CONTENTS

FIGURES

TABLES

20. MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

20.1. INTRODUCTION

20.1.1. Project Background

The South Galilee Coal Project (SGCP) is a new open-cut and underground coal mining operation located approximately 12 kilometres (km) south-west of the township of Alpha in Central Queensland.

The SGCP will have a life of approximately 35 years. Over the life of the Project, the SGCP aims to produce approximately 447 Million tonnes (Mt) of product coal for the export market. A detailed description of the SGCP is provided in **Section 4—Project Description**.

20.1.2. Relationship to Other Projects

The relationship of the SGCP to publicly known development proposals in the region is described in **Section 1.3**. There are a number of proposed coal mines in the vicinity of the SGCP, including:

- Galilee Coal Project, proposed by Waratah Coal Pty Ltd
- Alpha Coal Mine, proposed by the GVK Group
- Kevin's Corner, proposed by the GVK Group
- Carmichael Coal Mine and Rail Project, proposed by Adani Mining Pty Ltd.

The development and implementation of the SGCP will be dependent on the successful development of infrastructure (e.g. electricity and water supply infrastructure and a rail link to a coal export terminal). The proposed and existing mining/infrastructure projects described **Section 1.3** are subject to separate environmental impact assessment (EIA) and approvals processes.

Opportunities for co-location of existing/proposed infrastructure are discussed in detail in **Section 2—Project Rationale and Alternatives**.

20.1.3. Public Consultation

A comprehensive public consultation program has been an integral component of the EIS process.

Consultation has been undertaken with landholders, key stakeholders, government agencies and the broader community, and has included the following engagement tools and activities:

- face-to-face meetings
- production and distribution of Project information/updates (e.g. fact sheets)
- public communication activities (e.g. Community Information Days, media releases and adverts)
- formation and meetings of interest groups (e.g. Community Reference Group and Technical Reference Group)
- establishment of Project contact points (e.g. SGCP freecall hotline, website, dedicated email and mailing addresses)
- direct mail
- community survey.

Appendix D—Consultation Report provides a consultation report which describes the identification of stakeholders, the consultation activities undertaken to date, outcomes of consultation and how these have been considered and/or addressed in this EIS.

Public consultation will continue to be undertaken over the life of the Project, as detailed in the Social Impact Assessment presented in **Appendix Q—Social Impact Assessment**.

20.1.4. Environmental Impact Statement Study Team

This Environmental Impact Statement (EIS) for the SGCP has been prepared and collated by Mining and Energy Technical Services Pty Ltd, with assistance from AMCI (Alpha) Pty Ltd and a team of specialist sub-consultants. A detailed summary of the EIS study team, including names, qualifications and experience of those involved in preparing the EIS is provided in **Appendix E—Study Team**.

20.1.5. Environmental Record of Proponents

The SGCP Proponents (the Proponent) are joint venture participants AMCI (Alpha) Pty Ltd and Alpha Coal Pty Ltd (Alpha Coal), a subsidiary of Bandanna Energy. AMCI is the manager of the joint venture and is responsible for the preparation of this Environmental Impact Statement (EIS).

The AMCI Group was founded in 1986 and is a private global mining, investment and trading business. The AMCI Group currently holds significant strategic investments in private and public mining in Australia, the United States, South Africa, Europe and South America.

AMCI is experienced in coal exploration and mine development, and was instrumental in the development of several mines in Queensland and New South Wales, including Coppabella, Moorvale, Carborough Downs and Glennies Creek. Further information about AMCI can be obtained from www.amcicapital.com. Environmental, community and safety obligations are given priority by the Proponents.

Neither AMCI nor Alpha Coal Pty Ltd have been subject to any proceedings under Commonwealth, State or Territory law in relation to environmental protection or conservation issues. The SGCP will be undertaken in accordance with AMCI's Corporate Environment Policy (refer to **Appendix T—Corporate Environment Policy**).

20.2. RELEVANT MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

As described in **Section 3.2.1.3** of the EIS, actions that have, will have or are likely to have, a significant impact on one or more of the eight Matters of National Environmental Significance (MNES), are considered to be 'controlled actions' and require approval under the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*).

On 16 June 2010, following referral to the Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA), (now the Department of Sustainability, Environment, Water, Populations and Communities [SEWPaC]) in accordance with the *EPBC Act*, the SGCP was determined to be a 'controlled action' pursuant to Section 75. The relevant controlling provisions are:

- Sections 18 and 18A (listed threatened species and ecological communities)
- Sections 20 and 20A (listed migratory species).

As a 'controlled action', the SGCP requires approval from the Commonwealth Minister for SEWPaC under Part 9 of the *EPBC Act*.

The survey effort and findings relevant to these controlling provisions are detailed in **Section 20.2.1** to **Section 20.2.3**. Potential impacts and mitigation measures are described in **Section 20.3** to **Section 20.5**.

20.2.1. Listed Threatened Species

Desktop searches of the following databases were undertaken:

- *EPBC Act* Protected Matters Search Tool
- DEHP Wildlife Online (Wildnet)
- Birds Australia Atlas
- Queensland Museum.

Desktop search results indicated that six threatened flora species, and 13 threatened fauna species listed under the *EPBC Act* may be potentially present within the SGCP area, including:

- Two-nerved Wattle (*Acacia deuteroneura*)
- Branch-flowered Wattle (*Acacia ramiflora*)
- Ooline (*Cadellia pentastylis*)
- Silver Kurrajong (*Commersonia argentea*)
- King Blue-grass (*Dichanthium queenslandicum*)
- Short-leaved Milk-vine (*Micromyrtus rotundifolia*)
- Northern Quoll (Dasyurus hallucatus)
- South-eastern Long-eared Bat (*Nyctophilus corbeni*)
- Koala (Phascolarctos cinereus)
- Collared Delma (*Delma torquata*)
- Ornamental Snake (*Denisonia maculata*)
- Yakka Skink (*Egernia rugosa*)
- Dunmall's Snake (*Furina dunmalli*)
- Brigalow Scaly-foot (*Paradelma orientalis*)
- Fitzroy River Turtle (*Rheodytes leukops*)
- Squatter Pigeon (Geophaps scripta scripta)
- Star Finch (sth) (Neochmia ruficauda ruficauda)
- Black-throated Finch (sth) (*Poephila cincta cincta*)
- Australian Painted Snipe (*Rostratula australis*).

The nearest records for locations of known threatened flora species records from database searches are shown in **Figure 20-5** to **Figure 20-10**. The nearest records for locations of known threatened fauna species records from database searches are shown in **Figure 20-12** to **Figure 20-30**.

Based on the habitats present and the geographic distribution of species, each species was assigned a likelihood of presence within the SGCP area. Species deemed likely to be present within the Project area were assessed for potential impacts on their ecology resulting from the SGCP.

20.2.1.1. Survey Effort

Field surveys for threatened flora and fauna species were conducted according to best practice sampling and methodologies, concomitant with the spatial extent of habitats present.

20.2.1.1.1. Terrestrial Flora

Field flora surveys were undertaken within the mine survey area in April and October 2009 and within the infrastructure corridor area in May/June and September 2011. Flora surveys included community-level vegetation assessments and targeted searches for threatened species within specific habitats.

Site selection for targeted surveys consisted of a stratified random sampling design consistent with the DEC (2004) methods. Two types of surveys were conducted, including:

- intensive systematic searches along parallel transects of approximately 50 m intervals
- targeted searches of potential habitat of flora species.

Targeted searches were conducted on foot. The span of the search area was 2–5 m in width, depending on vegetation structure and ground visibility. Flora assessment site locations are shown on **Figure 20-1**.

Further details on flora survey methodology are presented in **Section 5.1** of **Appendix N—Terrestrial Ecology Technical Report**.

