Land Class

- Class C1 - GQAL
- Class C1/C2 - partly GQAL
- Class C2 - other pasture land

Data Source : GQAL - LRAM (2011). Topography - Geoscience Australia.

Alpha Coal Pty Ltd

South Galilee Coal Project

Good Quality Agricultural Land

0 5

Kilometres

Scale: 1:175,000 (A4)

23/08/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 7-5

METSERVE Mining & Energy Technical

SouthGalilee

S:\PROJECTS\AM001_STH_GALILEE\GIS_MAPINFO\WSPACES\AM001_FIG 7-5 GQAL.WOR

7.2.3.1. Carboniferous

7.2.3.1.1. Lake Galilee Sandstone

Deposition of the Galilee Basin began with the Late Carboniferous Lake Galilee Sandstone which lies unconformably on the Ducabrook formation of the Drummond Basin in the northern region of the Galilee Basin. In the southern region of the Basin, the Lake Galilee Sandstone is believed to overlie various Devonian basement units.

7.2.3.1.2. Jericho Formation

The Jericho Formation is fluvio-deltaic, with some glacial influence, and conformably overlies the Lake Galilee Sandstone. It consists of mudstone, siltstone and sandstone units including the Oakleigh Siltstone Member.

7.2.3.1.3. Jochmus Formation

The Jochmus Formation in turn conformably overlies the Jericho Formation and is similarly fluvio-deltaic, with minor glacial influence. The Jochmus Formation consists of sandstone, mudstone, siltstone, tuff and conglomerate units.

7.2.3.2. Permian

7.2.3.2.1. Aramac Coal Measures

The Jochmus Formation is conformably overlain by the Early Permian Aramac Coal Measures which consist of fluvial sandstone and siltstone units with major coal beds.

7.2.3.2.2. Colinlea Sandstone

The Early to Middle Permian Colinlea Sandstone unconformably overlies the Jochmus formation in the eastern and southern central Galilee Basin. Deposition of the unit occurred in an alluvial environment dominated by peat swamps and easterly and southerly flowing rivers. Sediments were derived from volcanic and metamorphic provinces to the north of the Basin's margins. Strata range from light-medium grey carbonaceous, highly argillaceous siltstone to shale interbedded with minor white to light grey, very fine to fine grained, angular to sub-rounded micaceous quartzose sandstone and coal.

7.2.3.2.3. Peawaddy Formation

The marine paralic Peawaddy Formation was deposited in a low-energy environment, associated with reduction in stream gradients caused by marine incursion into southern and central regions of the Galilee Basin due to a rise in sea level.

7.2.3.2.4. Black Alley Shale

As for the Peawaddy Formation, the Black Alley Shale was deposited in a reduced energy environment associated with marine incursion in the southern and central regions of the Galilee Basin. The unit is comprised of dark grey to black shale and siltstone with interbedded light green-grey tuff and fine to very fine, labile sandstone.

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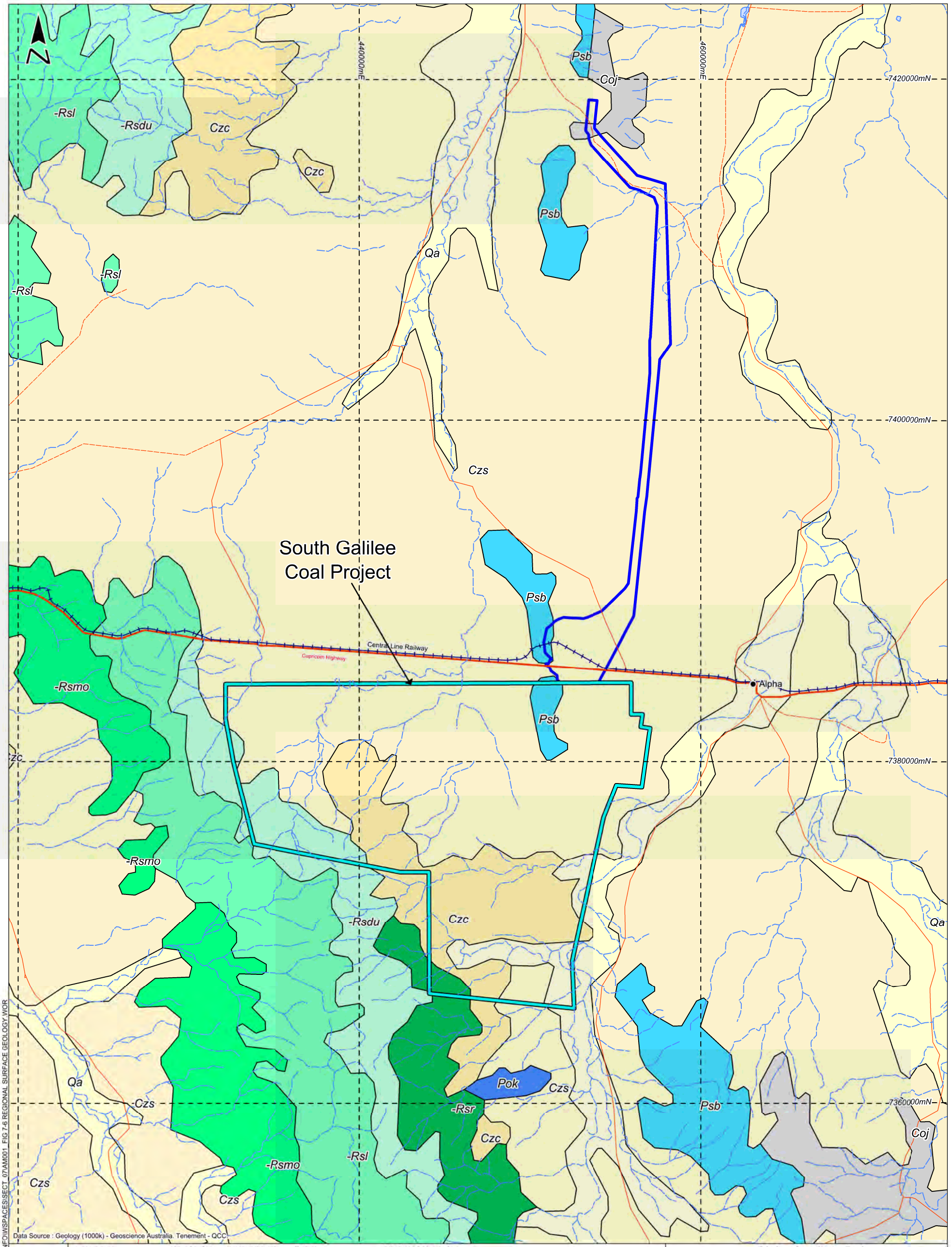


LEGEND

- MLA70453
- SGCP Infrastructure Survey Area
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- River
- Waterway

Map Symbol	Geological Age	Unit Name	Lithological Description
-Rsdu	Early Triassic	Dunda beds	Lithic to quartzose sandstone, siltstone, mudstone
-Rsl	Early Triassic	Clematis Group	Medium to coarse-grained quartzose to sublabile, micaceous sandstone, siltstone, mudstone and granule to pebble conglomerate
-Rsmo	Middle Triassic	Moolayember Formation	Micaceous lithic sandstone, micaceous siltstone
-Rsr	Triassic	Rewan Group	Lithic sandstone, pebbly lithic sandstone, green to reddish brown mudstone and minor volcanilithic pebble conglomerate (at base)
Coj	Early Carboniferous	Joe Joe Group	Tillitic conglomerate, lithic sandstone, siltstone, minor mudstone and coal
Czc	Cainozoic	sedimentary rocks 72357	Undifferentiated consolidated Cainozoic sedimentary rocks; sandstone, limestone conglomerate, siltstone; commonly ferruginised, silicified or poorly consolidated
Czs	Cainozoic	sand plain 38499	Sand plain, may include some residual alluvium: sand dominant, gravel, clay
Pok	Late Permian	Blackwater Group	Sandstone, siltstone, shale, mudstone, coal, tuff, conglomerate
Psb	Late Permian	Blackwater Group	Quartzose to lithic sandstone, siltstone, carbonaceous shale, minor coal and sandy coquinite
Qa	Quaternary	alluvium 38485	Channel and flood plain alluvium, gravel, sand, silt, clay

Alpha Coal Pty Ltd

South Galilee Coal Project

Regional Surface Geology

5 0 5

Kilometres

Scale: 1:200,000 (A3)

24/08/2012

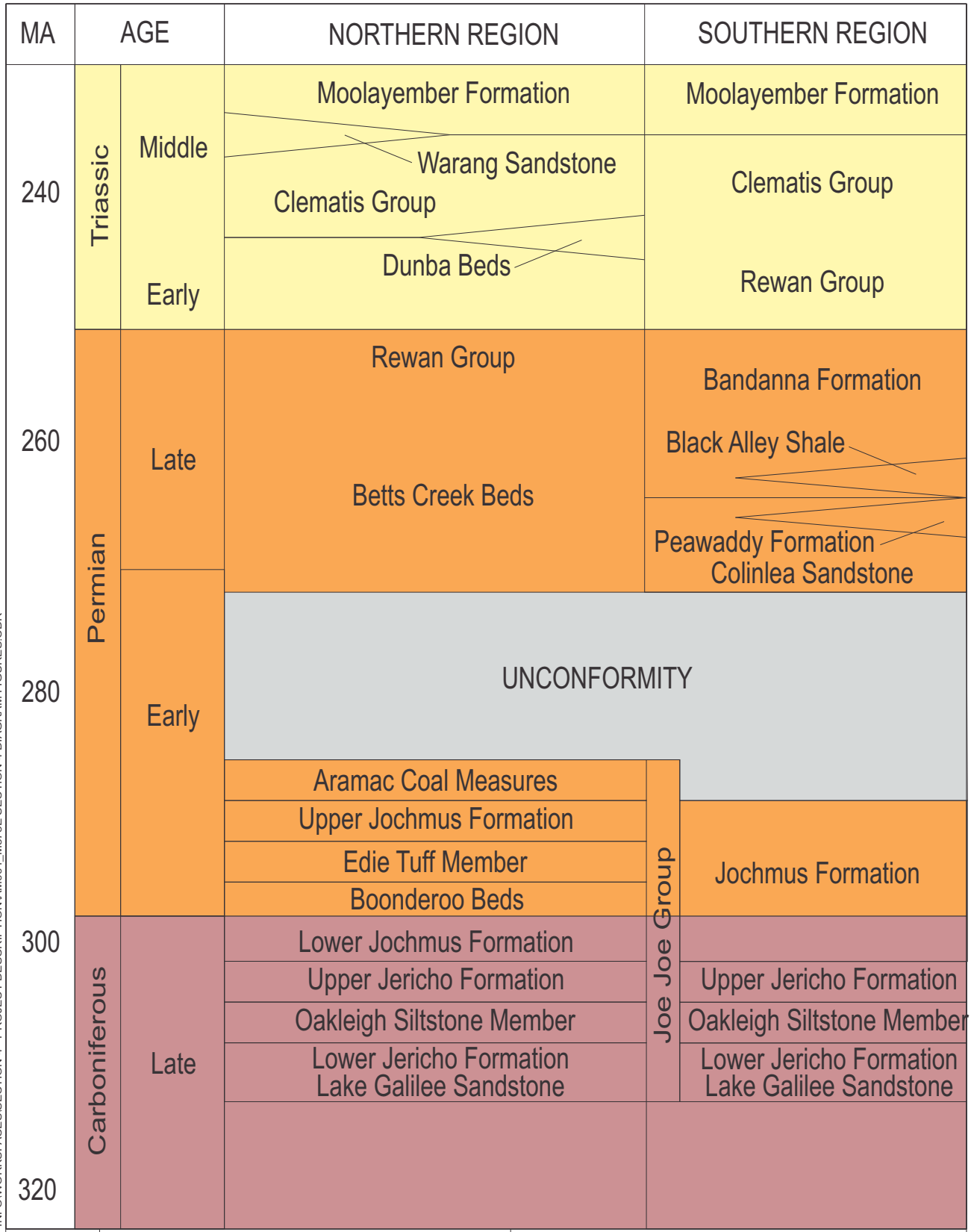
Proj. : MGA Z55
Datum: GDA 1994

FIGURE 7-6

METSERVE
Mining & Energy Technical Consultants

SouthGalilee

S:\PROJECTS\AM001_STHGALILEE_EIS\GIS_MAPINFO\WSPACES\SECT_07\AM001_FIG 7-6 REGIONAL SURFACE GEOLOGY.WOR



S:\PROJECTS\AM001 STH GALILEE EIS_MAPINFO\WORKSPACES\SECTION 4 - PROJECT DESCRIPTION\AM001_M373E SECTION 4 DIAGRAM FIGURES.CDR

METSERVE Mining & Energy Technical Services Pty Ltd

SouthGalilee

Data Source: AMCI and Bandanna Energy (2011)

Alpha Coal Pty Ltd

South Galilee Coal Project

Stratigraphic Section of the Galilee Basin Geology

05/07/2012

FIGURE 7-7

7.2.3.2.5. Bandanna Formation

The Late Permian Bandanna Formation ranges from a lacustrine/paludal to a fluvial deposit in the southern region of the Galilee Basin, conformably overlying the Colinlea Sandstone and inter-fingering with the Black Alley Shale. The unit is the target formation of the SGCP and is composed of:

- grey slightly micaceous and silty, carbonaceous sub-fissile shale
- grey argillaceous and carbonaceous siltstone
- grey fine to medium grained fused, micaceous quartz, feldspathic sandstone
- coal.

The Bandanna Formation contains multiple coal seams which are generally known as Seam A to Seam F.

7.2.3.2.6. Rewan Formation

The Late Permian to Early Triassic Rewan Group unconformably overlies the Bandanna Formation. The formation is composed of terrestrial alluvial sediments including meandering channel deposits and flood-basin siltstone and sandstone units.

7.2.3.3. Triassic

7.2.3.3.1. Dunda Beds

The Dunda beds consist of quartz labile sandstone and interbedded lutite and are a transitional unit between the Early Triassic members of the Upper Rewan Formation and the Clematis Sandstone. They have been described as light grey, olive grey and yellow grey in colour and fine to coarse grained.

7.2.3.3.2. Clematis Sandstone

Late to Middle Triassic in age, the Clematis Sandstone is a poorly sorted, fine to coarse grained, angular to sub-angular quartzose sandstone with minor red siltstone and mudstone and rare conglomerate and thin interbeds of variegated shale.

7.2.3.3.3. Moolayember Formation

The Moolayember Formation is a Late to Middle Triassic fluvio-lacustrine deposit consisting of light grey-green, yellow and brown, argillaceous siltstone, sandstone and mudstone units with slight interbedded mica. It is the uppermost unit of the Galilee Basin.

7.2.3.4. Tertiary

Tertiary deposits overlie the Galilee Basin and comprise consolidated siltstone and sandstone typically 5 to 15 m thick and are thickest in the northern and central region of the SGCP.

7.2.3.5. Quaternary

Quaternary deposits in the SGCP are mostly alluvial and consist of gravel, sand and poorly consolidated clayey sandstone. Thickness of the Quaternary sediments varies over the Project area, but generally thickens to the east.

7.2.3.6. Mineral Resource Geology

The SGCP exploration program undertaken over the last four years has focussed on the northern portion of EPC 1049. The initial objective of the program was to delineate a sufficient resource to support a large-scale long-life operation. Subsequently, exploration has involved in-fill drilling to convert previously 'inferred' resource into the 'measured' and 'indicated' JORC categories. Over 36,000 m of drilling has been undertaken to date over a 100 km^2 area, including 163 chip holes and 129 cored holes.

Coal resources within the SGCP are contained in the Permian Bandanna Formation. The Bandanna Formation contains multiple coal seams, which are generally known as Seam A through to Seam F.

The primary target seams for the SGCP, the D1 and D2 seams, are interpreted to consist of three plies varying in thickness from 0.5 to 4.5 m (AMCI and Bandanna Energy, 2011).

Current estimates of the resource indicate that approximately 498 million tonnes (Mt) run-of-mine (ROM) thermal coal will be extracted from the SGCP open-cut and underground mining areas. Of this, approximately 177 Mt ROM coal will be mined in the open-cut operation and approximately 321 Mt ROM coal will be mined in the underground operation.

Figure 4-2 to **Figure 4-13** indicates the conceptual layout of the SGCP over the life of the Project. The boundaries of MLA 70453 are shown on **Figure 7-1**.

7.2.3.6.1. Coal Quality

Analytical results obtained from the exploration program show that the SGCP coal is high volatile sub-bituminous coal. Indicative coal quality is shown in **Table 7-2.**

Table 7-2 Coal Quality Characteristics

Typical Coal Properties	SGCP Coal
Inherent Moisture (mass % ad)	6.5
Ash (PA) (mass % ad)	13.0
Volatile Matter (% ad)	34.0
Total Sulfur (% ad)	0.9
Fixed Carbon (% ad)	46.5
Gross Calorific Value (kcal/kg ad)	6,250

ad = air dried

Source: AMCI and Bandanna Energy (2011)

7.2.3.6.2. *Coal Quantity*

Current estimates of the resource indicate that approximately 480 Mt of ROM thermal coal will be extracted from the SGCP open-cut and underground mining areas.