20.2.1.1.2. Terrestrial Fauna

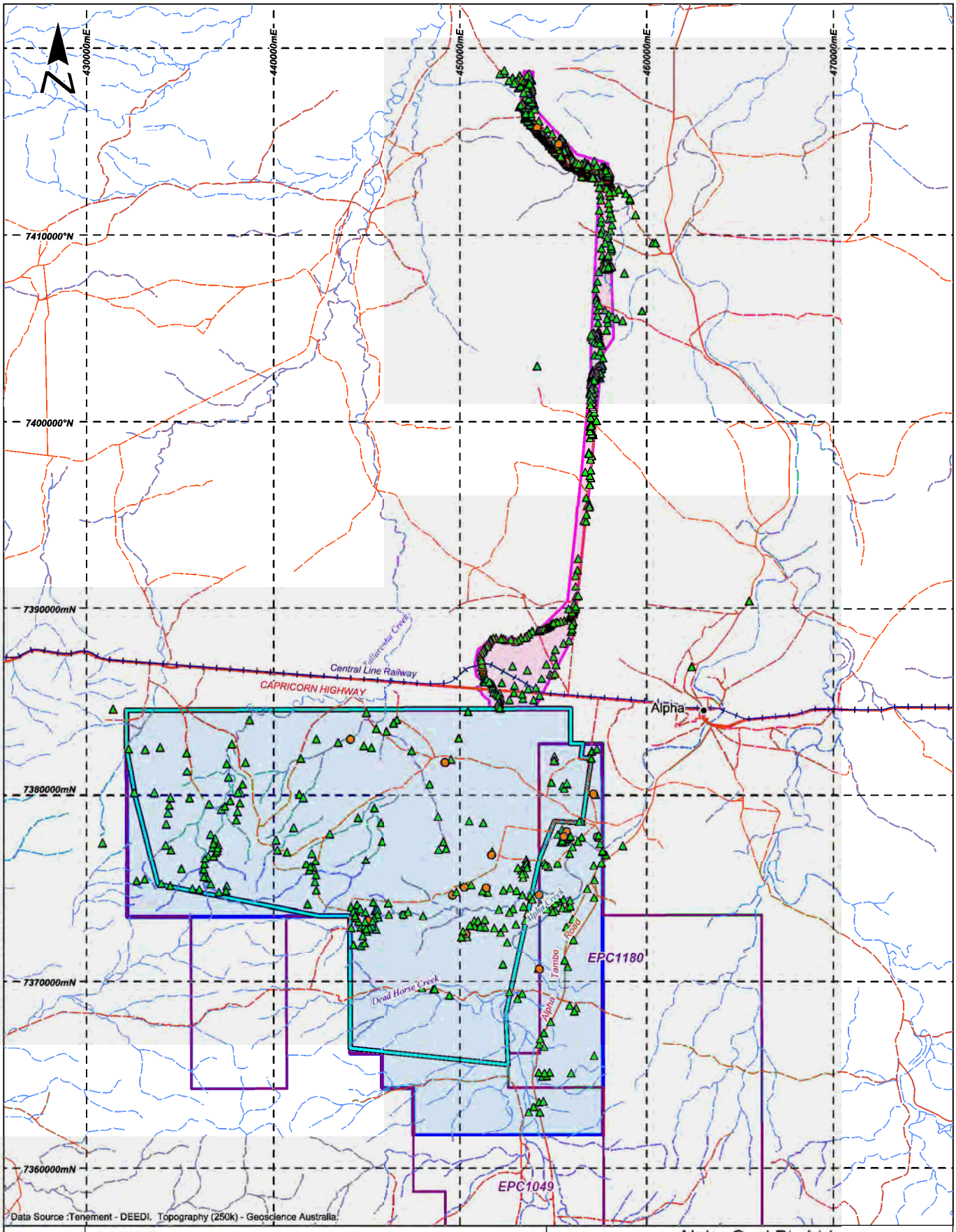
Fauna surveys were conducted within the mine area from 14–19 October 2009 and 26 April - 3 May 2010, and within the infrastructure corridor from 18 May–1 June 2010.

Surveys were conducted within all habitat types within the SGCP area. Faunal habitats were represented by six broad categories:

- Brigalow woodland on cracking clays
- Eucalypt woodland with grassy ground cover
- Eucalypt woodland with a low mixed shrub layer (including *Callitris*)
- Eucalypt woodland with spinifex (*Triodia spp*.) ground cover
- Lancewood woodland on stony soil
- Paperbark woodland.

The highest quality examples of each habitat category were selected for sampling, in order that the results of these surveys can be conservatively extrapolated to the remainder of the SGCP area. Twelve sampling sites within the mine survey area and six sampling sites within the infrastructure corridor survey area were selected (refer to **Figure 20-2**). The October 2009 (dry season) survey focused on six sampling sites within the western portion of the mine survey area (called Western 1–6).

The April 2010 (wet season) survey focused on six sites in the eastern section of the mine survey area (Eastern 1–6). The May 2011 (dry season) survey assessed sites within the infrastructure corridor survey area (Corridor 1-6).



S:\PROJECTS\AM001_STH_GALILEE\IS\GIS_MAP\INFO\WSPACES\AM001_FIG 8-3 FLORA ASSESSMENT SITE LOCATIONS.WOR

METSERVE

SouthGalilee

LEGEND

- MLA70453
- Exploration tenement
- Mine survey area
- Infrastructure corridor survey area
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- Stream
- Population centre

Flora assessment site

- Quaternary
- Secondary

Alpha Coal Pty Ltd

South Galilee Coal Project

Flora Assessment Site Locations

2.5 0 2.5

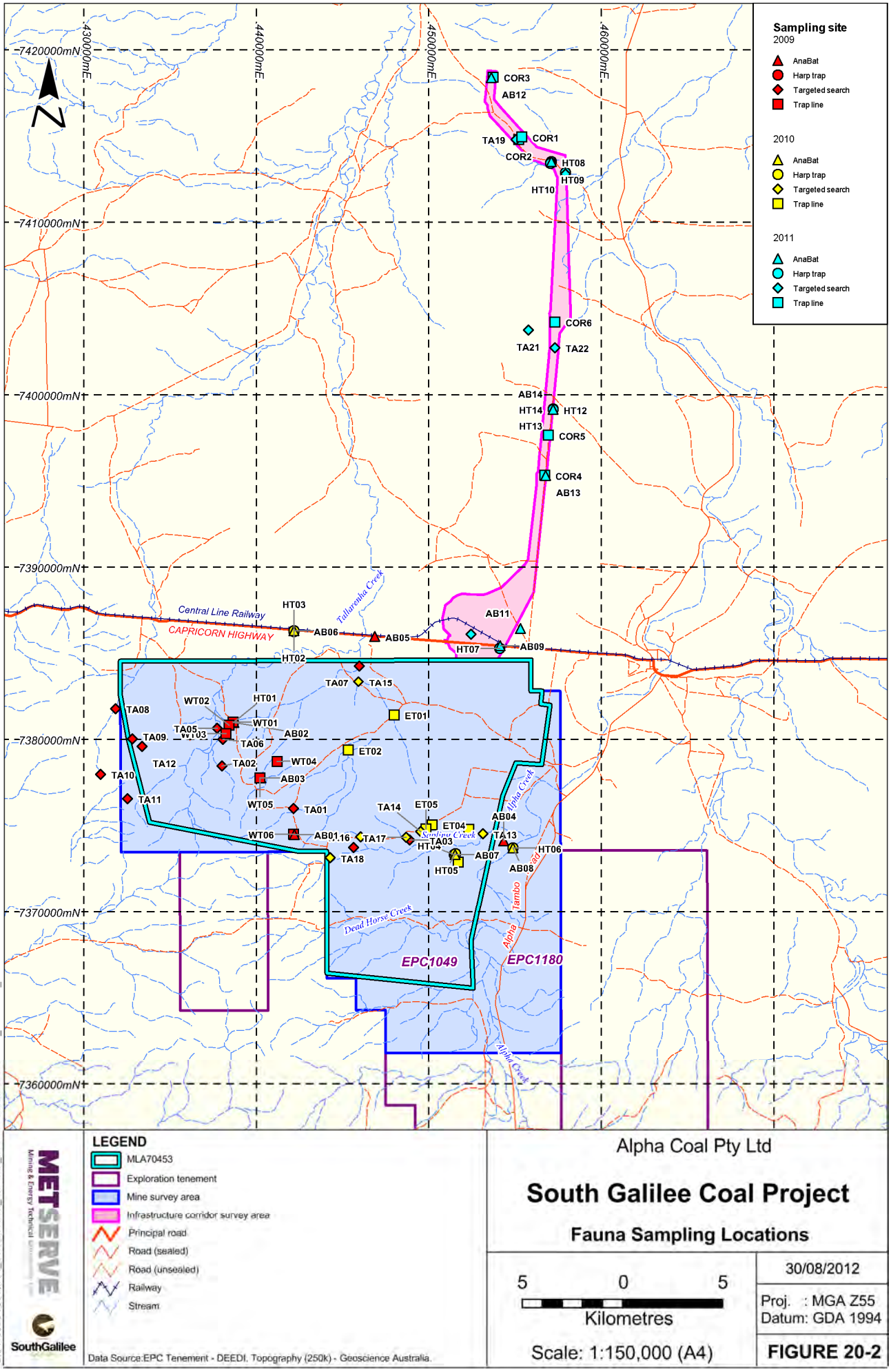
Kilometres

Scale: 1:150,000 (A4)