A summary of the Australasian Joint Ore Resource Committee (JORC) Code compliant resources contained in the D1 and D2 seams is provided in **Table 7-3**.

Table 7-3 SGCP Resource Base

Seam	Resources (Mt)			
	Measured	Indicated	Inferred	Total
D1	50.4	105.8	555.0	711.2
D2	116.3	100.5	251.0	467.8
Total	166.7	206.3	806.0	1,179.0

Source: AMCI and Bandanna Energy (2011)

7.2.3.7. *Geochemistry Assessment*

This Section provides the findings of the geochemical investigation carried out on waste rock material from the SGCP.

The specific objectives of this study are to:

- determine the acid forming potential of the waste rock and coal rejects, as well as evaluate the acid rock drainage (ARD), salinity and sodicity risks associated with the material from the SGCP area
- determine the chemical composition of the waste rock and coal rejects in order to identify any toxicity concerns for revegetation
- identify the potential geochemical implications for waste rock and coal reject disposal and mine operations, and provide preliminary recommendations for environmental management.

7.2.3.7.1. *Geochemical Testwork Program*

A geochemical testwork program was undertaken to characterise the overburden, interburden and coal and provide a basis for assessing potential environmental issues associated with the handling of these materials.

Initial geochemical testing was undertaken in early 2009 to provide a broad indication of ARD potential. This testing involved collecting 54 samples from open holes BH99C and BH100C. Samples were collected from chip piles collected each metre and combined into composites according to lithological boundaries. The parameters testing included the following:

- pH and Electrical Conductivity (EC) of deionised water extracts
- total sulfur (S)

- acid neutralising capacity (ANC)
- single addition net acid generation (NAG).

A total of 186 samples were collected from fully cored holes CK162, CK165C and SP142, drilled as part of the 2010 geotechnical drilling program. Continuous samples were collected from the available core for each hole from the base of the weathered Permian through to the D2 floor.

Samples were analysed for total S, which was used to select a smaller subset for the following testing:

- ANC
- single addition NAG.

In addition, specialised testing was carried out on selected samples, including:

- extended boil and calculated NAG testing
- sulfur speciation
- kinetic NAG testing
- acid buffering characteristic curve
- multi-element testing of solids
- multi-element testing of deionised water extracts.

7.2.3.7.2. Geochemical Characterisation Results

The pH, EC in decisiemens per metre (dS/m) and acid forming characteristics (total sulfur, maximum potential acidity (MPA), ANC, net acid producing potential (NAPP) and NAG) test results are summarised in **Table 7-4**.

Table 7-4 Geochemical Characterisation Results

	pH[1]	EC (dS/m)[1]	Total %S[2]	MPA[2]	ANC[2]	NAPP (kg H_2SO_4/t)[2]	NAG pH[2]
Min	2.4	0.04	0.01	0	0	-294	1.8
Mean	5.4	0.52	0.23	7	19	-11	4.4
Max	7.8	3.13	3.49	107	294	107	8.5

Source: **Appendix I—Geochemistry Technical Report**

1 Data obtained from samples collected in early 2009 from holes BH99C and BH100C

2 Data obtained from samples collected in early 2009 (from holes BH99C and BH100C) and in 2010 (from holes CK162, CK165C and SP142)

pH and EC

The analysis of the pH and EC provides an indication of the inherent acidity and salinity of the material when it is initially exposed to the surface. The results of the initial geochemical test-work undertaken in early 2009 indicate that the $pH_{1:5}$ (i.e. suspension comprising a ratio of one part soil and five parts deionised water) ranges from 2.4 to 7.8, with approximately half the samples showing no inherent salinity with a pH greater than six.

$EC_{1:5}$ values (i.e. suspension comprising a ratio of one part soil and five parts deionised water) ranged from 0.04 to 3.13 dS/m, with approximately half the samples falling within the non-saline to slightly saline range with an EC of 0.3 dS/m or less. Environmental Geochemistry International Pty Ltd (2011) suggest that the lower $pH_{1:5}$ and higher $EC_{1:5}$ values are the result of partial pyrite oxidation occurring between sample collection and sample testing.

The results indicate a general lack of immediately available acidity and salinity in the samples except where partial oxidation of pyrite has occurred. Pyrite oxidation would therefore be the main source of salinity in overburden material.

The relationship between sodicity and salinity is important when considering the dispersive nature of the material. Highly sodic soils can lead to weak aggregate stability, clay dispersion, surface crusting and poor drainage due to a decrease in the hydraulic conductivity of the soil. High salinity soils are generally non-dispersive and can result in flocculation as the high salinity counteracts the high sodicity. The Exchangeable Sodium Percentage (ESP) values for the two surface Tertiary soil samples were non sodic, but the weathered and fresh Permian samples were mainly sodic to very strongly sodic.

Acid Forming Characteristics

Total sulfur testing was carried out of 240 samples, with results ranging from below detection to 3.49 %. Total sulfur testing found that Tertiary and weathered Permian samples had low total sulfur values of less than 0.05 % and a negligible risk of acid formation. The fresh Permian samples show a broad range of sulfur values, with approximately 75 % of samples having relatively low values of 0.2 % or less. Coal samples are significantly more enriched in sulfur (i.e. median sulfur content of 1.2 %) than other lithologies, which have medians of less than 0.2 %.

ANC testing was conducted on 196 samples and ranged up to 294 kg H_2SO_4/t. ANC values were mostly low with median values of 5 kg H_2SO_4/t or less. Coal samples had low ANC of close to 10 kg H_2SO_4/t or less. Other lithologies did not show strong associations with ANC.

The NAPP value is an acid-base account calculation which uses sulfur and ANC values. It represents the balance between the maximum potential acidity and ANC. Samples that plot above the ANC:MPA = 1 (NAPP = 0) line (refer to **Figure 7-8**) are NAPP negative, indicating an excess in acid buffering capacity over potential acidity. These samples may have sufficient ANC to prevent acid generation. Conversely, a positive NAPP value indicates that the material may be acid generating. Approximately half the samples tested were NAPP positive and half NAPP negative.

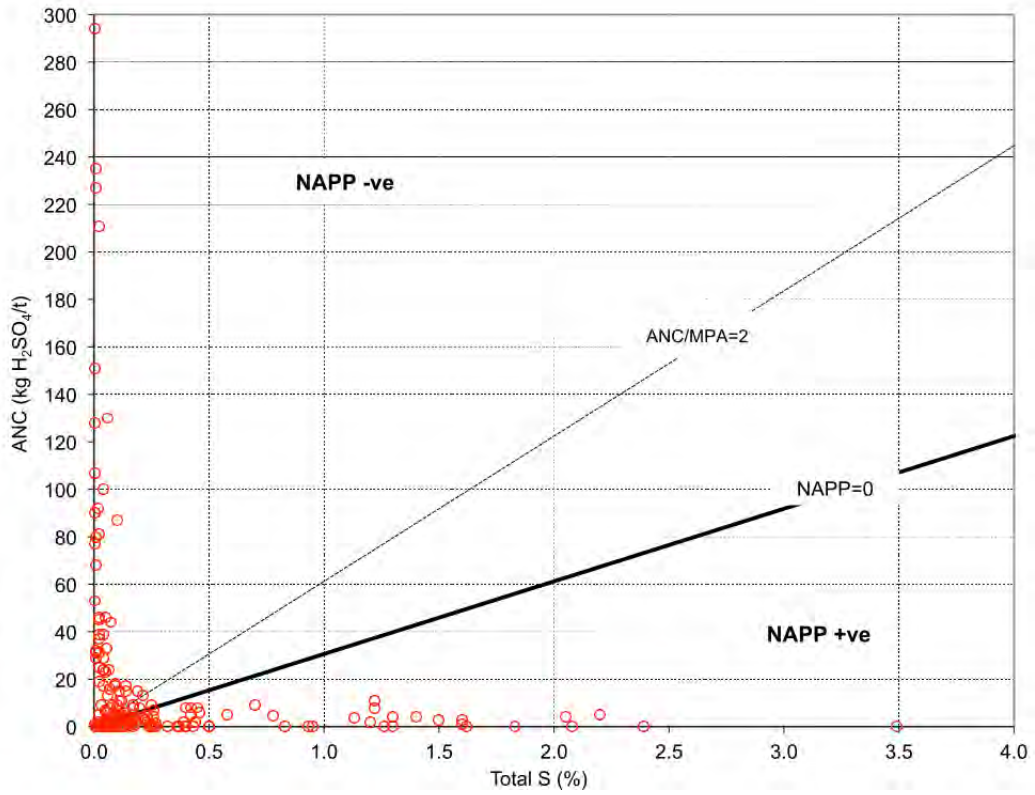


Figure 7-8 Acid-Base Account Plot for Waste Rock Samples

Acid Buffering Characteristic Curve (ABCC) testing was carried out on 11 fresh Permian samples to evaluate the availability of the ANC measured. The ABCC results indicated that the availability of the ANC in the SGCP overburden/interburden materials may be significantly less than the total ANC measured.

Kinetic NAG tests provide an indication of the kinetics of sulfide oxidation and acid generation for a sample. Results indicated that pyritic PAF materials represented by the samples tested were likely to exhibit rapid pyrite reaction rates after exposure to atmospheric oxidation and short lag times of days to weeks before low pH conditions develop.

Water extract testing indicates that once acid conditions develop, elevated concentrations of dissolved Al, Co, Cu, Fe, Mn, Ni, SO_4 and Zn are likely to occur. However, the solubility of metals/metalloids will be largely determined by pH and control of ARD is expected to also control metal/metalloid release.

Figure 7-9 is a plot of the NAPP values compared to the NAG values. Samples with negative NAPP values and NAG greater than 4.5 are non-acid forming (NAF). Samples with a positive NAPP value and a NAG value less than 4.5 are considered potentially acid forming (PAF). All other regions of the figure are classified as uncertain.

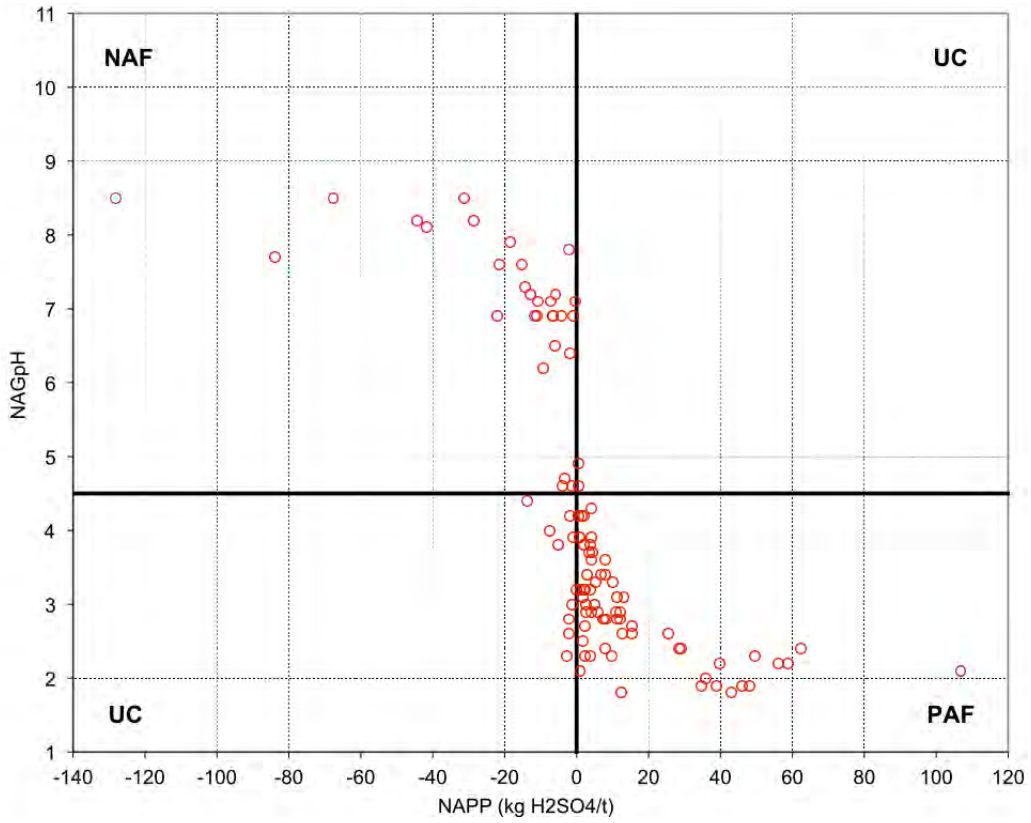


Figure 7-9 ARD Classification for Fresh Permian Waste Rock Samples

Results of geochemical characterisation undertaken to date suggest that the bulk of the overburden and interburden material is likely to be NAF, and suggest the presence of a large continuous section of NAF material from the surface down to the upper portion of the fresh Permian. Permian is likely to be dominated by NAF materials (approximately 65 %) but will also include PAF and potentially acid forming low capacity (PAF LC) materials.

The roof within 5 m of the D1 seam appears to be the main PAF horizon of concern, having sulfur values of >1 %. There are a number of other lower capacity PAF horizons associated with coal seams and also within interburden between seams D1 and D2. Final pit floor material will mainly comprise D2 floor, which is likely to be PAF LC. ROM coal and coal rejects are also likely to be mainly PAF.

Coal stockpiles may also be sources of ARD, depending on reaction rates and stockpile residence times.

7.2.3.8. Geotechnical Assessment

The SGCP mining operations will cut through the Bandanna Formation, targeting the D1 and D2 seams. The maximum mining depth for the proposed open-cut will be 140 m. The mining depth for the underground is between 140 m and 450 m.

A geotechnical assessment has been undertaken to identify any significant constraints to operations. The principal source of data for the geotechnical assessment has been samples obtained from 16 fully cored geotechnical drill holes, which:

- were spread along strike of the D1 seam sub-crop in the northern part of EPC 1049
- were generally concentrated on the Creek Farm and 'Sapling' properties in the area proposed for initial open-cut mining
- extended down dip (to the west) to the approximate B1 seam sub-crop of the open pit areas near the Creek Farm and 'Sapling' properties.

No impediments to open-cut mining of the D1 and D2 seams have been identified in these initial areas, although economic constraints and high wall heights will limit the western down dip extent of mining.

7.2.3.9. Fossil Potential

The age and depositional sequence of the SGCP geology indicate that fossils may be present. Fossil specimens of plant leaves and stems have been recorded in drill cores during exploration activities undertaken to date.

7.2.4. Soils

A soil survey and land suitability assessment of the SGCP area was undertaken by Land Resources Assessment and Management Pty Ltd (LRAM) in July 2011 (refer to **Appendix J—Soils and Land Suitability Technical Report**).

7.2.4.1. Methodology

The methodology used in the soil survey is described in detail in **Appendix J—Soils and Land Suitability Technical Report** and a summary is provided below.

A land system represents a unique landscape pattern that contains a distinctive combination of geology, landform, soil and vegetation features. As land systems are based on distinctive soil patterns, they can be used to develop a separate map of soil distribution.

Land systems across the Nogoa-Belyando area have been mapped and described by CSIRO (Gunn *et. al.*, 1967) and the Queensland Environmental Protection Agency (EPA) (Lorimer, 2005). Existing CSIRO land system mapping and EPA land unit mapping was reviewed to obtain an understanding of the anticipated land resources within the study area.

Following a review of existing data, a detailed soil survey of the proposed disturbance area was undertaken in July 2011. The soil survey was conducted at 1:100,000 scale across the Project area, except in areas of expected high disturbance, where a mapping scale of 1:50,000 was used.

The soil survey described the major profile and topographic attributes so that soils could be classified and major observable limiting factors could be identified.

Soil profile and landscape features were recorded at 102 sites. Detailed soil profiles were collected to a maximum depth of 1.8 m at a total of 32 sites, using a vehicle mounted sampling tool, hand auger or pits and cuttings.

Fifty eight soil samples from 13 profiles representing the main soils within the SGCP area were submitted for laboratory analysis. A further four surface samples were collected to test general fertility and one subsoil sample was taken to test soil erodibility.

The surface soil samples submitted for laboratory analysis were analysed for the following parameters:

- soil pH
- electrical conductivity (EC)
- chloride (Cl^-)
- exchangeable cations (e.g. calcium, magnesium, sodium, potassium and aluminium)
- cation exchange capacity (CEC)
- total nitrogen (Total N)
- organic matter content
- available phosphorous
- moisture content
- clouding and slaking.

The subsoil samples submitted for laboratory analysis were analysed for the following parameters:

- soil pH
- EC
- Cl^-
- exchangeable cations
- CEC
- moisture content
- clouding and slaking.

The survey methodology met the requirements described by DME (1995) and Schoknect *et. al*. (2008). All site descriptions used the standard terminology of the Australian Soil and Land Survey Field Handbook (The NCST, 2009).

7.2.4.2. *Soil Mapping Units and Descriptions*

As described in **Table 7-5**, eleven soil types were identified within the SGCP area. Mapping units (refer to **Figure 7-10**) were determined on the basis of similarity in morphological and topographic attributes. Boundaries were gradually refined from the initial aerial photogrammetry boundaries by the use of field observations and GPS instruments. The soil scheme of Isbell (1998) was used to classify types and the Australian Soils and Land Survey Handbook (McDonald *et al*., 1990) was also referenced.

Table 7-5 Soil Mapping Units and Area within the SGCP

Soil Type	ASC Suborder[1]	Terrain Unit[2]	General Description	Area (ha)
Rocky sands and sandy loams	Clastic Rudosols and Leptic Tenosols	Steep to rolling low hills on little weathered sedimentary rocks	Shallow soil with many large pebbles to stones and frequent rock outcrop and thin, grey, loamy sand or sandy loam that either directly overlies weathered rock or grades into a paler subsurface layer of similar texture which then overlies rock; weathered rock at <150 to 300 millimetres (mm) depth.	1,960
Ironstone sands and sandy loams	Clastic Rudosols and Leptic Tenosols	Scarps on strongly weathered sedimentary rocks	Shallow soil with iron-stained medium pebbles to stones common and red sandy loam of variable thickness that either directly overlies weathered rock or grades into a similarly coloured subsurface layer of loamy sand which then overlies ferricrete; weathered rock at <100 to 400 mm depth.	245
Shallow red-yellow earths	Red and Yellow Kandosols	Level plains to undulating rises on strongly weathered sedimentary rocks	Gradational soil with thick, grey or brown sandy loam merging into red or yellow subsoil increasing in texture with depth from sandy loam to sandy clay loam and occasionally to sandy light clay; clear change into gravelly, mottled (yellow-grey and some red), gravelly clay loam, sandy medium clay between 400 mm and 1 m depth.	20,535
Deep red-yellow earths	Red and Yellow Kandosols	Level plains to undulating rises on strongly weathered sedimentary rocks	Gradational soil with thick, grey or brown sandy loam merging into red or yellow subsoil increasing in texture with depth from sandy loam to sandy clay loam and occasionally to sandy light clay; clear to gradual change into mottled (yellow-grey and some red), gravelly clay loam, sandy to sandy medium clay below 1 m depth.	3,370
Shallow red-grey texture contrast (TC) soils	Red and Grey Sodosols	Gently undulating plains and rises on strongly weathered sedimentary rocks	Red sandy loam of variable thickness over conspicuously bleached sandy loam to sandy clay loam that rapidly changes into mottled, red and grey sandy light clay to sandy medium clay; strongly weathered rock usually at 400 to 750 mm depth.	40

Table 7-5 Soil Mapping Units and Area within the SGCP (cont)

Soil Type	ASC Suborder[1]	Terrain Unit[2]	General Description	Area (ha)
Deep red-grey TC soils	Red, Brown and Grey Sodosols	Gently undulating rises on strongly weathered sedimentary rocks	Thin, brown or dark grey, sandy loam to clay loam, sandy over occasionally thick subsurface layer of similar texture but paler colour with rapid change into mottled (red to brown and grey) sandy light clay to medium heavy clay; strongly weathered rock below 1 m and usually below 1.5 m depth.	660
Deep yellow-grey TC soils	Yellow and Grey Sodosols	Level plains to undulating rises on strongly weathered sedimentary rocks	Grey sandy loam to clay loam, fine sandy of variable thickness usually over conspicuously bleached subsurface layer of similar texture and thickness that rapidly changes into mottled (yellow, grey and red) sandy light medium clay to heavy clay between 100 mm and 1.1 m depth; strongly weathered rock below 1 m and usually below 1.5 m depth.	1,415
Alluvial red TC soils	Red Chromosols	Alluvial plains on recent alluvium	Thick, dark sandy loam over paler, red subsurface layer of similar texture that rapidly changes into red sandy light clay which may contain grey mottles often overlying a buried layer of mottled (red, yellow and grey) sandy clay loam often; total profile depth including buried layer at least 1.5 m.	1,120
Alluvial yellow-grey TC soils	Yellow and Grey Sodosols	Alluvial plains and drainage depressions on recent alluvium	Grey to dark surface layer of sandy loam, sandy clay loam or clay loam and variable thickness often over a thick, sporadically or conspicuously bleached paler subsurface layer of similar variable texture with a rapid change into mottled (grey, yellow and red) sandy light clay to sandy medium heavy clay; total profile depth including buried layer at least 1.5 m.	1,875
Alluvial sands and sandy loams	Stratic Rudosols and Leptic Tenosols	Alluvial plains and drainage on recent alluvium	Thin, grey or brown, loamy coarse sand to sandy loam grading into a slightly browner or redder subsurface layer then into brighter coloured, red or brown subsoil of similar texture; soil profile depth at least 1.5 m but buried layers of coarse sand may occur below this depth.	nd[3]
Alluvial loams and earths	Stratic Rudosols, Grey Dermosols and Red and Yellow Kandosols	Alluvial plains and drainage depressions on recent alluvium	Either: stratified loams with a moderately thick, dark sandy clay loam over buried layers of varied texture, colour and thickness; or loamy gradational soils similar to the *Deep red-yellow earths* but overlying buried layers of varied texture, colour and thickness rather than a mottled, gravelly layer.	nd[3]

Source: **Appendix J—Soils and Land Suitability Technical Report**

1 ASC suborder represents the soil taxonomic classification (to its second or suborder level) using the Australian Soil Classification (Isbell, 2002)

2 A terrain unit is based on weathering history of the underlying rocks and resultant regolith cover

3 The 'Alluvial sands and sandy loams' and 'Alluvial loams and earths' only occur as minor soils associated with other dominant soils and therefore their areas could not be readily determined (nd)

7.2.4.3. Soil pH

The majority of soils have a predominantly medium acid to moderately alkaline pH in the surface layer, however surface pH is strongly acid in the Rocky sands and sandy loams soil type. **Table 7-6** shows the pH results.

The data indicates that there is no potential within the top 1.8 m of all soil profiles for acid generation by disturbance of PAF materials.

Table 7-6 Soil Analytical Results

Soil Type[1]	pH	CEC (milliequivalents per 100 g soil)[2]
Rocky sands and sandy loams	4.3	2
Ironstone sands and sandy loams	5.9	3
Shallow red-yellow earths	6.5 - 8.3	4 – 32
Deep red-yellow earths	5.7 – 7.2	3 – 6
Deep red-grey TC soils	6.4 – 6.5	4 – 15
Deep yellow-grey TC soils	5.5 – 6.0	4
Alluvial red TC soils	6.1	5
Alluvial yellow-grey TC soils	5.0 – 6.0	2 - 5
Alluvial sands and sandy loams	6.9	4

Source: **Appendix J—Soils and Land Suitability Technical Report**

1 Shallow red-grey TC soils were not sampled for laboratory analysis as they cover only 40 ha and should have the same chemical and physical properties as the Deep red-grey TC soils. Alluvial loams and earths were not sampled as they represent only a very minor soil on the alluvial plains and drainage depressions

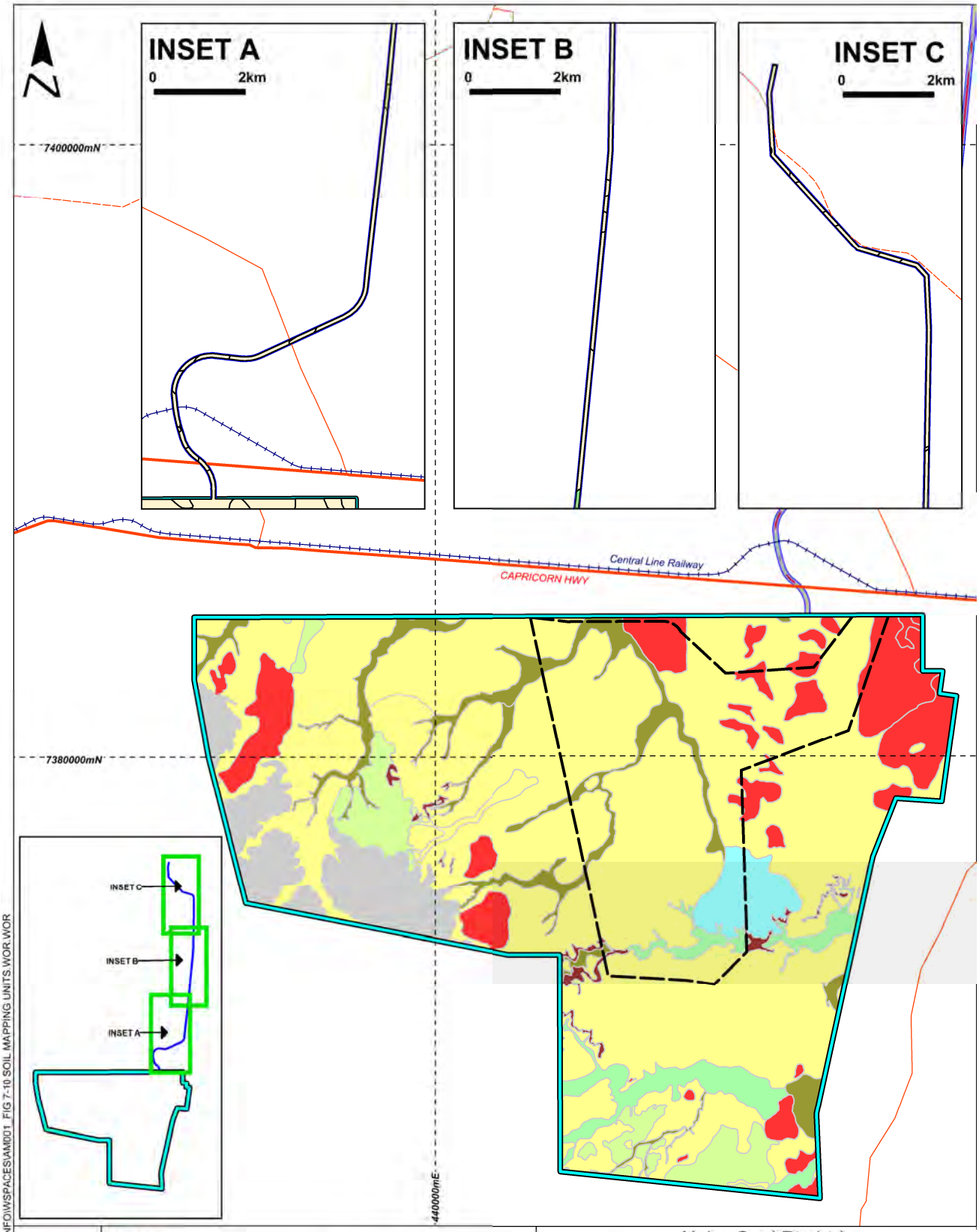
2 CEC is a measure of the soil ability to retain positively charged nutrients (e.g. calcium, magnesium, potassium, ammonium) for use by plant roots, as well as sodium and aluminium

7.2.4.4. Cation Exchange Capacity

The CEC results for the soils within the SGCP area are provided in **Table 7-6**.

7.2.4.5. Soil Salinity

Salinity refers to the concentration of soluble salts in the soil water. Elevated soil salinity within the root zone can retard plant growth. Salinity at or near the surface is not a significant constraint within the SGCP area as approximately 87 % of the area has no salinity hazard. In those soils with salinity constraints, typically the salinity increases with depth through the subsoil. Any activity that disturbs saline subsoil and brings it to the surface can impact on rehabilitation and may result in soluble salts being leached from the soil material and moved downslope.



LEGEND

- MLA70453
- SGCP infrastructure corridor
- Area of direct disturbance
- Principal road
- Road (sealed)
- Railway

Soil Types

- Alluvial red TC soils
- Alluvial yellow-grey TC soils
- Deep red-grey TC soils
- Deep red-yellow earths
- Deep yellow-grey TC soils
- Ironstone sands and sandy loams
- Rocky sands and sandy loams
- Shallow red-grey TC soils
- Shallow red-yellow earths

Data Source: Soils - LRAM. Topography (250k raster) - Geoscience Australia.

Alpha Coal Pty Ltd

South Galilee Coal Project

Soil Mapping Units Within the SGCP

0 5

Kilometres

Scale: 1:175,000 (A4)

23/08/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 7-10

S:\PROJECTS\AM001_STH_GALILEE\GIS_MAP\INFO\WSPACE\AM001_FIG 7-10 SOIL MAPPING UNITS.WOR.WOR

7.2.4.6. Soil Sodicity and Dispersion

Soil sodicity is used as an indicator of dispersion. Sodic soil (ESP 6 to 14) is usually considered as being dispersive and strongly sodic soil (ESP ≥15) is nearly always dispersive.

All soil samples from the surface and subsurface layers are non-sodic (ESP <6), except for one subsurface sample from the *Alluvial yellow-grey TC soil*, which had an ESP of six.

Subsoil in the *Shallow red-yellow earths, Deep red-grey TC soils, Deep yellow-grey TC soils and Alluvial yellow-grey TC soils* was sodic or strongly sodic and represent dispersive texture contrast soils. All other subsoils were non-sodic.

7.2.4.7. Erosion Potential

Soil erosion is governed by the inherent erosion potential of the soil profile, the topography of the site, volume and intensity of the incident rainfall and the land use practices which determine the amount of vegetative cover and condition of the ground surface.

The wind erosion hazard in the SGCP area is negligible due to rainfall levels and groundcover. Approximately 41 % of the SGCP has a minor water erosion hazard and 46 % has a moderate water erosion hazard. Only 9.5 % of the SGCP area has a severe or extreme water erosion hazard.

The erosion potential of soils, determined by the rate of infiltration at the surface, permeability of the profile and coherence of the soil particles, is presented in **Table 7-7**. Whilst many of the soils are highly erodible, the grazing practices and generally gentle slopes have restricted erosion to relatively few areas (generally along drainage lines).

7.2.4.8. Soil Fertility

Soil fertility is a prime determinant of the ability to successfully re-vegetate disturbed areas.

All soils have a low to very low level of at least one of the major nutrients, and approximately 96 % of the SGCP area has a moderate or greater soil fertility constraint, typically a combination of low organic matter and low available phosphorous.

Table 7-7 Inherent Soil Erodability

Soil	Erodability Rating	Factors
Rocky sands and sandy loams	Moderate	Incoherent to weakly coherent sandy material which is quite permeable but can be easily detached by flowing water
Ironstone sands and sandy loams	Moderate	Incoherent to weakly coherent sandy material which is quite permeable but can be easily detached by flowing water
Shallow red-yellow earths	Moderate	Sandy profiles with incoherent to weakly coherent surface layer and quite permeable profile though the mottled, gravelly layer below the subsoil may be partly dispersive
Deep red-yellow earths	Moderate	Sandy profile with incoherent to weakly coherent surface layers and quite permeable profile though the mottled, gravelly layer below the subsoil may be partly dispersive
Shallow red-grey TC soils	Very high	Coherent, permeable surface layer overlying very slowly permeable subsoil causing water to pond then seep along the top of the very dispersive subsoil
Deep red-grey TC soils	Very high	Coherent, permeable surface layer overlying very slowly permeable subsoil causing water to pond then seep along the top of the very dispersive subsoil
Deep yellow-grey TC soils	High	Coherent, permeable surface layer overlying very slowly permeable subsoil causing water to pond then seep along the top of dispersive subsoil
Alluvial red TC soils	Low	Weakly coherent surface layer and quite permeable profile
Alluvial yellow-grey TC soils	Very high	Coherent, permeable surface layer overlying very slowly permeable subsoil causing water to pond then seep along the top of the very dispersive subsoil
Alluvial sands and sandy loams	Moderate	Incoherent to weakly coherent sandy material which is quite permeable but can be easily detached by flowing water

Source: **Appendix J—Soils and Land Suitability Technical Report**

7.2.4.9. Topsoil Resources

Topsoils will be stripped prior to any excavation works for later use in the rehabilitation and revegetation of the SGCP. Approximately 80 % of the SGCP area has very thick layer(s) suitable for topsoil and therefore has no topsoil depth constraint. The recommended topsoil stripping depths have been determined by a soil survey (refer to **Appendix J—Soils and Land Suitability Technical Report**) and are summarised in **Table** 7-8.

Table 7-8 Recommended Topsoil Stripping Depths

Soil Type	Recommended Soil Stripping Depth (mm)
Rocky sands and sandy loams	100
Ironstone sands and sandy loams	50–100
Shallow red-yellow earths	300
Deep red-yellow earths	300
Shallow red-grey TC soils	250–400
Deep red-grey TC soils	100–350
Deep yellow-grey TC soils	100–300
Alluvial red TC soils	300
Alluvial yellow-grey TC soils	150–300

Source: **Appendix J—Soils and Land Suitability Technical Report**

7.2.5. Land Contamination

Searches of the Queensland Environmental Management Register (EMR) and the Contaminated Land Register (CLR) were conducted for all lots covered by MLA 70453 and the infrastructure corridor. No sites on the properties relating to the SGCP are included on either register. A copy of the search results are provided in **Annexure A**.