30/07/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-1


Sampling site
2009
AnaBat
Harp trap
Targeted search
Trap line
2010
AnaBat
Harp trap
Targeted search
Trap line
2011
AnaBat
Harp trap
Targeted search
Trap line
7420000mN
7410000mN
7400000mN
7390000mN
7380000mN
7370000mN
7360000mN
430000mE
440000mE
450000mE
460000mE
COR3
AB12
TA19
COR1
COR2
HT08
HT09
HT10
COR6
TA21
TA22
AB14
HT14
HT12
HT13
COR5
COR4
AB13
AB11
HT07
AB09
HT03
AB06
AB05
HT02
TA07
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TA01
TA14
ET05
ET04
AB04
WT06
AB01
TA17
TA03
TA13
HT06
TA18
HT05
AB07
AB08
Central Line Railway
CAPRICORN HIGHWAY
Tallarenha Creek
Alpha Creek
Scotopa Creek
Alpha Tambo Gap
Dead Horse Creek
EPC1049
EPC1180
LEGEND
MLA70453
Exploration tenement
Mine survey area
Infrastructure corridor survey area
Principal road
Road (sealed)
Road (unsealed)
Railway
Stream
Data Source:EPC Tenement - DEEDI, Topography (250k) - Geoscience Australia.
Alpha Coal Pty Ltd
South Galilee Coal Project
Fauna Sampling Locations
5 0 5
Kilometres
Scale: 1:150,000 (A4)
30/08/2012
Proj. : MGA Z55
Datum: GDA 1994
FIGURE 20-2
METSERVE
SouthGalilee
S:\PROJECTS\AM001_STHGALILEE_EIS\GIS_MAPINFO\WSPACES\SECT_20\AM001_FIG 20-2 FAUNA SAMPLE LOCATIONS.WOR

Fauna surveys involved trapping and targeted searches. Targeted searches included visual searches for vertebrates during daylight hours. The purpose of the targeted searches was to survey habitats in which trapping was not conducted (e.g. waterbodies).

Trapping methodologies employed:

- Elliott traps (to target small terrestrial mammals)
- pitfall trap lines (to target small terrestrial vertebrates)
- funnel traps
- harp traps (to sample microchiropteran communities)
- AnaBat SD1 call detection unit (to capture the echolocation calls of insectivorous bat species)
- diurnal bird surveys
- nocturnal surveys (for frogs, reptiles, birds and mammals)
- opportunistic records.

A detailed description of fauna survey methodology is provided in **Section 5.2** of **Appendix N—Terrestrial Ecology Technical Report**. Based on species accumulation curves generated from the 18 fauna trapping sites (see **Section 8.3.1.2** of **Chapter 8 – Nature Conservation**), the sampling effort of these surveys was sufficient to detect most species present on-site.

20.2.1.1.3. Aquatic Ecology

Aquatic ecology field surveys were conducted in April 2010 and in July 2011. Sampling aimed to survey macroinvertebrates, macrocrustaceans, fish and aquatic macrophyte communities, aquatic habitats and *in-situ* water quality monitoring.

Aquatic ecology field survey methods included:

- macroinvertebrate sampling (using a sweep net)
- backpack electrofishing
- fyke netting
- seine netting
- bait trapping
- completion of AUSRIVAS habitat assessment field sheets
- monitoring using a multi-parameter water quality meter.

The aquatic ecology sampling locations are shown on **Figure 20-3**.

A detailed description of surveys undertaken to identify surface aquatic ecology is provided in **Section 2.5** of **Appendix O—Aquatic Ecology Technical Report**.

20.2.1.1.4. Subterranean Fauna

Surveys for subterranean fauna were undertaken in accordance with the *EPA Guidance Statement No. 54, Guidance for the Assessment of Environmental Factors: Consideration of Subterranean Fauna in Groundwater and Caves during Environmental Impact Assessment in Western Australia* (EPA, 2003) and *EPA Guidance Statement No. 54a, Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia* (EPA,2007).

Stygofauna surveys of the local groundwater systems were undertaken from 16–21 June 2011. Samples were taken from a total of 22 groundwater bore sites (refer to **Figure 20-4**).

Specialised troglofauna traps were placed in 28 groundwater bores in June 2011 (refer to **Figure 20-4**) and left in place for six weeks. The traps were collected in August 2011.

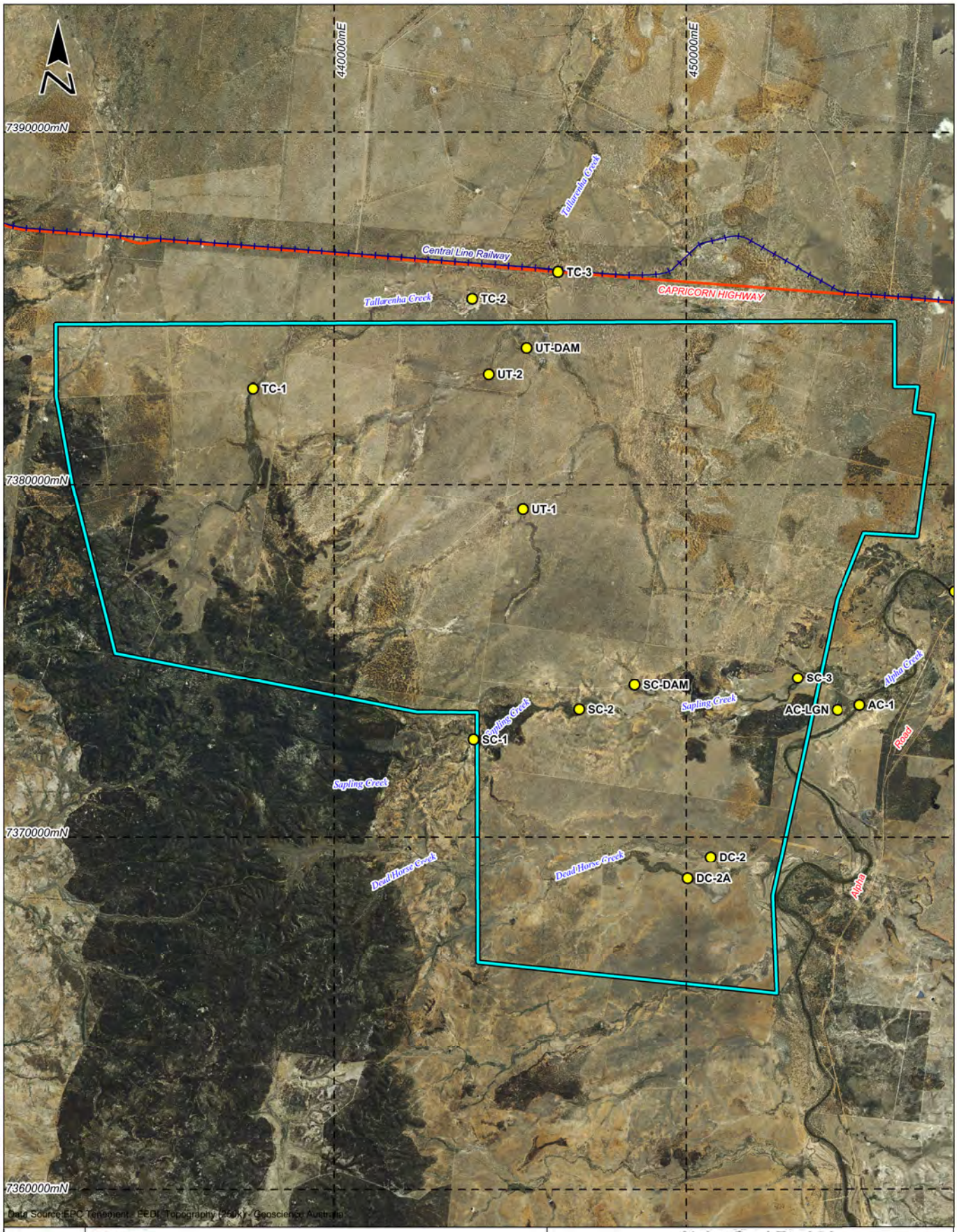
Attempts were made to sample the hyporheic zone at three pits located on Sapling Creek. Due to the absence of standing water and/or significant interference in groundwater/surface water interaction by grazing practices, no hyporheic faunal samples were collected.

A detailed description stygofauna and troglofauna survey methodology is provided in **Sections 2.6** and **2.8** of **Appendix O—Aquatic Ecology Technical Report**.