In the past, the SGCP site has been used for cattle grazing and contamination may have occurred through the use of agricultural chemicals (e.g. dips, drenches and herbicides), however, no such facilities have been identified within MLA 70453 or the infrastructure corridor.

7.2.6. Scenic Amenity and Lighting

This Section provides an assessment of the visual qualities and character of the land surrounding the SGCP area and any potential impact on the visual quality and character that may occur as a result of the SGCP.

This Section addresses the methodology used, the existing landscape and visual characteristics, potential effects and impact generators and provides an assessment of the visual impact both during the life of the SGCP and from a residual perspective.

The environmental values to be maintained are the existing landscape character and scenic amenity.

7.2.6.1. Methodology

The guidelines used in this assessment are described in **Section 7.1**. It is acknowledged that, despite using an approach designed to minimise the subjective nature of visual impact assessments, some subjectivity is inherent and unavoidable in the visual impact assessment process.

7.2.6.1.1. Desktop Study and Field Observations

An initial desktop study was conducted and involved an analysis of topographic maps and aerial imagery for the SGCP and immediate surrounding areas. The locations of the known surrounding homesteads, roads and the township of Alpha were identified to determine potential viewpoints.

Viewpoints that were identified from the desktop analysis were visited in the field on the 17 and 19 May 2011 and assessed for sensitivity to the proposed development (refer to **Figure 7-11**). The weather conditions were favourable for conducting the assessment, characterised by sunshine with very little cloud. Digital photos were taken at a number of viewpoints.

7.2.6.1.2. Local Council Designations

The SGCP is located within the boundary of the Barcaldine Regional Council LGA, therefore the applicable former Jericho Shire Planning Scheme was referenced. Under that plan, the SGCP is located within the Rural Zone (refer to **Figure 3-1**).

As described in **Section 7.1**, in the rural context, the relevant planning scheme requires that ridgelines and escarpments be maintained in a natural state to protect rural character and landscape values. A separation distance of at least 50 m is required for all Rural Zone "buildings" and "structures" from ridgelines or escarpments.

The Jericho Shire Planning Scheme also requires that the design of lighting does not prejudice the amenity of the Rural Zone through poorly directed lighting, lighting overspill or lighting glare. To achieve this, direct lighting or lighting should not exceed 8.0 lux at 1.5 m beyond the boundary of the site.

The SGCP will not impact on the visual amenity of ridgelines and escarpments or significantly impact on the amenity of the Rural Zone through lighting impacts.

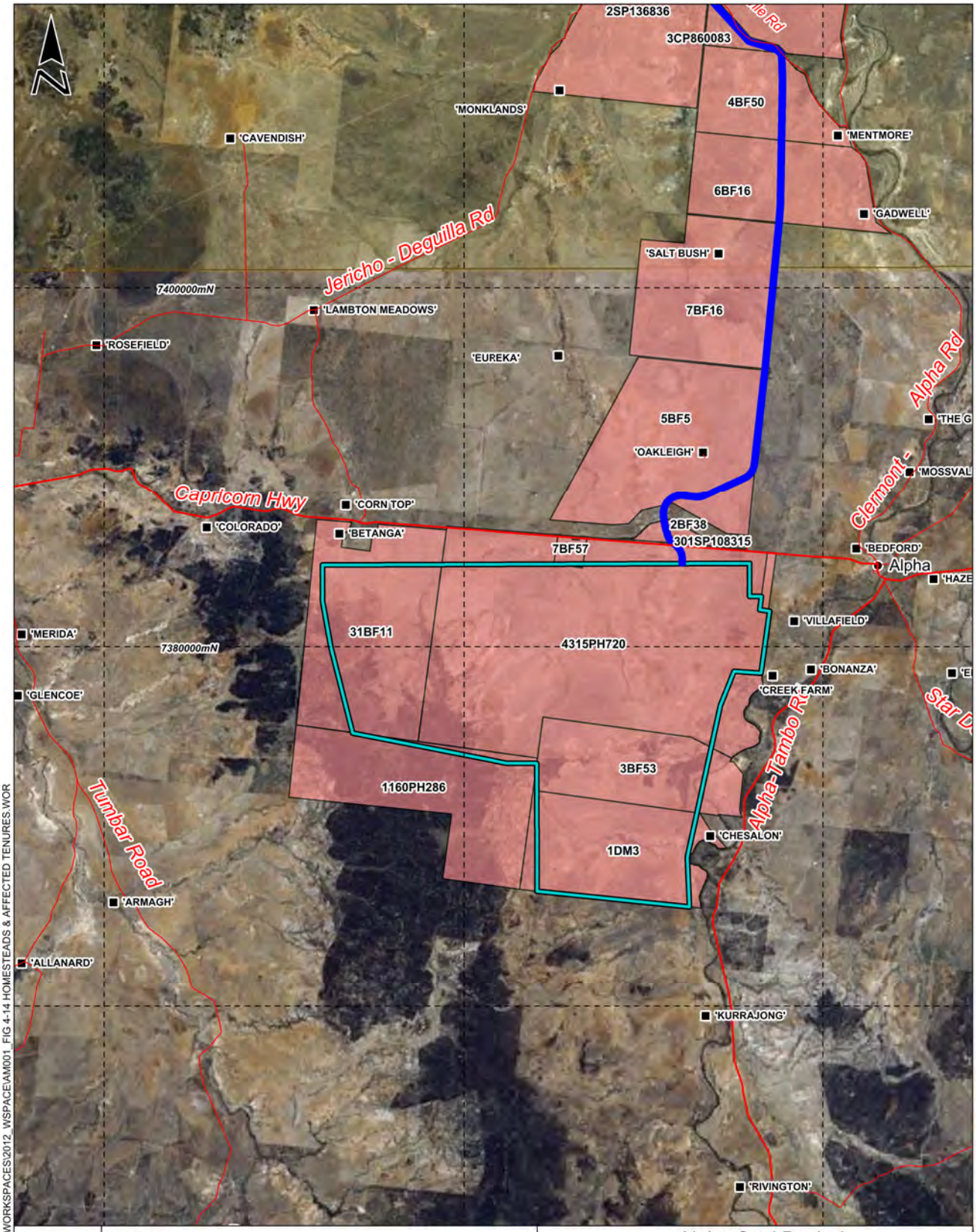
7.2.6.1.3. Development of Photographic Montages with Predicted Mine Contours

Photographs from potentially sensitive viewpoints towards the SGCP were taken, along with data such as elevation, GPS position and bearing. A geo-referenced 3-D computer model of the mine plan was developed.

The location information was digitally combined with the photographic image and the 3-D model of the conceptual final mine plan landforms, to produce a visualisation of the predicted mine impacts on the visual envelope from the viewpoint in the field. These photographic montages give a visual representation of the proposed impacts from the SGCP.

7.2.6.1.4. Landscape and Visual Assessment

The term 'landscape assessment' describes the existing character, features and quality of the landscape surrounding the SGCP area. 'Visual assessment' relates to the changes to the surrounding scenic values as a result of changes to the landscape. It also considers people's responses to the changes, and to the overall effects with respect to visual amenity or aesthetic condition. For the purposes of the landscape and visual assessment, visual amenity is assessed for areas both within and peripheral to the SGCP.



LEGEND

- MLA70453
- Directly affected property
- SGCP infrastructure corridor
- Roads
- Population centre
- Homestead

Data Source:
Cadastral (Barcaldine May2010)-DERM. Topo (250k raster)-Geoscience Australia.

Alpha Coal Pty Ltd

South Galilee Coal Project

Homesteads in the Vicinity of the SGCP

5 0 5
Kilometres

Scale: 1:300,000 (A4)

08/20/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 7-11

METSERVE Mining & Energy Technical Services Pty Ltd

SouthGalilee

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The characterisation of the SGCP has been based on an assessment of the natural, cultural, social, and aesthetic factors as they exist today compared to the predicted landscape character following the completion of proposed mining and post mining rehabilitation activities.

7.2.6.2. Landscape Assessment

7.2.6.2.1. Existing Land Use

The land use in the region surrounding the SGCP consists of beef cattle production and associated activities, primarily on pastoral leases.

A number of other mining developments have been proposed in the Galilee Basin, situated to the north of the SGCP (refer to **Section 1.3**).

7.2.6.2.2. Natural Features

The natural topography is dominated by gently undulating plains and rises of low relief. The plains in the east and north-east generally decline from more elevated low hills located along the western portion of MLA 704543. The topography of the region ranges from 350 to 600 m AHD on the eastern flanks of the Great Dividing Range.

The major regional topographic features are the Drummond Range located approximately 60 km east of the SGCP and the Great Dividing Range, which runs in a north to south direction approximately 10 km west of the SGCP.

Vegetation in the region is typical of the bioregion and is primarily open acacia forest and eucalypt woodland. The majority of the area has been cleared for improved pastures for cattle grazing.

7.2.6.2.3. Social and Cultural Factors

The SGCP and surrounding area comprises land used for cattle grazing. The SGCP is located within a new coal basin, the Galilee Basin, and a number of new coal mines are proposed to the north.

The SGCP is located approximately 12 km south-west of the township of Alpha. There is little residential development in the region outside of the town centre, with only isolated homesteads surrounding the SGCP, as shown on **Figure 7-1**.

Cultural heritage associated with both Indigenous and non-Indigenous use of the land in the region is discussed in **Section 15—Indigenous Cultural Heritage** and **Section 16—Non-Indigenous Cultural Heritage**. The existing social environment and associated social impact assessment is included in **Section 17—Social**.

7.2.6.2.4. Landscape Sensitivity

Landscape sensitivity is categorised as high, medium, low or negligible according to the degree to which a particular landscape or area can accommodate change arising from a particular development without detrimental effects on its character. The classification of sensitivity is based on:

- the existing land use
- the pattern and scale of the landscape
- visual enclosure/openness of the views and the distribution of visual receptors
- scope for mitigation measures that will be in character with the existing landscape
- the value placed on the landscape.

The landscape within the vicinity of the SGCP is considered to have a moderate sensitivity to landscape changes arising from the SGCP, given that it currently primarily supports rural activities.

7.2.6.3. Visual Assessment

7.2.6.3.1. Existing Visual Elements

As there are no existing mines in the immediate vicinity of the SGCP, the key existing visual elements of the area are predominantly grazing lands and natural vegetation.

In the broader context, the Great Dividing Range to the west of the SGCP is a key visual element of the natural landscape.

7.2.6.3.2. Viewpoint Sensitivity

Viewpoint sensitivity is determined by a number of factors including:

- viewing distance
- viewing frequency
- viewpoint importance
- viewing duration
- viewing angle and focus.

In general, sensitivity increases with frequency, importance, duration, angle and focus of the view, but decreases with distance.

Using the factors above, the most sensitive viewpoints were identified as surrounding homesteads and public views from Hobartville Road. These viewpoints have been assessed as Primary Viewpoints and are discussed further in this Section.

The more distant views of less significance have been discussed as Secondary Viewpoints and are also discussed in this Section. The other public viewpoint in the area will be from the Capricorn Highway. Views from the Capricorn Highway are anticipated to be transitory, and the location is therefore classified as a less significant viewpoint.

This view, along with a number of private homesteads, is assessed as a Secondary Viewpoint.

The desktop search did not identify any viewpoints deemed to be of community or cultural significance (e.g. those included in guidebooks or tourist maps).

7.2.6.3.3. Primary Viewpoints

The Primary Viewpoints surrounding the SGCP are comprised mostly of surrounding homesteads as well as the view from the town of Alpha and a point on Hobartville Road. Residential properties are considered to be potentially sensitive to visual impacts as residents can be exposed on a regular and/or prolonged basis. **Table 7-9** provides an assessment of the sensitivity of the Primary Viewpoints to the visual features of the SGCP.

Table 7-9 Assessment of Primary Viewpoint Sensitivity

Viewpoint Location	Distance (approx) (km)[1]	Frequency	Importance	Duration	Angle/ Focus	Overall Sensitivity
Betanga Homestead	16	Medium	High	High	Low	Medium
Creek Farm Homestead	10	High	High	High	Medium	High
Chesalon Homestead	11	High	High	High	Medium	High
Oakleigh Homestead	14 (from MLA 70453) 4 from infrastructure corridor	Medium	High	Low	Low	Medium
Hobartville Road	0.3 from infrastructure corridor	Medium	Medium	Low	Low	Medium
Alpha	16	Low	Medium	Low	Low	Low

[1] Distance calculated from a point located centrally within MLA 70453, rather than to the closest point of the lease boundary

The Betanga homestead is located north-west of MLA 70453. As the closest homestead on the north-western side of the SGCP, Betanga homestead is conservatively considered to be representative of homesteads in this vicinity (e.g. Colorado, Rosefield, Lambton Meadows, etc.). The view is partially obstructed by trees and stockyards.

The Creek Farm homestead is located to the east of MLA 70453. Due to the proximity to the SGCP and the mine infrastructure in that part of MLA 70453, the frequency of this view is expected to be high. The view towards the SGCP is partially screened by vegetation. As the closest homestead on the eastern side of the SGCP, the Creek Farm homestead is conservatively considered to be representative of viewpoints located east of the Project (e.g. Bonanza, Villafield, Bedford etc.).

The Chesalon homestead is located to the south-east of MLA 70453. Due to the proximity of the homestead to the southern open pit and waste rock emplacement, the frequency and duration of views are expected to be high. The importance of the view is expected to be high. The existing view is partially obscured by vegetation.

The Oakleigh homestead is located west of the infrastructure corridor and north of MLA 70453. As the closest homestead on this side of the infrastructure corridor, Oakleigh homestead is considered to be conservatively representative of the Saltbush, Monklands and Eureka homesteads. The principal impact on visual amenity for this location is expected to be the infrastructure corridor. The frequency and duration of views towards the infrastructure corridor are expected to be of a medium range due to the distance and the scale of the infrastructure itself. The view towards the infrastructure corridor is expected to be predominantly screened by vegetation.

The infrastructure corridor alignment is proposed to run south of and parallel to Hobartville Road for approximately 7 km. Along this section of Hobartville Road, intermittent views to the infrastructure corridor may be possible. The duration and angle/focus of this view is predicted to be low as the infrastructure corridor will be at right angles to the direction of travel (with the exception of the rail crossing point), which means that it will not be part of the main field of view of people using the road. Along this section of the road, there will be a distance of approximately 200 to 400 m between Hobartville Road and the infrastructure corridor. The view to the infrastructure corridor is expected to be predominantly obscured by vegetation (refer to **Plate 7-1**). The importance of this view is expected to be medium as a significant portion of the traffic using the Hobartville Road is expected to be mine workers from other proposed projects in the area.

Plate 7-1 View South Towards SGCP Infrastructure Corridor from Hobartville Road

The view from the Alpha township is expected to be restricted by the topography of the area, intervening distance to the SGCP and the vegetated landscape. The frequency of the view is expected to be very low as the residential areas of the township are located below the highest elevation point (shown in **Plate 7-2**). The duration of views and focus towards the SGCP are expected to be low.

Plate 7-2 View Towards SGCP from Alpha Township

An assessment of the visual impacts of the SGCP on these viewpoints is provided in subsequent sections.

7.2.6.3.4. Secondary Viewpoints

The Secondary Viewpoints are considered to have lower sensitivity and will be less likely to be impacted by visible features of the SGCP. These are identified in **Table 7-10**.

Table 7-10 Assessment of Secondary Viewpoint Sensitivity

Viewpoint Location	Distance (approx) (km)	Frequency	Importance	Duration	Angle/ Focus	Overall Sensitivity
Gadwell Homestead	2	Low	High	Low	Low	Low
Capricorn Highway (east of Tallarenha Creek crossing)	7 (from MLA 70453)[1]	Medium	Medium	Low	Low	Medium
Corn Top Driveway	16[1]	Low	Medium	Low	Low	Low

The Gadwell homestead is located east of the infrastructure corridor. The visual impact of the corridor is expected to be diminished by the infrequent and short duration views as well as the topography and vegetation. The Gadwell homestead is considered to be conservatively representative of other homesteads located east and north-east of the infrastructure corridor (e.g. Mentmore, Tresillian, Mossvale and The Grove homesteads).

The Capricorn Highway runs parallel to the northern boundary of MLA 70453. The views towards the SGCP are expected to be infrequent, of low duration and low importance. Views towards MLA 70453 are at right angles to the direction of travel along the highway and therefore will not form part of the main field of view for people travelling along the highway. Views from the Capricorn Highway will generally be screened by vegetation. Although this section of the road is considered the most likely to have views of the SGCP, it still contains tall trees in the foreground. The distance to the SGCP will further diminish the impacts on visual amenity.

Corn Top Homestead is not expected to have a view to the SGCP due to vegetation, topography and distance. The start of the driveway into the property is expected to have some view of the SGCP, albeit of low overall sensitivity. The frequency, duration and angle of this view are low due to vegetation screening as well as the Capricorn Highway and Central Line Railway.

7.3. POTENTIAL IMPACTS AND MITIGATION MEASURES

7.3.1. Land Use and Tenure

7.3.1.1. Tenure

As described in **Section 7.2.1**, the SGCP will be located within MLA 70453 and the infrastructure corridor.