20.2.1.2. Survey Results

20.2.1.2.1. Threatened Terrestrial Flora

None of the six potentially present *EPBC Act* listed threatened flora species (refer to **Section 20.2.1**) were recorded in the SGCP area (refer to **Table 20-1**). All six listed species are not deemed likely to occur on site, based on their habitat requirements and/or absence of local records (refer to **Table 20-1**). The nearest records for each of these six threatened flora species listed under the *EPBC Act* is shown on **Figure 20-5** to **Figure 20-10**. A total of 312 plant species were recorded on-site. This high diversity reflects the thoroughness of surveys.



LEGEND

- MLA70453
- Railway
- Principal road
- Groundwater Bores

Alpha Coal Pty Ltd

South Galilee Coal Project

Aquatic Ecology Sample Site Locations

0 5

Kilometres

Scale: 1:150,000 (A4)

30/07/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-3

METSERVE Mining & Energy Technical Services

SouthGalilee

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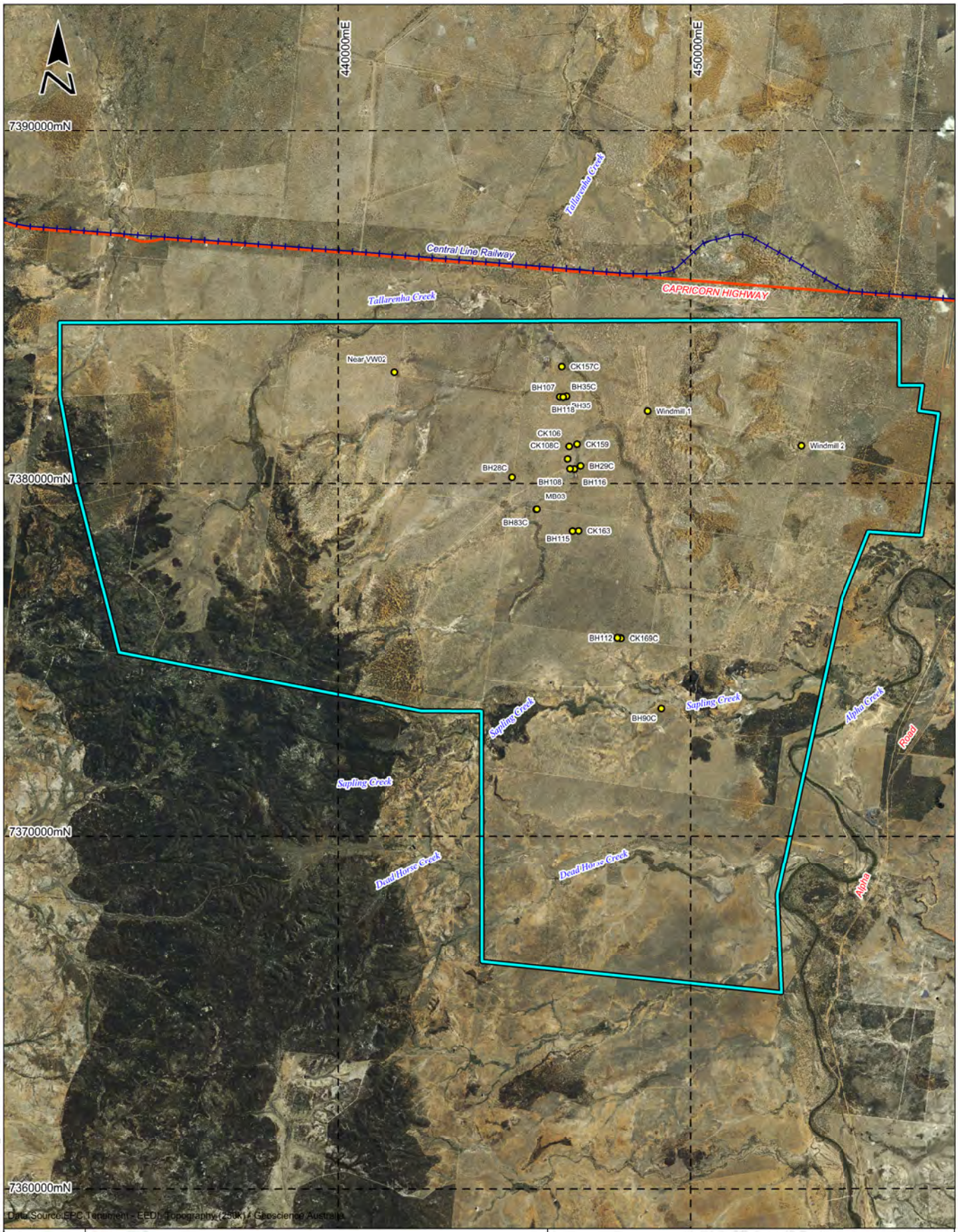


LEGEND

- MLA70453
- Railway
- Principal road
- Groundwater Bores

METSERVE

SouthGalilee

Alpha Coal Pty Ltd

South Galilee Coal Project

Subterranean Fauna Sampling Locations

0 5

Kilometres

Scale: 1:150,000 (A4)

30/07/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-4

S:\PROJECTS\AM\001 STH GALILEE E S_MAP\NI-D\WORKSPACES\2012_WSPACE\AM001_FIG 8-11 TO 13 BOREDRILL FIGURES.WOR

Table 20-1 Likelihood of Occurrence of Threatened and Near Threatened Flora Species in the SGCP Area

Scientific Name	Common Name	*EPBC Act*	Likelihood of Presence*	Distribution, Ecology and Habitat Preference	Background Information and Results of Field Assessments
Acacia deuteroneura	Two-nerved Wattle	V	Possible	• *Acacia deuteroneura* is a shrub to 3 m high with hairless, waxy, white branchlets (DEWHA, 2008a). • Flowering specimens have been collected in August, fruiting specimens in November (DEWHA, 2008a). • It is known from only two locations - one 64 km north-north-east of Tambo in central western Queensland, growing on a knoll of weathered sandstone with *Eucalyptus bakeri* and the other from 60 km north of Tambo (DEWHA, 2008a). • Large tracts of similar but inaccessible country occur north and south-east of the known locality and the species may be more widely distributed (SEWPaC, 2012a). • Grows in skeletal soil on knoll of weathered sandstone with *Eucalyptus bakeri* (SEWPaC, 2012a). • Species is likely to be susceptible to extinction by stochastic events (e.g. too-frequent fire) (DEWHA, 2008a).	Records of this species were present only within the *EPBC Act* Protected Matters Search Tool which includes predictive results. No local records from specimen or observation-backed databases were present. Known from approximately 70 km south of the SGCP area. It is regarded that the large areas of similar habitat to the north of the known population may contain this species (Pedley, 1979). This habitat includes areas in the west of the SGCP area on weathered sandstone (landzone 10 under DEHP RE framework). Is it considered possible that this species occurs on landzone 10 regions within the SGCP area.
Acacia ramiflora	Branch-flowered Wattle	V	Possible	• *Acacia ramiflora* is a slender shrub growing to 3 m high with globular flower heads (SEWPaC, 2012b). • Distribution is restricted to the Torrens Creek-Pentland area, and also near the headwaters of the Gilbert River (SEWPaC, 2012b). • Grows in woodland on sandstone hills (SEWPaC, 2012b).	No local records from specimen- or observation-backed databases were identified. The closest record of this species to the SGCP area is approximately 235 km to the north, near Bulliwallah. The species occurs on sandstone hills (DEWHA, 2008), including woodlands dominated by *Corymbia leichhardtii* (Williams *et al.*, 2004). While suitable habitat occurs within the SGCP area, there are no local records of this species.

Table 20-1 Likelihood of Occurrence of Threatened and Near Threatened Flora Species in the SGCP Area (cont)

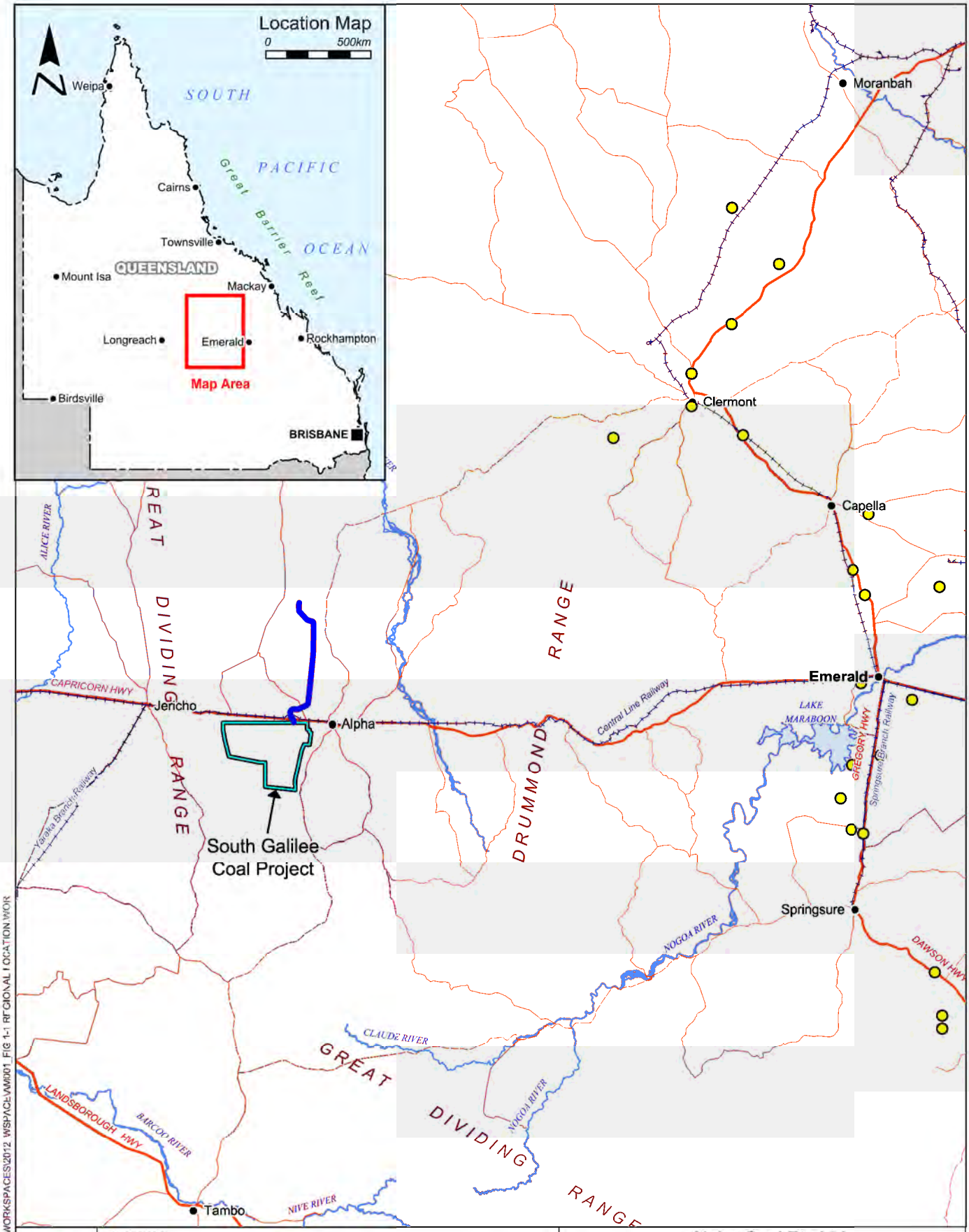
Scientific Name	Common Name	*EPBC Act*	Likelihood of Presence*	Distribution, Ecology and Habitat Preference	Background Information and Results of Field Assessments
Cadellia pentastylis	Ooline	V	Possible	• *Cadellia pentastylis* is a medium-sized spreading tree growing to between 10 and 25 m high (DEWHA, 2008b). • Occurs from NSW north to Carnarvon Range and Callide Valley, south-west of Rockhampton (DEWHA, 2008b). • Grows in dry rainforest, semi-evergreen vine thickets and sclerophyll ecological communities, often locally dominant or as an emergent (DEWHA, 2008b). • Conserved within a number of national parks including Tregole National Park (NP), Sundown NP, Carnarvon Gorge NP, Mt Kaputar NP, Gamilaroi Nature Reserve (NR), Gibraltar NR, Bunal Flora Reserve (FR), Mehi FR, Campbell State Forest (SF) and Deriah SF (DEWHA, 2008b). • Land clearance, feral animals and weeds are identified threats to this species (SEWPaC, 2012c).	Records of this species were present only within the *EPBC Act* Protected Matters Search Tool which includes predictive results. No local records from specimen or observation-backed databases were present. This species usually occurs in dry rainforest and semi-evergreen vine thickets. However, it is known from sclerophyll ecological communities, co-dominating with eucalypt and cypress pine species (DEC, 2005). It is considered possible that the species occurs on sandstone ranges or hills and lowlands on metamorphic rock (Land zone 10 under DEHP RE framework) within the SGCP area.
Commersonia argentea	Silver Kurrajong	V	Unlikely	• *Commersonia argentea* is a shrub that grows to 1.5–4 m. • Occurs from near Injune, west along the Great Dividing Range towards Tambo in central Queensland (DEWHA, 2008c).	All species records are from the south Brigalow Belt region. This species is not believed to occur or have suitable habitat within the SGCP area.
Dichanthium queenslandicum	King Blue-grass	V	Unlikely	• Perennial grass species most frequent in the Brigalow Belt North bioregion (DEWR, 2007).	This species occurs mostly on black clay soils and could potentially be found in RE 11.4.8 within the SGCP area, although this is unlikely as there are no records this far inland. This species is not believed to occur within the SGCP area.

Table 20-1 Likelihood of Occurrence of Threatened and Near Threatened Flora Species in the SGCP Area (cont)

Scientific Name	Common Name	*EPBC Act*	Likelihood of Presence*	Distribution, Ecology and Habitat Preference	Background Information and Results of Field Assessments
Marsdenia brevifolia	Short-leaved Milk-vine	V	Unlikely	• *Marsdenia brevifolia* is a sub-shrub to 1 m high. • Flowering occurs from November to February, fruiting from February to June (DEWHA, 2008d). • Occurs in north and central Queensland where it is known from localities near Townsville, Springsure and north of Rockhampton (DEWHA, 2008d). • Reserved in Minerva Hills National Park, near Springsure (DEWHA, 2008d). • The main identified threats are grazing, land clearing, and too frequent burning (DEWHA, 2008d).	According to the Wildnet database, this species has been recorded north of Bogantungan, approximately 65 km east of Alpha. It occurs in a variety of habitat types but is typically located in dry eucalypt forests with grassy understories on steep rocky slopes or ridges. While dry eucalypt forests are common within the SGCP area, most areas are not rocky. Although this species is not considered likely to occur, there is possible habitat in the western portion of the SGCP area.

* **Unlikely** = Habitat not present and no local records. **Possible** = Suitable habitat or local records were present; or where potential habitat was widespread but specific habitat features were absent and extensive targeted surveys did not reveal the presence of the species or where suitable habitat was present by very limited in extent and targeted did not reveal the presence of the species

Status: **V** = vulnerable



S:\PROJECTS\AM001 STH GALILEE E SL_MAPINFO\WORKSPACES\2012 WSPACE\AM001_FIG 1-1 REGIONAL LOCATION.WOR

LEGEND

- MLA70453
- Infrastructure Corridor
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- River
- Population centre

Species:

- Two-nerved Wattle (*Acacia deuterapeura*)

Data Source:
Tenement - DEEDI. Topography (250k) - Geoscience Australia.