Where a substantial portion of land will be required for mining operations (e.g. the Creek Farm and Sapling Creek properties), SGCP proposes to acquire land by negotiation, where practicable. Surface rights will also be required over part of the Chesalon and Betanga properties.

In the event that agreement cannot be reached with landholders, surface rights compensation will be determined by the Land Court of Queensland.

One petroleum tenement (Exploration Permit Petroleum 668) overlies MLA 70453. In accordance with legislative requirements, the mining lease application triggers a need to notify and consult with the EPP holder and enter into negotiations to maximise resource use.

SGCP will finalise required land acquisitions and consent from other tenement holders prior to commencement of construction.

SGCP will continue to undertake stakeholder consultation as described in **Section 17—Social** and **Appendix R—Social Impact Management Plan**.

7.3.1.2. Native Title

The SGCP has undertaken the appropriate engagement with the identified Aboriginal Party as required by the Commonwealth *Native Title Act 1993*. SGCP has developed a Cultural Heritage Management Plan (refer to **Section 15—Indigenous Cultural Heritage**).

7.3.1.3. Land Use

The SGCP will alter land use in the local area, by reducing the availability of land for agricultural purposes during the operational phase. Grazing may continue to be undertaken in areas not subject to direct disturbance as a result of the SGCP.

The impacts on rural land uses will be offset by the economic benefits of the SGCP described in **Section 18—Economic Environment** and **Appendix S—Economic Technical Report.**

The potential impacts of the SGCP on directly affected and adjacent landholders will be mitigated by the implementation of a Landholder Management Plan (refer to **Section 17—Social** and **Appendix R—Social Impact Management Plan**).

As shown on **Figure 7-3**, the SGCP infrastructure corridor will intersect a stock route which runs parallel and to the north of the Central Line Railway. Consultation with the DEHP's Stock Route Management Unit indicates that the objective of mitigation measures for affected stock routes should be to maintain connectivity. The Proponent will undertake detailed design of the infrastructure corridor in consultation with the DEHP Stock Route Management Unit and design concessions may include provision for an underpass or overpass.

SGCP will continue to undertake stakeholder consultation as described in **Section 17—Social** and **Appendix R—Social Impact Management Plan**.

7.3.1.3.1. Land Use Suitability

Factors influencing changes in land suitability include changed physical, chemical and biological properties of the soil, changes in slope and slope length and soil depth.

Final land use criteria for the SGCP include a mix of cattle grazing and native vegetation. The limitations to cattle grazing of the post mining landforms within the SGCP site are based on slope.

Steep sloping areas such as the slopes of the waste rock emplacements, ramps and the final void are unlikely to sustain grazing without erosion unless regrading work is done. These areas are constrained by slope angle, the nature of soil cover and altered soil moisture profile. Consequently, no parts of the final waste rock emplacements, ramps or final void are proposed to be grazed. These landforms will be rehabilitated to areas of native bushland. Further information is provided in **Section 5—Rehabilitation and Decommissioning**.

Activities associated with the SGCP do not propose to limit the land use suitability of the areas surrounding the SGCP.

The land within MLA 70453 is not likely to become part of a Protected Area Estate nor is it likely to be protected as part of any treaty.

7.3.1.3.2. Agricultural Land Class

As described in **Section 7.2.1.3.2**, the SGCP area contains approximately 780 ha of GQAL.

The construction and operation of the SGCP has the potential to impact upon GQAL by:

- reducing the productive area
- impeding optimal paddock layout and stock management practices for efficient production
- modifying overland flow patterns, potentially increasing erosion and sedimentation of the local waterways
- introducing weed species, or increasing their distribution.

SPP 1/92 provides a framework for considering the value of GQAL in development assessment. SPP 1/92 acknowledges that there will be developments that can legitimately alienate GQAL because they represent an overriding benefit to the community.

The SGCP is considered to provide the following overriding community benefits:

- it allows for utilisation of the coal resources of the State
- it will provide substantial employment within Queensland
- it will facilitate the establishment of a locally/regionally significant industry that provides substantial export income to the State
- there is no alternative location on land of lesser agricultural quality, as the SGCP location is dictated by the location of coal reserves
- the land is typical of grazing land in the region.

Information regarding the economic productivity of the SGCP area is provided in **Section 18—Economic Environment**.

The SGCP is expected to have a minor impact on GQAL as only approximately 5 ha of GQAL are likely to be subject to direct disturbance. The potential impacts of the SGCP on directly affected and adjacent landholders will be mitigated by the implementation of a Landholder Management Plan (**Section 17—Social** and **Appendix R—Social Impact Management Plan**).

7.3.2. Topography

By the manner of its operation, open-cut mining will result in significant alteration of the existing topography (e.g. removal of topography and creation of a new topographic surface at the waste rock emplacements). Open-cut mining will also require the diversion of Sapling Creek and alteration of surface drainage. Further information on the diversion of overland flows is provided in **Section 9—Water Resources**.

These impacts are typical of open-cut mining methods. However, there are also significant mitigation and management measures implemented progressively over the life of the mine to minimise both the degree and extent of these impacts.

Section 5—Rehabilitation and Decommissioning details the progressive and final rehabilitation plans and ultimate rehabilitation success criteria for the SGCP. As a minimum, all areas significantly disturbed by mining activities will be rehabilitated to a stable landform with self-sustaining vegetation cover.

Coal resources are also proposed to be mined by underground mining techniques once open-cut mining has progressed sufficiently. The conceptual layout of the underground mining operations is presented in **Figure 4-3** to **Figure 4-12**.

Underground mining at the SGCP is likely to result in surface expressions of subsidence. After coal has been extracted from a longwall panel, the roof over the area from which the coal has been removed is allowed to collapse or "goaf" (ACA, 2008). Subsidence occurs when the strata located above the goaf zone bends into the void, resulting in vertical fractures and bed separation (Mine Subsidence Engineering Consultants (MSEC), 2007).

The degree of subsidence is dependent on a number of factors, including the thickness of coal extracted, the extent of the area mined, width of chain pillars, the depth of the seam below the surface, the nature of overburden present above the coal seam and other geological factors (University of Wollongong, undated b).

Subsidence typically involves a gradual lowering of the surface strata leading to compressive strain in the centre of the subsided area and tilts and tensile strains around the edges of the subsided area which may result in the formation of cracks at the surface (University of Wollongong, undated b).

A subsidence assessment was conducted for the SGCP by Seedsman Geotechnics Pty Ltd and is presented in **Appendix H—Subsidence**.

Subsidence predictions for the SGCP, detailed discussion of the potential impacts associated with subsidence and proposed mitigation and management measures are provided in **Section 20—Matters of National Environmental Significance** .

7.3.3. Geology

7.3.3.1. Resource Utilisation

As described in **Section 2—Project Rationale and Alternatives**, detailed mine planning and Pre-Feasibility Assessment indicate that the target coal seams can be most economically extracted using the mining methods proposed.

The conceptual mine plan has been developed on the basis of standard mining assumptions and the geological model. The design of the underground mining area includes a stand-off to avoid the identified Threatened Ecological Communities (refer to **Section 8—Nature Conservation**).

7.3.3.2. Geochemical Impacts

As described in **Section 7.2.3.7**, geochemical characterisation undertaken to date suggests that the bulk of the overburden and interburden material is likely to be NAF, with a large continuous section of NAF material from the surface down to the upper portion of the fresh Permian. Permian is likely to be dominated by NAF materials (approximately 65 %) but will also include PAF and PAF-LC materials.

The roof within 5 m of the D1 seam appears to be the main PAF horizon of concern, having sulfur values of >1 %. There are a number of other lower capacity PAF horizons associated with coal seams and also within interburden between the D1 and D2 seams. Final pit floor material will mainly comprise D2 floor, which is likely to be PAF-LC. ROM coal and coal rejects are also likely to be mainly PAF.

Coal stockpiles may also be sources of ARD, depending on reaction rates and stockpile residence times.

Waste rock from the open pit mining operations and coal rejects from the CHPP will be placed in the waste rock emplacements.

Environmental conditions for development of acid sulfate soils (ASS) were not observed within the SGCP area and it is extremely unlikely that ASS are present. Although the Rocky sands and sandy loams soil type has an extremely acid pH, its minimal clay content means it has a limited capacity to generate acid and it is located outside of the direct disturbance area for the SGCP.

As indicated in **Section 7.2.4.3**, the data indicates that there is no potential within the top 1.8 m of all soil profiles for acid generation by disturbance of PAF materials during earthworks and construction.

An Acid Mine Drainage Management Plan (AMDMP) will be developed to outline appropriate management measures. The AMDMP will be prepared in accordance with the Assessment and Management of Acid Drainage guideline of the Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland series (DME, 1995) and any other applicable best practice guidelines.

To reduce the risk of ARD, enriched metal concentration and potential release to vegetation (plant uptake), atmosphere (dusting) or water resources (leaching), the following waste rock emplacement management measures will be considered and/or implemented:

- dust suppression (watering) during emplacement construction
- selective handling of PAF material overburden and interburden materials
- selective placement or encapsulation of material in the 5 m above seam D1 (e.g. deep burial away from the outer slopes of the waste rock emplacement)

- PAF waste rock and rejects will be surface treated with crushed limestone and/or lime water treatment of drainage to control ARD
- the final pit floor will be treated with limestone, high ANC NAF and/or water treatment depending on the ARD reaction rates and acid loads
- selective placement or encapsulation of coal rejects
- exposure time of PAF and dispersive material to the surface will be minimised to reduce the potential formation of acid leachate and soil dispersion
- the waste rock emplacement will be contoured so that runoff is shed from the landform
- the final landform will incorporate engineered cover systems at closure (e.g. soil covers, designed to adequately protect the waste rock emplacement from potential wind/surface water erosion and moisture infiltration)
- drainage works will be designed to maintain long-term stability of the engineered cover.

Portions of the lower capacity PAF/PAF-LC zones may be amenable to ARD control through mixing with high ANC NAF materials and/or addition of limestone. Further investigation and testing will be undertaken to determine the effectiveness of mixing lower capacity PAF horizons with higher ANC NAF materials in order to control ARD.

Coal stockpile drainage will be collected and treated with lime, if required, depending on ARD reaction rates and stockpile residence time.

Drilling and geochemical test work will continue to be undertaken to:

- further investigate the occurrence of PAF and PAF-LC material across the deposit
- better define the variation and continuity of the zone of higher ANC fresh Permian overburden intercepted in hole SP142
- assess the NAF/ANC overburden material for acid buffering potential
- better assess the sodicity potential of overburden materials
- construct an ARD model suitable for predicting the distribution of these zones during operations
- conduct leach column testing on a range of material types to help assess reaction kinetics and leachate compositions
- conduct additional ARD testing of coal and coal rejects to better define the acid potentials.

Results of these ongoing investigations will be used to validate and, if necessary, revise the methods for handling and storage of overburden and interburden material to minimise the potential for adverse environmental impact.

A geochemical monitoring program will be established to routinely sample and test waste materials during operations. The program will monitor variation in acid potential, reconcile the ARD prediction model and check ARD rock type materials handling and placement.

Surface water and groundwater monitoring will also be undertaken as described in **Section 9—Water Resources**. Field observations and pit water quality monitoring will be undertaken in order to identify the potential development of low pH conditions or ARD within the active pit surface or runoff ponds on the waste rock emplacement (refer to **Section 9—Water Resources**).

7.3.3.3. Geotechnical Impacts

As described in **Section 7.2.3.8**, no impediments to open-cut mining of the D1 and D2 seams have been identified, although economic constraints and high wall heights will limit the western down dip extent of mining.

Based on the assessment undertaken to date, the following key geotechnical conditions will apply to the SGCP open-cut mining:

- Pit wall stability – application of the pit wall design parameters detailed in **Table 7-11** are expected to maintain adequate levels of stability for the low walls and highwalls formed during progressive mining. Provision of pre-split drill and blast for the highwalls is considered mandatory in this regard but will not avoid the effects of adversely oriented faults that are likely to be encountered at various stages. Wall stability will be further enhanced by good operational scaling practice.
- Material excavatability – overburden removal should be readily accomplished through all Tertiary materials and to approximately 80 % of the depth of weathered Permian by large excavation equipment in face shovel or backhoe configuration. The remaining approximately 20 % of weathered Permian and all fresh Permian will require drill and blast to uncover coal economically.
- Trafficability – trafficability on the D2 seam floor will be affected to some degree by the predominance of siltstone and carbonaceous mudstone over sandstone in this stratigraphic position. However, most floor rock is medium strength and only one of the 16 geotechnical drillholes contained carbonaceous mudstone which would be classified as low strength rock.
- In-pit waste rock emplacement – instability is unlikely to be an issue at SGCP through a combination of low floor dip and the apparent absence of bedding parallel shears in the floor rock types.

Design parameters based on the geotechnical assessment are provided in **Table 7-11**.

The design parameters outlined in **Table 7-11** are illustrated in **Figure 7-12**.

SGCP proposes to extend the geotechnical drilling programme to cover the northern part of the Creek Farm property as well as the underground mining area.

7.3.3.4. Fossils

As described in **Section 7.2.3.9**, plant fossil specimens have been recorded in drill cores during exploration activities undertaken to date.

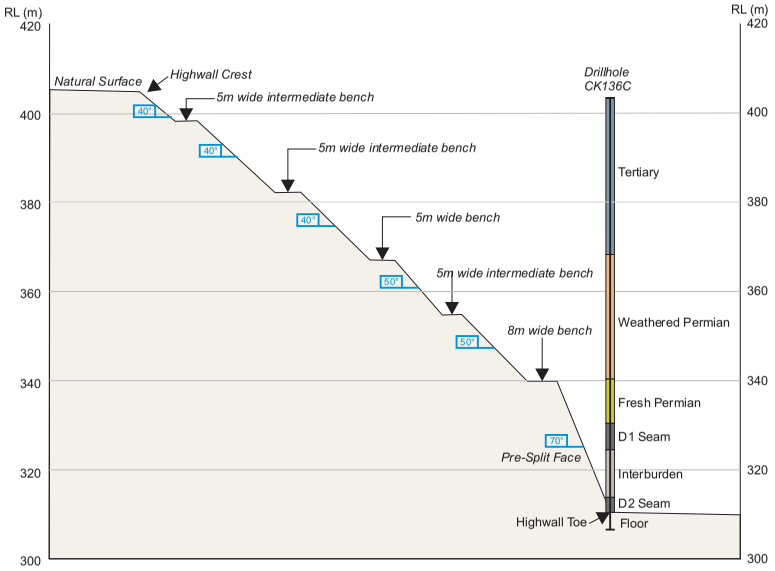
In the event of a significant fossil find, the find will be demarcated and the Queensland Museum will be alerted.