Alpha Coal Pty Ltd

South Galilee Coal Project

Nearest Records for Two-nerved Wattle

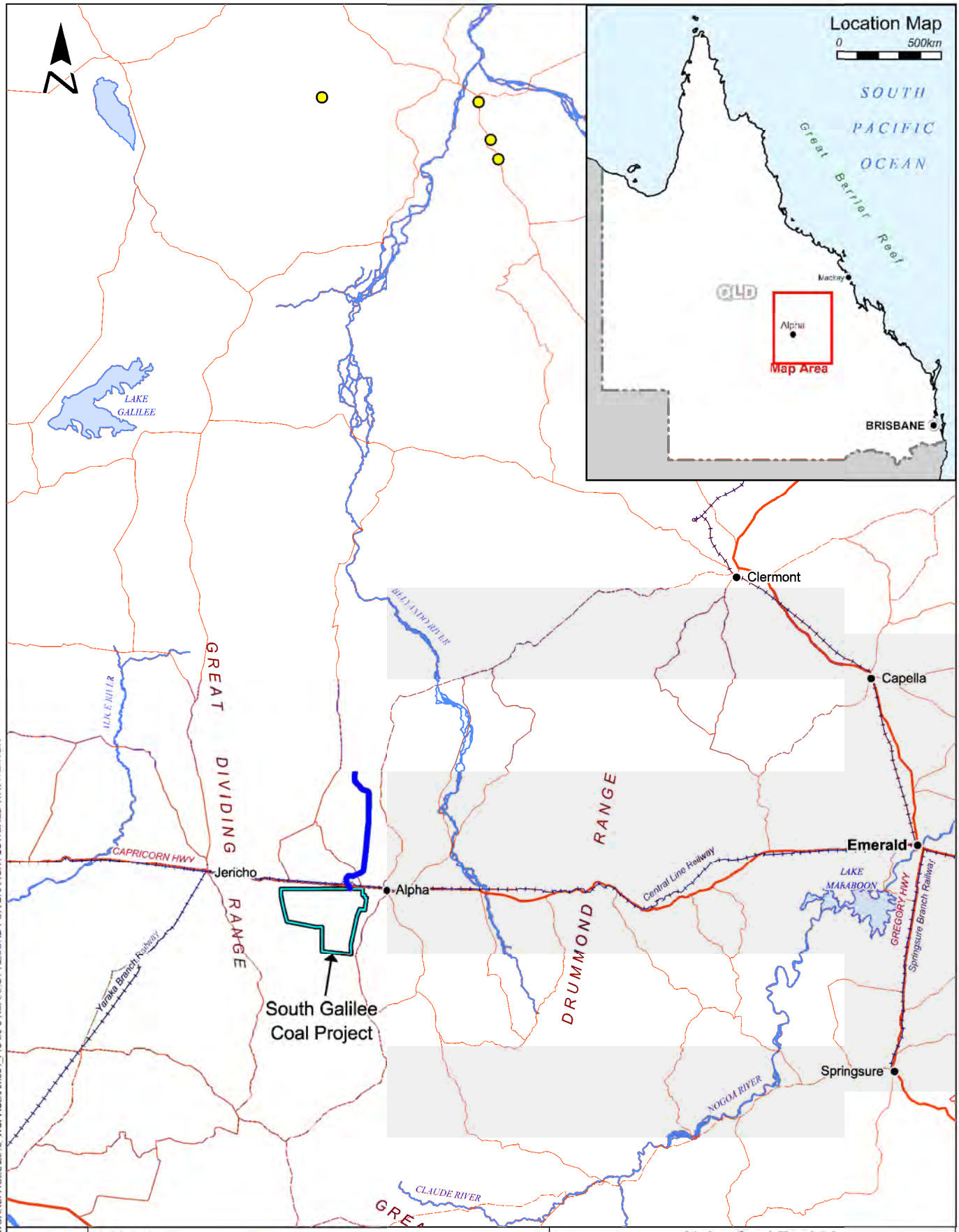
25 0 25
Kilometres

Scale: 1:1,500,000 (A4)

30/07/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-5



LEGEND

- MLA70453
- Infrastructure Corridor
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- River
- Population centre

Species:

- Branch-flowered Wattle (*Acacia ramiflora*)

Data Source:
Tenement - DEEDI. Topography (250k) - Geoscience Australia.

Alpha Coal Pty Ltd

South Galilee Coal Project

Nearest Record for Branch-flowered Wattle

25 0 25
Kilometres

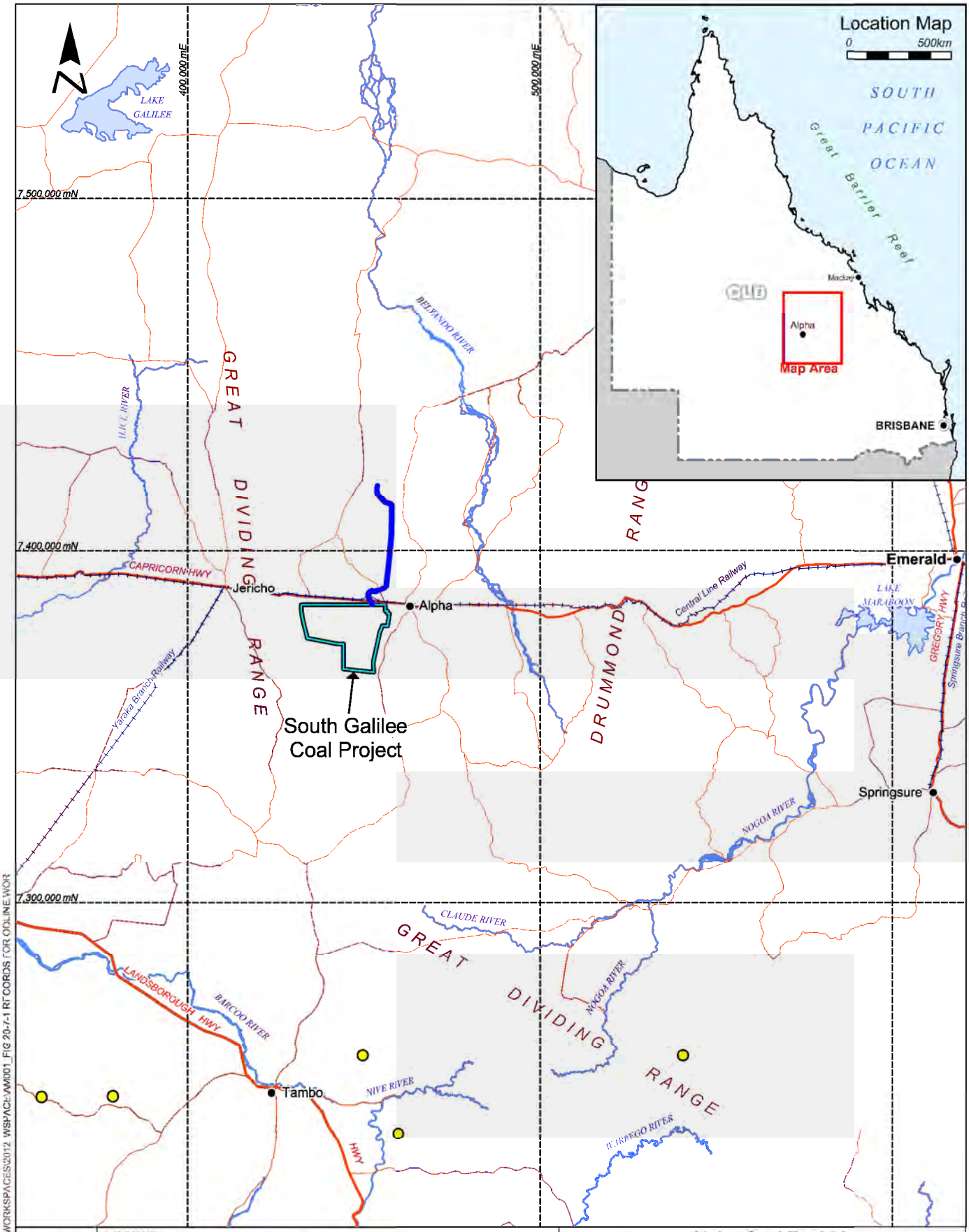
Scale: 1:1,500,000 (A4)

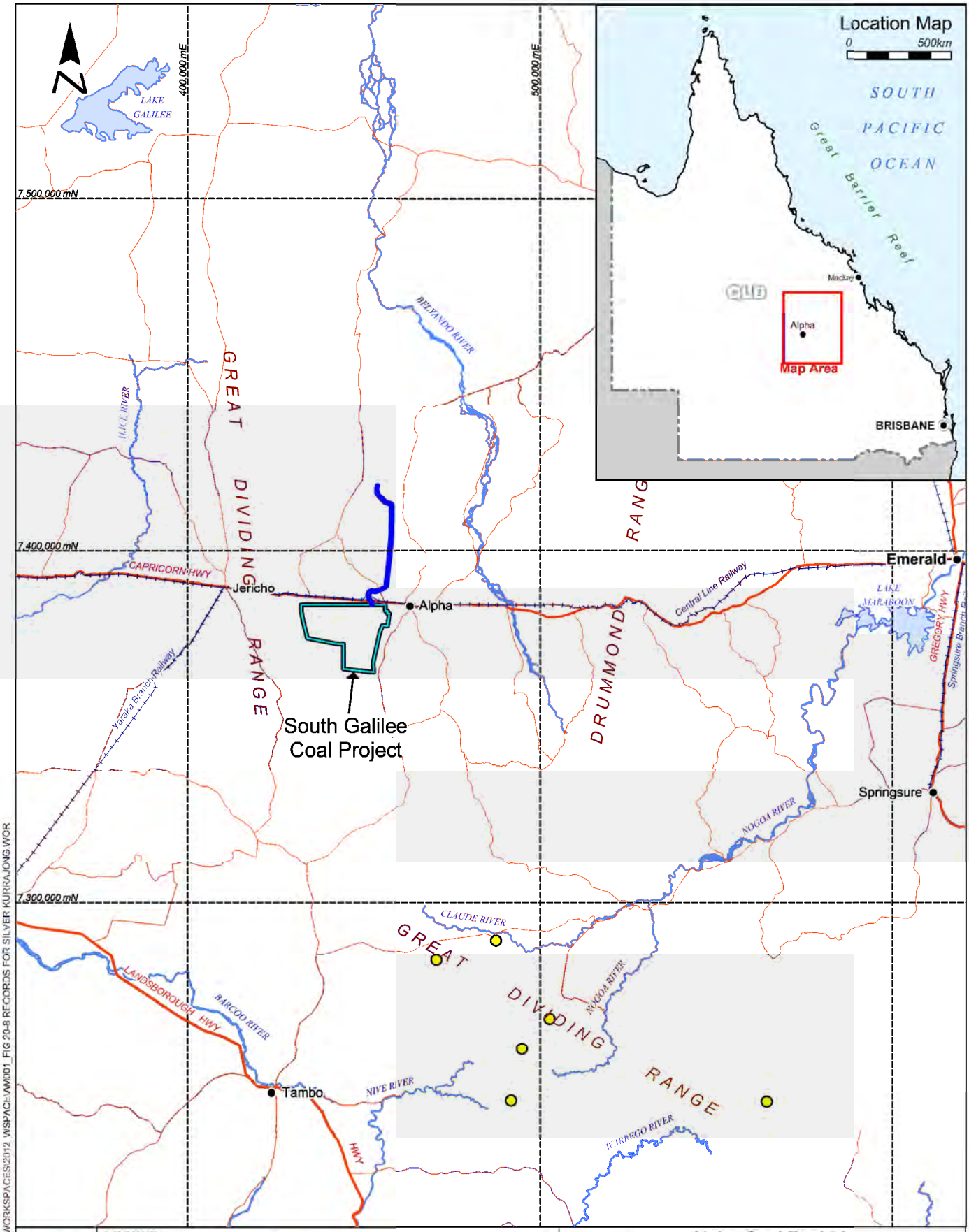
31/07/2012

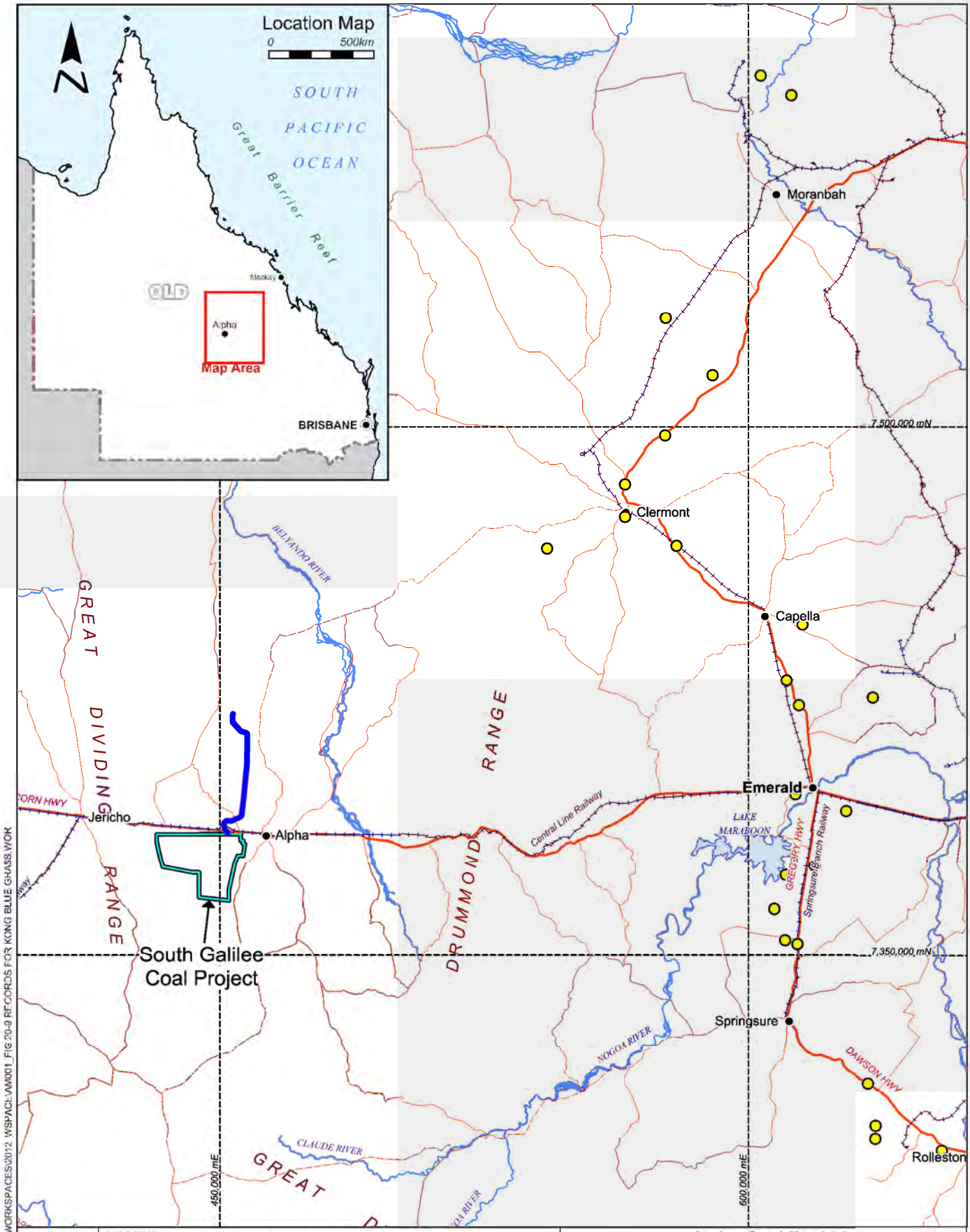
Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-6

S:\PROJECTS\AM001 STH GALILEE E SL_MAPINFO\WORKSPACES\2012 WSPACE\AM001_FIG 20-6 NEAREST RECORD FOR BRANCH-FLOWERED WATTLE.WOR


Location Map
0 500km
SOUTH PACIFIC OCEAN
Great Barrier Reef
Mackay
Alpha
Map Area
BRISBANE
LAKE GALILEE
400,000 mE
500,000 mE
7,500,000 mN
7,400,000 mN
7,300,000 mN
BELYANDO RIVER
ILIC RIVER
GREAT DIVIDING RANGE
DRUMMOND RANGE
CAPRICORN HWY
Jericho
Alpha
Emerald
Central Line Railway
LAKE MARABOON
GREGORY HWY
Springsure Branch
Yaraka Branch Railway
South Galilee Coal Project
Springsure
NOGOA RIVER
CLAUDE RIVER
LANDSBOROUGH HWY
BARCOO RIVER
Tambo
NIVE RIVER
HWY
ILKAEGO RIVER
LEGEND
MLA70453
Exploration tenement
Principal road
Road (sealed)
Road (unsealed)
Railway
River
Population centre
Species:
Ooline (Cadellia pentastylis)
Data Source: Tenement - DEEDI, Topography (250k) - Geoscience Australia.
METSERVE
SouthGalilee
Alpha Coal Pty Ltd
South Galilee Coal Project
Nearest Records for Ooline
25 0 25
Kilometres
Scale: 1:1,500,000 (A4)
31/07/2012
Proj. : MGA Z55
Datum: GDA 1994
FIGURE 20-7
S:\PROJECTS\AM001 STH GALILEE E SL_MAPINFO\WORKSPACES\2012 WSPACE\AM001_FIG 20-7-1 RECORDS FOR OOLINE.WOR


Location Map
0 500km
SOUTH PACIFIC OCEAN
Great Barrier Reef
Mackay
Alpha
Map Area
BRISBANE
LAKE GALILEE
400,000 mE
500,000 mE
7,500,000 mN
7,400,000 mN
7,300,000 mN
BELYANDO RIVER
ILIC RIVER
GREAT DIVIDING RANGE
DRUMMOND RANGE
CAPRICORN HWY
Jericho
Alpha
Emerald
Central Line Railway
LAKE MARABOON
GREGORY HWY
Springsure Branch
Yaraka Branch Railway
South Galilee Coal Project
Springsure
NOGOA RIVER
CLAUDE RIVER
GREAT DIVIDING RANGE
LANDSBOROUGH HWY
BARCOO RIVER
Tambo
NIVE RIVER
HWY
ILLIRGO RIVER
LEGEND
MLA70453
Exploration tenement
Principal road
Road (sealed)
Road (unsealed)
Railway
River
Population centre
Species:
Silver Kurrajong (Commersonia argentea)
Data Source: Tenement - DEEDI, Topography (250k) - Geoscience Australia.
METSERVE
SouthGalilee
Alpha Coal Pty Ltd
South Galilee Coal Project
Nearest Records for Silver Kurrajong
25 0 25
Kilometres
Scale: 1:1,500,000 (A4)
31/07/2012
Proj. : MGA Z55
Datum: GDA 1994
FIGURE 20-8
S:\PROJECTS\AM001 STH GALILEE E SL_MAPINFO\WORKSPACES\2012 WSPACE\AM001_FIG 20-8 RECORDS FOR SILVER KURRAJONG.WOR



LEGEND

- MLA70453
- Exploration tenement
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- River
- Population centre

Species:

- King Blue grass (*Dichanthium queenslandicum*)

Data Source: Tenement - DEEDI, Topography (250k) - Geoscience Australia.