Table 7-11 Open-cut Low Wall, Highwall and Waste Rock Emplacement Design Parameters

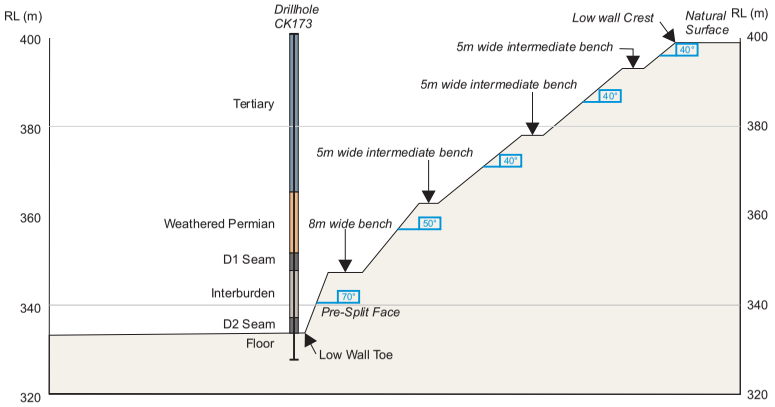
Geotechnical Unit	Design Parameter
Tertiary	15 m (vertical) face height at 40 degrees (°) (from horizontal) with 5 m wide intermediate benches at 15 m vertical spacing
Weathered Permian	Maximum 15 m (vertical) face height at 50° (from horizontal) with 5 m wide intermediate benches at 15 m vertical spacing and an 8 m wide bench at top of fresh rock
Fresh Permian overburden, interburden and coal seams	A 15 m wide bench at top of fresh rock then a 70° pre-split face to the floor of D2 seam with a maximum vertical face height of 65 m above the floor of D2 seam A 15 m wide intermediate bench is to be incorporated into the highwall face when 65 m vertical height is exceeded
Non-coal material types from all of above units as feed for waste rock emplacements	Set-back from crest of box cut low wall to toe of waste rock emplacement should be the same as the vertical height from the low wall crest to the D1 or D2 seam floor – whichever is the lower unit being mined Allow 25° angle of repose for Tertiary and 35° for all Permian materials with 20 m maximum vertical height between 10 m wide benches in emplacement

Source: AMCI and Bandanna Energy (2011)

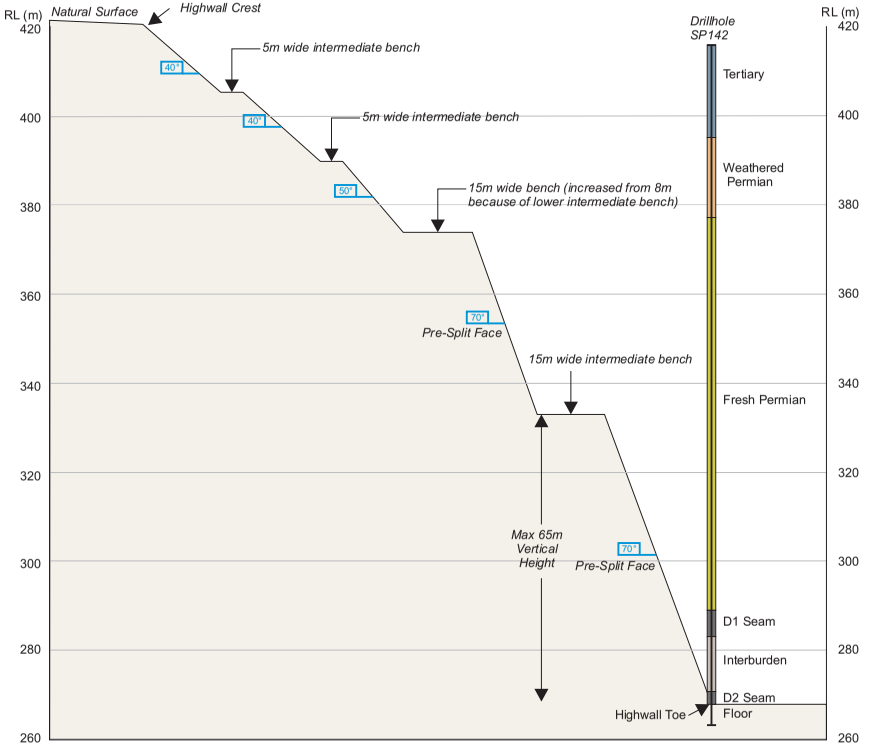
INTERMEDIATE HIGHWALL PROFILE



LOW WALL PROFILE



ULTIMATE HIGHWALL PROFILE



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SouthGalilee COAL PROJECT

Alpha Coal Pty Ltd

South Galilee Coal Project

Low Wall and Highwall Design Profiles

23/08/2012

FIGURE 7-12

7.3.4. Soils

7.3.4.1. Topsoil Management

Topsoil resources directly impacted by mining activities will be stripped ahead of mining for reuse in the rehabilitation program. To maintain the integrity of vegetation in areas adjacent to disturbed areas, appropriate erosion, sediment and dust controls will be established prior to and during soil disturbance.

Prior to stripping the soil, vegetation on areas to be disturbed will be cleared and windrowed. The windrowed material may be retained for fauna habitat, shipped or burned on-site.

Topsoil stripping depths are provided in **Table 7-8**. Where there is variation in recommended stripping depths, detailed field checking will be undertaken prior to stripping to confirm appropriate stripping depth.

Care will be taken to ensure that dispersive clay subsoils are not stripped and mixed with topsoil. Designated topsoil stockpiling areas will be suitably prepared to minimise topsoil losses. Where practicable, topsoil stockpiles will be constructed with dozers in a manner that will minimise compaction and create a rough surface to reduce erosion and maximise storage of rainfall.

The duration of topsoil stockpiling will be minimised where practicable to reduce soil deterioration and weed colonisation. Where stockpiles are to remain in place until the decommissioning phase, they will be sown with an appropriate seed mix to maintain an adequate groundcover.

Topsoil stockpile heights will be kept to a minimum and, depending on topsoil structure, will be no greater than 2 m high mounds, where practicable.

SGCP soils are typically lacking in at least one soil nutrient, so a nitrogen phosphorous-potassium fertiliser and composted organics will be added to topsoil prior to use in rehabilitation.

7.3.4.2. Soil Erosion

The potential impacts of erosion and landform instability include:

- impacts on water quality (suspended solids)
- impacts on surface water channels (sedimentation)
- rehabilitation failure
- loss of structural ability
- compromise of water material capping
- increased infiltration and potential for leaching.

An Erosion and Sediment Control Plan (ESCP) will be developed and implemented prior to the commencement of construction. The ESCP will be developed in accordance with the EPA Guideline—*EPA Best Practice Urban Stormwater Management: Erosion and Sediment Control* and the *Soil Erosion and Sediment Control – Engineering Guidelines for Queensland Construction Sites* (Institute of Engineers Australia (Qld Division) 1996)). The ESCP will contain standard erosion control measures as well as specific measures applicable to particular areas/processes. The ESCP will also detail the monitoring and reporting program for erosion and sediment control structures and practices. An indicative erosion monitoring program is attached to **Appendix J—Soils and Land Suitability Technical Report**.

The standard erosion control measures will include the following:

- major earth works will be scheduled to avoid the high rainfall period of December to March, where practicable
- the following erosion control measures will be implemented for all works that disturb the land surface where slopes exceed 1 %:
    - access and disturbance will be minimised to essential areas only
    - all bare earth areas will be surrounded with a berm to divert upslope stormwater runoff from around the site
    - runoff control devices (e.g. 'whoa boys', berms, temporary sediment fencing, straw bale banks or geotextile socks filled with coarse filter media) will be installed to reduce slope length on access tracks and other disturbed ground
    - stripping and stockpiling of topsoil will be undertaken immediately prior to the commencement of bulk earthworks, where practicable
    - topsoil and subsoil stockpiles will be constructed on the contour and will be protected from runoff with diversion banks (or similar) upslope, and formed with runoff control devices immediately downslope
    - disturbed areas will be rehabilitated following the completion of works, where practicable
    - channels/drains and inlet/outlet works will be designed to convey water at least up to the design peak flow
    - rock filter dams, sediment traps and/or sediment basins will be incorporated into the design of stormwater runoff controls for all major disturbance areas
    - energy dissipaters will be installed at drainage outlets
    - with the exception of stream diversions and diversion drains, all water control structures will be located above the riparian zone.

The ESCP will include specific mitigation measures for areas of dissected terrain, areas with dispersive texture contrast soils, areas with severe subsoil salinity, waste rock emplacements, subsidence areas, borrow pits and minor stream crossings. A summary of these specific measures is provided in **Table 7-12**.

Specific details of water management infrastructure (including sediment control dams, diversions and channels) are provided in **Section 9—Water Resources**.

Table 7-12 Summary of Specific Erosion Controls

Area	Control Measure
Dissected terrain	• exclude these areas from development, where practicable • avoid location of ancillary facilities within this area • minimise the number of access tracks • locate any essential access tracks on gentle grades diagonally across the slope • minimise drainage to line crossings, where practicable • incorporate general all-purpose fertilisers into local topsoil material used as planting media during rehabilitation • implement all erosion control measures applicable to sloping areas with dispersive texture contrast soils (below)
Sloping areas with dispersive texture contrast soils	• avoid inverting the soil or leaving clay subsoil exposed during clearing and/or grubbing • treat any exposed clay subsoil as soon as practicable through amelioration and capping with planting media and/or impermeable material • leave at least 100 mm of undisturbed soil material on top of clay subsoil during grubbing operations • level and lightly compact the land surface as soon as practicable following the completion of clearing/grubbing operations in a manner that spreads runoff water away from the disturbed area • fill any holes with soil material so clay subsoil is not exposed • reshape the land surface on top of pipelines and adjacent service tracks in a manner that spreads runoff water away from the disturbed area • cap pipeline mounds with at least 100 mm of ameliorated topsoil and seed • where pipelines or access tracks are not mounded, reduce slope length by installing runoff control devices at regular intervals (e.g. 'whoa boys', sediment fences, straw bale banks or geotextile socks)
Areas with severe subsoil salinity	• bury excavated subsoils deep or cap with at least 300 mm of suitable topsoil following completion of construction activities • if saline subsoil is required to be stockpiled for a short period, the stockpile will be surrounded with a berm to prevent water running onto the stockpile from further upslope and to detain runoff water within the stockpile area
Waste rock emplacements	• design the final surface topography to adequately control surface water runoff • maximum slope of external batters should be 33 % (1V:3H) • cap emplacement with a minimum of 100 mm of suitable topsoil • if there is insufficient topsoil, mulch with rock fragments of at least 60 mm diameter • revegetate with appropriate plant species

Table 7-12 Summary of Specific Erosion Controls (cont)

Area	Control Measure
Subsidence areas	• rehabilitate areas with significant subsidence-induced surface cracks by ripping to a minimum 300 mm depth, regrading and seeding
Borrow pits	• implement standard erosion control measures and erosion control measures applicable to sloping areas with dispersive texture contrast soils (above) • careful location of borrow pits in dissected terrain • surround any pits that expose saline subsoil with a berm • implement runoff control devices to prevent water running over the cut faces from further upslope and to detain runoff water within the disturbed area • minimise erosion due to rainfall splash by leaving final cut faces as close to vertical as practicable
Minor stream crossings	• stream crossings will avoid sections of active, unstable stream flow with a potential high risk of stream bank erosion • minimise disturbance to stream banks • restabilise crossing points as soon as practicable following disturbance by refilling and slightly compacting, capping with at least 100 mm suitable topsoil and revegetating

Source: **Appendix J—Soils and Land Suitability Technical Report**.

7.3.4.3. Erosion Monitoring

An indicator of landform stability is the extent of soil loss from rehabilitation sites relative to background rates of soil loss. Selected final slopes on rehabilitation sites will be monitored to identify any exceedence of background soil loss rates.

An erosion monitoring program will be implemented and will include the following:

- the monitoring of rainfall and climatic conditions
- regular monitoring of temporary and permanent erosion and sediment control structures during construction, operations and decommissioning
- an assessment of vegetation cover at permanent, representative monitoring locations
- documenting evidence of failure or instability on rehabilitated slopes at permanent, representative monitoring sites
- maintaining photographic records at permanent, representative photographic stations, taken on a regular basis
- reporting as part of annual environmental reporting requirements.

Qualitative surveying (described above) will be undertaken to indicate excessive sediment loss from landforms. If necessary, sediment traps may also be utilised as an indicator of soil loss. Where monitoring identifies the need for corrective action to be implemented, alternative strategies will be investigated with reference to best practice guidance and appropriate industry standards.

7.3.5. Land Contamination

Under the *Environmental Protection Act 1994 (EP Act)*, landholders and Local Government must notify the DEHP that land has been, or is being used for a notifiable activity. Land that has been or is being used for notifiable activities is recorded on the EMR, which is maintained by the DEHP.

A number of activities associated with the SGCP will be classified as notifiable activities under Schedule 3 of the *EP Act*. The Proponent has a duty to notify the DEHP should potentially contaminating activities be carried out on-site.

The potential land contamination risks associated with the SGCP include:

- storage and use of fuel and chemicals
- landfill
- waste rock and reject handling and storage.

The above activities proposed at the SGCP pose a limited risk of contamination for the following reasons:

- all chemicals and fuels will be appropriately stored in accordance with relevant Australian Standards
- facilities and procedures will be implemented to minimise the risk of land contamination and appropriately manage wastes at the SGCP (refer to **Section 13—Waste**).

Waste rock geochemistry and potential for contamination from the waste rock emplacements is discussed in **Section 7.3.3.2** and **Section 13—Waste**.

Waste management measures will be implemented to minimise the risk of land contamination at the site, as described in **Section 13—Waste**. Waste management will aim to promote sustainable waste management practices in accordance with the *Waste Reduction and Recycling Act 2011*.

Strategies for the prevention of land contamination due to the storage, spillage or disposal of hazardous materials will include:

- where practicable, hazardous chemicals will be replaced with less harmful alternatives
- Material Safety Data Sheets (MSDS) for all chemicals used on-site will be kept in a central register and be available to all staff at all times
- construction of appropriate spill containment facilities for all areas where process reagents and petroleum products are stored and used
- establishing and maintaining a register of location and quantities of hazardous substances including their storage, use and disposal, which will be updated annually

- training of operators and implementation of safe work practices for minimising the risk of spillage
- induction of employees and contractors including environmental protection responsibilities
- validation sampling of any remediated area to establish the site as uncontaminated as per the *Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland* (EPA, 1998) and the *National Environment Protection (Assessment of Site Contamination) Measure 1999*
- preparation of a site map detailing the location of all potential contamination sources and sites that could potentially become contaminated
- development of remediation plans for any contaminated sites. The plans will be dependent on the contaminant type and contaminant levels. The remediation plan will include the details of the contaminated land investigation that form the basis of the remediation plan
- emergency plans in the event of a spill.

The key planning document to prevent or minimise land contamination will be the Waste Management Plan. Following completion, remediation and rehabilitation of the SGCP, no areas within MLA 70453 are anticipated to require inclusion on the CLR.

7.3.6. Scenic Amenity and Lighting

7.3.6.1.1. Impact Generators

The visual elements that require assessment are the:

- open-cut mining areas
- waste rock emplacements
- coal handling, stockpiling and processing areas
- accommodation village
- mine lighting requirements
- rail loop
- associated ancillary infrastructure
- infrastructure corridor
- mine rehabilitation areas.

Considering all views of notable sensitivity are a considerable distance from the SGCP, the primary features likely to impact on scenic amenity of the SGCP area are the proposed waste rock emplacements. The majority of sensitive views towards the waste rock emplacements are screened by topography and vegetation and therefore the impact of the waste rock emplacements is reduced.

Direct lighting is unlikely to be visible outside of the SGCP, however indirect lighting or the flow from the operations at night is likely to be visible from a number of viewpoints. The lighting associated with the SGCP mine site is likely to comprise:

- flood lighting for active operational areas
- lighting on conveyors
- lighting on work areas (e.g. CHPP and workshops)
- elevated flood lighting in the vicinity of the active waste rock emplacements
- vehicle lights.

The post-mining rehabilitation objective is to rehabilitate above ground disturbance areas to a native bushland use or grazing where practicable. This approach will result in the waste rock emplacement having a similar appearance to the existing undulating landform and will blend in with the surrounding landscape to some degree. The only residual disturbance will comprise the final void, which is unlikely to be visible from ground level outside MLA 70453.

7.3.6.2. Scenic Amenity

In order to determine the likely visual impacts on the primary sensitive receptors, a number of photoview simulations were undertaken from representative viewpoints. The representative viewpoints utilised for the simulations were:

- Betanga homestead
- Chesalon homestead
- Creek Farm homestead
- Oakleigh homestead.

The location of these viewpoints is provided on **Figure 7-13** to **Figure 7-24**.

The view from the Betanga homestead was taken from the front of the homestead. In the foreground of the view is a powerline, stockyards and scattered vegetation. The horizon line is partially obscured by vegetation.

The view from the Chesalon homestead is largely obscured by vegetation.

The view from the Creek Farm homestead is taken from the western side of the homestead. The view towards the SGCP is largely obscured by vegetation.

The view from the Oakleigh homestead towards the SGCP is taken from the southern side of the homestead looking towards the SGCP. The foreground of the view contains stockyards and a stand of trees. The horizon line is obscured by dense vegetation.

Views from the remaining Primary Viewpoints are considered to be influenced by the SGCP to a similar/lesser extent than those selected for the simulations.

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Figure 7-14 - Photoview Simulation, Year 15
Betanga Homestead

South Galilee Coal Project, Queensland
View looking south-east to SGCP from Betanga homestead
View Location 013 - Betanga
3D overlay showing Proposed Conditions - Year 15

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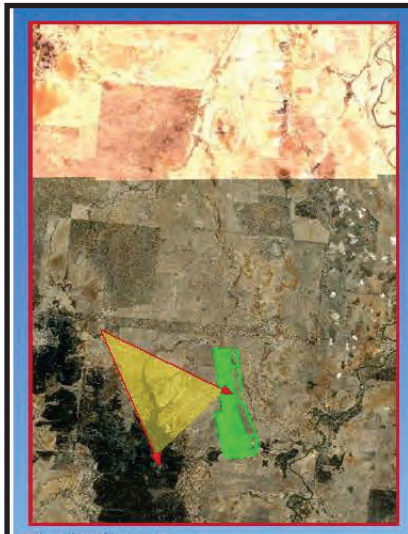

view location map

Figure 7-15 - Photoview Simulation, Year 33
Betanga Homestead

South Galilee Coal Project, Queensland
View looking south-east to SGCP from Betanga homestead
View Location 013 - Betanga
3D overlay showing Proposed Conditions - Year 33

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Figure 7-16 - Photoview Simulation, Existing Conditions
Chesalon Homestead

South Galilee Coal Project, Queensland
View looking north-west to SGCP from Chesalon homestead
View Location 103 - Chesalon
Existing Conditions, photographed 19 May 2011

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Figure 7-17 - Photoview Simulation, Year 15
Chesalon Homestead

South Galilee Coal Project, Queensland
View looking north-west to SGCP from Chesalon homestead
View Location 103 - Chesalon
3D overlay showing Proposed Conditions - Year 15

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Figure 7-18 - Photoview Simulation, Year 33
Chesalon Homestead

South Galilee Coal Project, Queensland
View looking north-west to SGCP from Chesalon homestead
View Location 103 - Chesalon
3D overlay showing Proposed Conditions - Year 33

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Figure 7-19 - Photoview Simulation, Existing Conditions
Creek Farm Homestead

South Galilee Coal Project, Queensland
View looking west to SGCP from Creek Farm homestead
View Location 055 - Creek Farm
Existing Conditions, photographed 17 May 2011

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S:\Projects\AM001 Sth Galilee EIS_MapInfo\Workspaces\Section 7 - Land\AM001_M440 Creek Farm Homestead.CDR

Figure 7-20 - Photoview Simulation, Year 15
Creek Farm Homestead

South Galilee Coal Project, Queensland
View looking west to SGCP from Creek Farm homestead
View Location 055 - Creek Farm
3D overlay showing Proposed Conditions - Year 15

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Figure 7-21 - Photoview Simulation, Year 33
Creek Farm Homestead

South Galilee Coal Project, Queensland
View looking west to SGCP from Creek Farm homestead
View Location 055 - Creek Farm
3D overlay showing Proposed Conditions - Year 33

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view location map

Figure 7-22 - Photoview Simulation, Existing Conditions
Oakleigh Homestead

South Galilee Coal Project, Queensland
View towards closest part of infrastructure and SGCP from Oakleigh homestead
View Location 043 - Oakleigh
Existing Conditions, photographed 17 May 2011

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Figure 7-23 - Photoview Simulation, Year 15
Oakleigh Homestead

South Galilee Coal Project, Queensland
View towards closest part of infrastructure and SGCP from Oakleigh homestead
View Location 043 - Oakleigh
3D overlay showing Proposed Conditions - Year 15

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Figure 7-24 - Photoview Simulation, Year 33
Oakleigh Homestead

South Galilee Coal Project, Queensland
View towards closest part of infrastructure and SGCP from Oakleigh homestead
View Location 043 - Oakleigh
3D overlay showing Proposed Conditions - Year 33

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The photoview simulations from the Betanga, Chesalon, Creek Farm and Oakleigh homesteads are provided in **Figure 7-13** to **Figure 7-24**. The photoviews provide a representation of existing conditions followed by a simulation of the photoview at Year 15 and Year 33.

Based purely on elevation and orientation (derived from the digital elevation model (DEM) for the Project), at Year 33 the Betanga Homestead will potentially have views to the infrastructure corridor, parts of the on-site rail and several topsoil stockpiles north of the on-site rail. However, these views will be screened by the intervening vegetation and topographical features and the sensitivity will be greatly reduced by through distance (refer to **Figure 7-13, Figure 7-14, Figure 7-15** and **Figure 7-25**).

As shown on **Figure 7-16, Figure 7-17, Figure 7-18** and **Figure 7-26**, at Year 33 the Chesalon Homestead is not predicted to have any views of the SGCP surface disturbance areas.

As shown on **Figure 7-19, Figure 7-20, Figure 7-21** and **Figure 7-27**, at Year 33 the Creek Farm Homestead is not predicted to have any views of the SGCP.

Although based on the DEM at Year 33, the Oakleigh Homestead is predicted to have views of the southern portion of the infrastructure corridor (**Figure 7-28**), in reality, these potential views will be screened by thick intervening vegetation (**Plate 7-3**). The Oakleigh Homestead is not predicted to have views of any SGCP visual elements within MLA 70453 (refer to **Figure 7-22**).

Plate 7-3 View Towards Infrastructure Corridor from Oakleigh Homestead

It is evident that there are no significant scenic amenity impacts at these Primary Viewpoints.

7.3.6.3. Landscape Character and Scenic Amenity

The existing scenic amenity value of the SGCP in the context of the surrounding region is considered low-moderate (common) given the lack of any significant or unusual visual elements and the large areas of land throughout Central Queensland that display similar landscape characteristics. There is substantial evidence of alteration to natural features resulting from agriculture. Therefore, the views are not considered to be pristine.

Views of agriculture and mining activities may appeal to some parts of the community and not to others. While in visual assessments, these activities are generally accepted as reducing the landscape character and scenic amenity, to some people they may increase these values. The limited views towards the SGCP from public vantage points may appeal to these people.

The proposed final landforms associated with the SGCP are similar in landscape character to the existing undulating nature of the regional landscape. However, given that there are currently no large-scale mining operations in the Galilee Basin, the impact of the SGCP on landscape character is expected to be moderate-high. Measures to shape and contour the final landform are described in **Section 5—Rehabilitation and Decommissioning**. Mitigation measures are described in **Section 7.3.6.5**.

7.3.6.4. Visual Impact

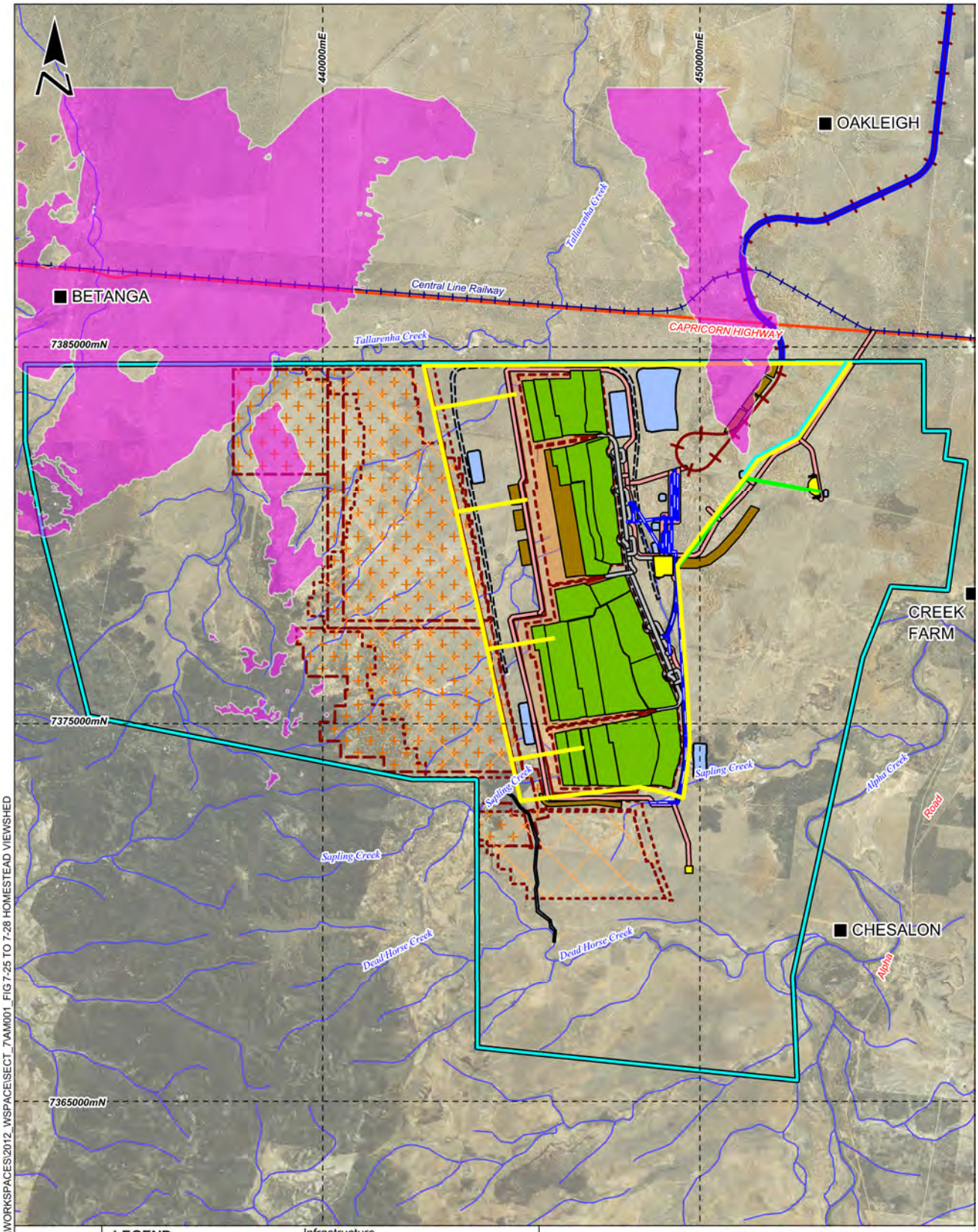
To assess the magnitude of the visual impact of the SGCP on the visual resource both on its own and from a cumulative perspective, five main factors were considered, namely visual intrusion, visibility, exposure, sensitivity and lighting.

7.3.6.4.1. Visual Intrusion

The SGCP has been assessed on the nature of its likely intrusion (physical characteristics) on the visual quality of the surrounding environment and its compatibility/discord with the landscape and surrounding use. Intrusion includes both the removal of existing visible landscape features and the creation of new ones.

The SGCP operations will involve the construction of waste rock emplacements that will become new elevated landforms in addition to the local landscape. The waste rock emplacements are likely to be visible in some parts of the local area and along some sections of the surrounding network.

The primary rehabilitation objective for the site upon decommissioning is to return areas disturbed by mining activities to self-sustaining native vegetation and/or grazing, in accordance with the land suitability objectives. The rehabilitation of areas disturbed by activities associated with the SGCP will be progressively undertaken as described in **Section 5—Rehabilitation and Decommissioning** and will involve the removal of infrastructure upon completion of mining. Some infrastructure may remain at the request of landowners (e.g. roads, dams).



S:\PROJECTS\AM001 STH GALILEE EIS_MAP\INFOWORKSPACES\2012_WSPACE\SECT_7\AM001_FIG 7-25 TO 7-28 HOMESTEAD VIEWSHED

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LEGEND

- MLA70453
- Infrastructure corridor
- Principal road
- River / Creek

Viewshed
- View from homestead

Mining Activity
- Open pit
- Waste rock emplacement
- D1 underground mining area
- D2 underground mining area

Infrastructure
- Facility area
- Stream diversion
- Drainage channel
- Water storage dam
- Topsoil stockpile
- Topsoil spreading & rehabilitation
- Heavy vehicle road
- Light vehicle road
- On-site rail component
- Coal & rejects conveyor

Utilities
- 66kV overhead power line
- 11kV overhead power line
- Raw water pipeline

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Viewshed from Betanga Homestead - Year 33

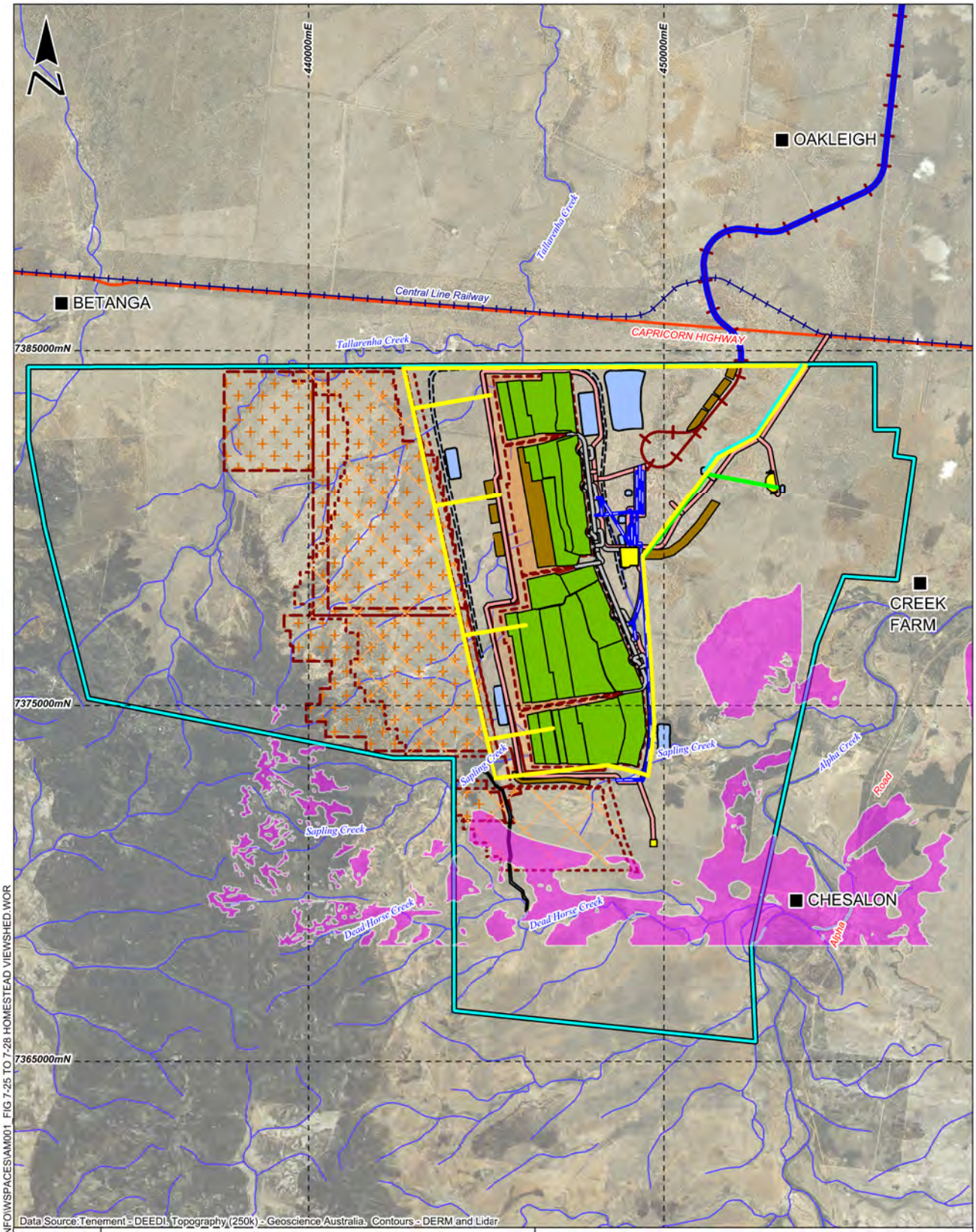
2.5 0 2.5
Kilometres

Scale: 1:150,000 (A4)

08/21/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 7-25



LEGEND

- MLA70453
- Infrastructure corridor
- Principal road
- River / Creek

Viewshed
- View from homestead

Mining Activity
- Open pit
- Waste rock emplacement
- D1 underground mining area
- D2 underground mining area

Infrastructure
- Facility area
- Stream diversion
- Drainage channel
- Water storage dam
- Topsoil stockpile
- Topsoil spreading & rehabilitation
- Heavy vehicle road
- Light vehicle road
- On-site rail component
- Coal & rejects conveyor

Utilities
- 66kV overhead power line
- 11kV overhead power line
- Raw water pipeline

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Viewshed from Chesalon Homestead Year 33

2.5 0 2.5

Kilometres

Scale: 1:150,000 (A4)

08/20/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 7-26

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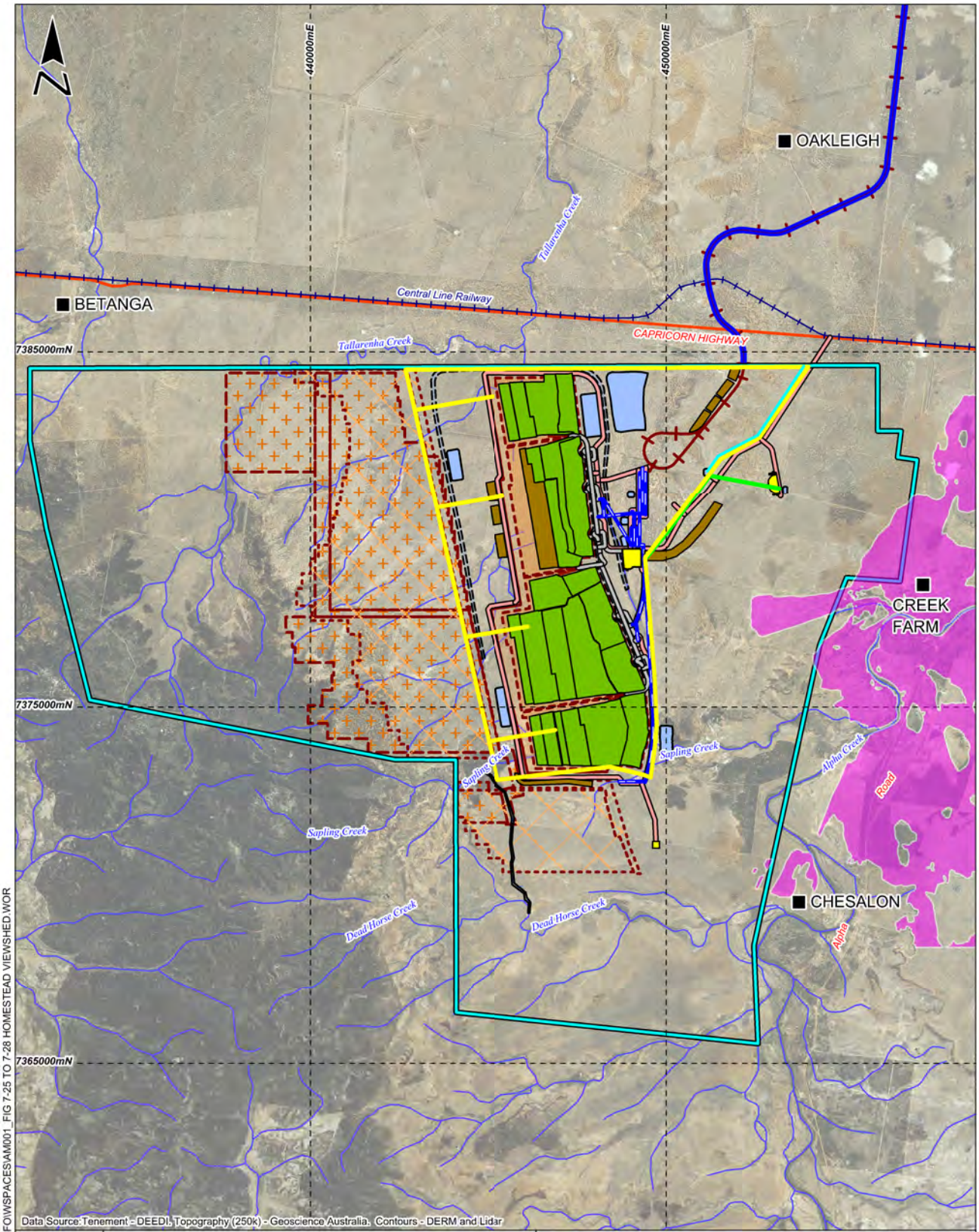

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LEGEND

- MLA70453
- Infrastructure corridor
- Principal road
- River / Creek

Viewshed
- View from homestead

Mining Activity
- Open pit
- Waste rock emplacement
- D1 underground mining area
- D2 underground mining area

Infrastructure
- Facility area
- Stream diversion
- Drainage channel
- Water storage dam
- Topsoil stockpile
- Topsoil spreading & rehabilitation
- Heavy vehicle road
- Light vehicle road
- On-site rail component
- Coal & rejects conveyor

Utilities
- 66kV overhead power line
- 11kV overhead power line
- Raw water pipeline

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Viewshed from Creek Farm Homestead Year 33

2.5 0 2.5

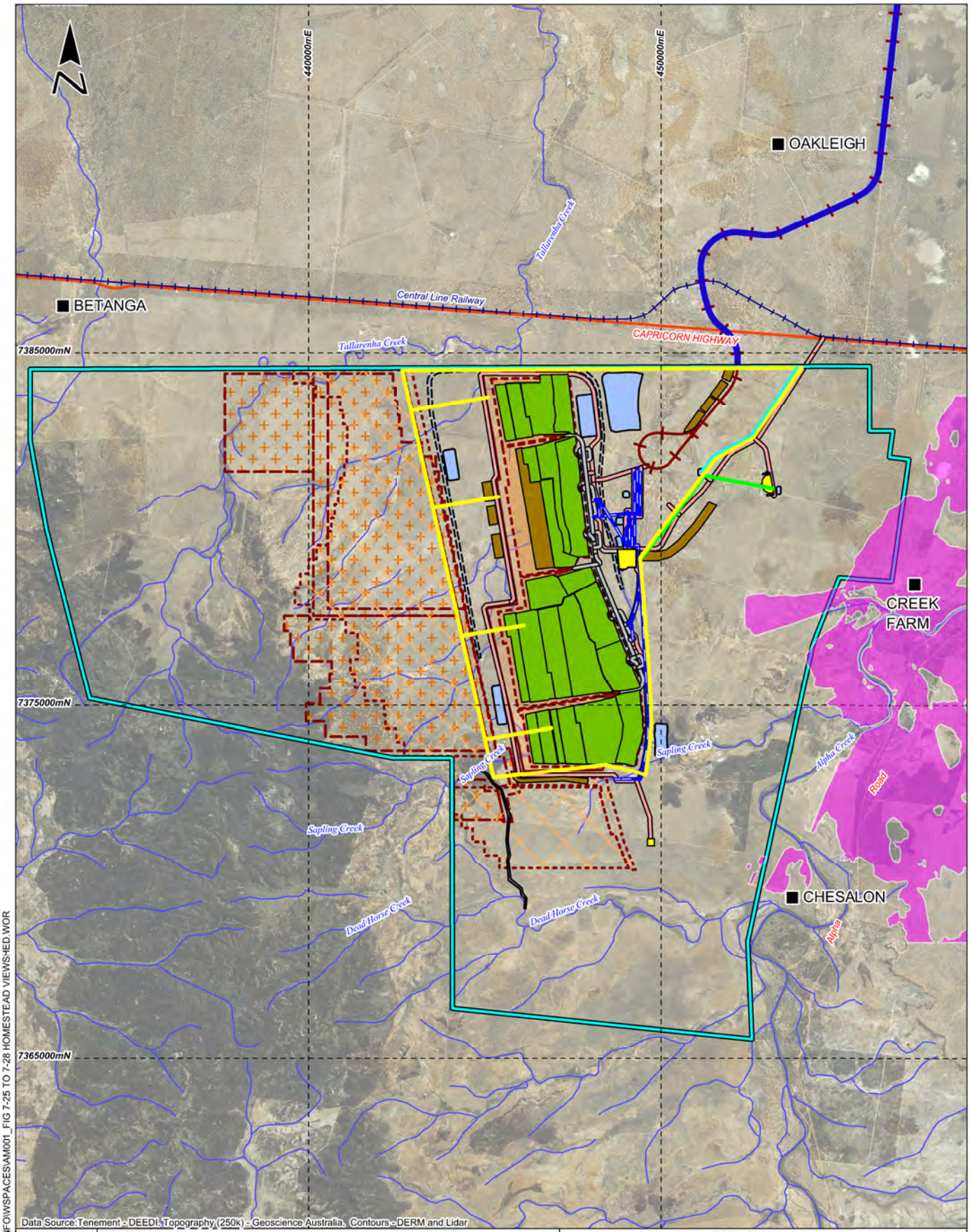
Kilometres

Scale: 1:150,000 (A4)

08/20/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 7-27



LEGEND

- MLA70453
- Infrastructure corridor
- Principal road
- River / Creek

Viewshed
- View from homestead

Mining Activity
- Open pit
- Waste rock emplacement
- D1 underground mining area
- D2 underground mining area

Infrastructure
- Facility area
- Stream diversion
- Drainage channel
- Water storage dam
- Topsoil stockpile
- Topsoil spreading & rehabilitation
- Heavy vehicle road
- Light vehicle road
- On-site rail component
- Coal & rejects conveyor

Utilities
- 66kV overhead power line
- 11kV overhead power line
- Raw water pipeline

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Viewshed from Oakleigh Homestead Year 33

2.5 0 2.5
Kilometres

Scale: 1:150,000 (A4)

25/07/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 7-28

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The rehabilitated waste rock emplacements will be generally consistent with the existing disturbed and undulating landform. Consequently, residual visual intrusion is assessed as low as few features in the landscape will change, and the proportion of the existing view that will change is very low. No sensitive receptors will be significantly affected by the change in the view. Progressive rehabilitation of the waste rock emplacements will also minimise adverse visual impacts throughout the mine life.

7.3.6.4.2. Visibility

As demonstrated in the photoview simulations (refer to **Figure 7-13** to **Figure 7-24**), the waste rock emplacements and other physical features of the SGCP will not be visible from the sensitive receptors within the local area. Whilst there may be vantage points from within the properties surrounding the SGCP that enable clear views towards the SGCP, these locations are considered to have very low sensitivity and as such, are unlikely to be impacted by the SGCP. Similarly, views from the surrounding road network have low sensitivity and are unlikely to be significantly impacted by the SGCP.

7.3.6.4.3. Exposure and Sensitivity

Visual exposure relates to the distance of the view (i.e. it is recognised that the impact of an object diminishes as the distance from the observer increases). The visual sensitivity of the Primary Viewpoints is assessed as ranging from low to high as the most sensitive receptors considered in this assessment are the residences in the areas of the proposed mining activities. The Primary Viewpoints are located between 0.3 and 16 km of the SGCP, and the views are largely screened by vegetation and intervening landforms.

The visual sensitivity of the Secondary Viewpoints is assessed as ranging from low to medium. The Secondary Viewpoints are located between 2 and 16 km of the SGCP, and the views are largely screened by vegetation and intervening landforms.

The impact significance on visual exposure is regarded as low as views towards the SGCP will generally be distant. Where views towards the SGCP are obtained at a short distance (primarily from the surrounding properties and within the mine operations) the impacts are likely to be low due to the low sensitivity of the view and the short duration of the views. Therefore potential impacts on places of work are expected to be low.

7.3.6.4.4. Lighting Impacts

Mining operations at the SGCP will be also undertaken at night. Therefore, lighting associated with operational areas is likely to be visible at night as a glow in the sky. While no significant direct impacts to sensitive viewpoints is predicted, mitigating measures such as retention or planting of vegetation between sensitive viewpoints and the mine will be assessed for effectiveness to minimise any lighting impact if complaints are received.

The waste rock emplacements and associated infrastructure are likely to be the most obvious elements of the SGCP, with lighting on the waste rock emplacements visible at night from some viewpoints. Lighting on the waste rock emplacements will be minimised to that required for safe operations. As described in **Section 7.3.6.5**, effective lighting strategies will be implemented on elevated infrastructure to ensure safe working environments and minimise light spillage to surrounding homesteads.

Artificial lighting regimes can result in changed habitat conditions for nocturnal fauna and associated impacts. Fauna known from within MLA 70453 that may be potentially affected by lighting associated with SGCP activities are nocturnal birds, reptiles and microbat species (refer to **Appendix N—Terrestrial Ecology Technical Report**). Artificial lighting tends to attract insects, and may therefore increase foraging opportunities for some nocturnal insectivores (e.g. microbats). All of these species are highly mobile and have abundant habitat outside of the proposed disturbance area. The potential impacts of lighting on fauna will be minimised by directing lights away from fauna habitats, where practicable.

The potential impacts of increased vehicle lighting are not expected to be significant as the sensitive receptors have limited exposure to the transport routes to be utilised by the SGCP. Therefore the increases in traffic are unlikely to have a significant impact on amenity.

The handling of coal product at the port facility is unlikely to have a significant impact on amenity surrounding the port. The sensitivity to additional industrial activity in the already heavily industrialised port area is likely to be low. Matters related to the port facility are subject to a separate approvals process.

7.3.6.5. Scenic Amenity Impacts Mitigation and Management

The magnitude of impact or degree of change as a consequence of the proposed activities associated with the SGCP is expected to be low to moderate due to the presence of limited vantage points providing views of the SGCP infrastructure. The magnitude of impact on decommissioning is regarded as low and beneficial due to vegetative rehabilitation and the creation of a final landform that will conform to the existing undulating landscape and the establishment of native vegetation in a sparsely vegetated area.

The primary indirect impact will be lighting from the mine infrastructure, particularly in the vicinity of the active waste rock emplacements. Lighting impacts at sensitive receptors are likely to be associated with a 'glow' from the operation rather than direct light impacts.

Where direct light impacts could potentially occur, appropriate mitigation measures will be implemented, including the installation of light fixtures in accordance with *AS 4282:1997 Control of the obtrusive effects of outdoor lighting*. This Australian Standard provides strategies to reduce light spillage beyond the immediate surrounds of the working area. For example, a screen or louvre attached to the light fitting to control light flux for all angles above 10 degrees below the horizontal will effectively reflect light onto the ground and improve lighting levels.

Other mitigation measures to reduce impacts on the visual amenity of the area include:

- use of high pressure sodium lights where practicable
- consideration of appropriate colour selection and finishes for mine infrastructure to reduce visual contrast
- dust suppression
- consideration of the orientation of lighting emitting infrastructure
- establishment of buffer vegetation between the proposed new surface infrastructure and sensitive receptors
- retaining existing vegetation on-site wherever practicable.

Based on the above assessment, the SGCP is assessed as having a low to moderate visual impact on the surrounding area.

7.3.7. Cumulative Impacts

The SGCP site and the locality have primarily been used for grazing and much of the SGCP site will be suitable for grazing post mining. The post mining land use is proposed to comprise a mosaic of self-sustaining vegetation communities and grazing land, using appropriate native tree, shrub and grass species, and improved pasture species where suitable.

The cumulative impacts on land use in the region will be relatively high during mining operations; however, for the end of mine life, the majority of mines have a rehabilitation plan that includes grazing and native vegetation in various proportions. While there will be changes in the land use and reductions in land suitability during mining, once mine decommissioning is completed and as much land as practicable is returned to the pre-existing land use, the final cumulative impact will be significantly reduced.

The cumulative impact on visual amenity is difficult to quantify. The region has few significant visual elements and there are large areas of land in Central Queensland that display similar landscape characteristics. While mining has definite visual impacts, how an individual perceives these impacts can vary significantly.

The cumulative impact of the SGCP, when added to the visual impact of the proposed mines in the surrounding region, is minimal.

Due to the mitigation and management measures proposed for the SGCP, cumulative impacts on final land use, land contamination and scenic amenity are not expected to increase significantly.

ANNEXURE A QUEENSLAND CONTAMINATED LAND REGISTER AND ENVIRONMENTAL MANAGEMENT REGISTER SEARCH RESULTS

Level 8, 400 George St • Brisbane, Queensland • GPO Box 2454 • Brisbane • QLD 4001 •
AUSTRALIA
Telephone (07) 3330 5685 • Facsimile (07) 3330 5754 •
www.derm.qld.gov.au/environmental_management/land/contaminated_land

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Jessie Keast
PO 306
Fortitude Valley Post Office
Fortitude Valley QLD 4006

Transaction ID: 1320305 EMR Site Id: 15 June 2011
Cheque Number:
Client Reference: 15429277

This response relates to a search request received for the site:
Lot: 7 Plan: BF57
null CAPRICORN HIGHWAY
DRUMMONDSLOPE

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

EMR/CLR Searches may be conducted online through www.smartservice.qld.gov.au or Citec Confirm www.confirm.com.au.

If you have any queries in relation to this search please phone (07) 3330 5685.

Darryl Byers
Registrar, Contaminated Land Unit

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SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Jessie Keast
PO 306
Fortitude Valley Post Office
Fortitude Valley QLD 4006

Transaction ID: 1320306 EMR Site Id: 15 June 2011
Cheque Number:
Client Reference: 15429277

This response relates to a search request received for the site:
Lot: 4315 Plan: PH720
null NO STREET ADDRESS
UNABLE TO VALIDATE (SEARCH MAY PROCEED)

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

EMR/CLR Searches may be conducted online through www.smartservice.qld.gov.au or Citec Confirm www.confirm.com.au.

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SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Jessie Keast
PO 306
Fortitude Valley Post Office
Fortitude Valley QLD 4006

Transaction ID: 1320307 EMR Site Id: 15 June 2011
Cheque Number:
Client Reference: 15429277

This response relates to a search request received for the site:
Lot: 31 Plan: BF11
null NO STREET ADDRESS
UNABLE TO VALIDATE (SEARCH MAY PROCEED)

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

EMR/CLR Searches may be conducted online through www.smartservice.qld.gov.au or Citec Confirm www.confirm.com.au.

If you have any queries in relation to this search please phone (07) 3330 5685.

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SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Jessie Keast
PO 306
Fortitude Valley Post Office
Fortitude Valley QLD 4006

Transaction ID: 1320308 EMR Site Id: 15 June 2011
Cheque Number:
Client Reference: 15429277

This response relates to a search request received for the site:
Lot: 3 Plan: BF53
null NO STREET ADDRESS
UNABLE TO VALIDATE (SEARCH MAY PROCEED)

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

EMR/CLR Searches may be conducted online through www.smartservice.qld.gov.au or Citec Confirm www.confirm.com.au.

If you have any queries in relation to this search please phone (07) 3330 5685.

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SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Jessie Keast
PO 306
Fortitude Valley Post Office
Fortitude Valley QLD 4006

Transaction ID: 1320309 EMR Site Id: 15 June 2011
Cheque Number:
Client Reference: 15429277

This response relates to a search request received for the site:
Lot: 1 Plan: DM3
null NO STREET ADDRESS
UNABLE TO VALIDATE (SEARCH MAY PROCEED)

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

EMR/CLR Searches may be conducted online through www.smartservice.qld.gov.au or Citec Confirm www.confirm.com.au.

If you have any queries in relation to this search please phone (07) 3330 5685.

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Registrar, Contaminated Land Unit

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www.derm.qld.gov.au/environmental_management/land/contaminated_land

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Jessie Keast
PO 306
Fortitude Valley Post Office
Fortitude Valley QLD 4006

Transaction ID: 1320310 EMR Site Id: 15 June 2011
Cheque Number:
Client Reference: 15429277

This response relates to a search request received for the site:
Lot: 1160 Plan: PH286
null NO STREET ADDRESS
UNABLE TO VALIDATE (SEARCH MAY PROCEED)

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

EMR/CLR Searches may be conducted online through www.smartservice.qld.gov.au or Citec Confirm www.confirm.com.au.

If you have any queries in relation to this search please phone (07) 3330 5685.

Darryl Byers
Registrar, Contaminated Land Unit