Alpha Coal Pty Ltd

South Galilee Coal Project

Nearest Records for King Blue-grass

25 0 25
Kilometres

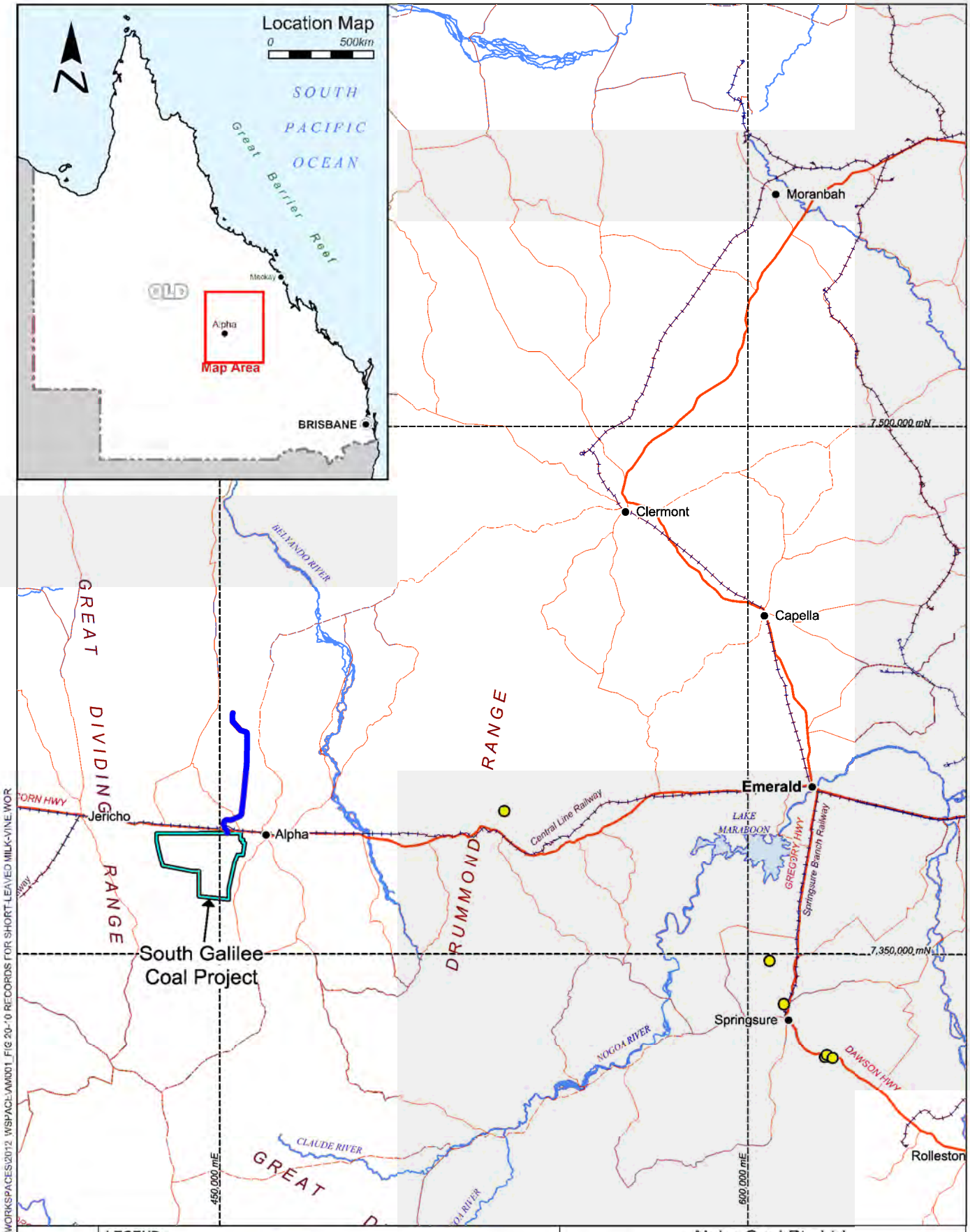
Scale: 1:1,500,000 (A4)

31/07/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-9

S:\PROJECTS\AM001 STH GALILEE E SL_MAPINFO\WORKSPACES\2012 WSPACE\AM001_FIG 20-9 RECORDS FOR KING BLUE GRASS.WOR



S:\PROJECTS\AM001 STH GALILEE E SL_MAPINFO\WORKSPACES\2012 WSPACE-AM001_FIG 20-10 RECORDS FOR SHORT-LEAVED MILK-VINE.WOR

LEGEND

- MLA70453
- Exploration tenement
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- River
- Population centre

Species:

- Short leaved Milk vine (*Marsdenia brevifolia*)

Data Source: Tenement - DEEDI, Topography (250k) - Geoscience Australia.

Alpha Coal Pty Ltd

South Galilee Coal Project

Nearest Records for Short-leaved Milk-vine

25 0 25
Kilometres

Scale: 1:1,500,000 (A4)

31/07/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-10

20.2.1.2.2. Terrestrial Fauna

The Brigalow Scaly-foot and Koala were confirmed to occur within the SGCP area (**Figure 20-11**). No other species listed as threatened under the *EPBC Act* were detected; although a further 11 species may potentially occur (refer to **Table 20-2**).

The Brigalow Scaly-foot is found mainly in the Brigalow Belt bioregion, from Inglewood in the south, north to Emerald, east to Gladstone and west to Blackall (DERM, 2010). The record from the SGCP is the first verified record of the species from the wider Alpha region (Richardson, 2008; SEWPaC, 2011a). The nearest publicly available records are from Idalia National Park located 215 km to the south-west, Buchanan located approximately 205 km to the north-west, Tambo located approximately 130 km to the south and Emerald located approximately 165 km to the east.

The Koala is widespread across coastal and semi-arid eastern Australia. Populations in New South Wales, the Australian Capital Territory and Queensland have recently been listed as Vulnerable under the *EPBC Act*, due to on-going declines.

Threatened species potentially occurring, according to the EPBC Protected Matters Search, but not recorded during ecological surveys were assigned a likelihood of occurrence within the SGCP area based on historical records, known geographical range and habitat availability (refer to **Table 20-2**).

The nearest records and potential habitat for each potentially present threatened fauna listed under the *EPBC Act* is shown on **Figure 20-11** to **Figure 20-30**.

Table 20-2 Likelihood of Occurrence of Threatened and Near Threatened Fauna Species in the SGCP Area

Scientific Name	Common Name	*EPBC Act* Status	Likelihood of Presence	Distribution, Ecology and Habitat Preference	Background Information and Results of Field Assessments
Mammals					
Dasyurus hallucatus	Northern Quoll	E	Possible	• Small, nocturnal, carnivorous marsupial. • Habitat usually requires some form of rocky area or structurally diverse woodlands/forest for denning/shelter purposes with surrounding vegetated habitats used for foraging and dispersal (SEWPaC, 2011). • Threats include lethal toxic ingestion caused by cane toads, removal, degradation and fragmentation of habitat, inappropriate fire regimes, weeds, feral predators and parasitism.	The EPBC Protected Matters search (50 km buffer) identified that this species or its habitat may occur within the area. No local records from specimen or observation-based databases were present. Suitable habitat is present within the SGCP area and it is therefore possible that this species occurs within the site, despite a lack of local records. The nearest records of this species are from the Carnarvon Range, approximately 120 km south of the SGCP area.
Phascolarctos cinereus	Koala	V	Confirmed	• Inhabits eucalypt forests and woodlands across eastern Australia. • In semi-arid Queensland, River Red Gum (*Eucalyptus camaldulensis*) and Poplar Box (*Eucalyptus populnea*) are important food trees (Gordon *et al.* 1988; Ellis *et al.* 2002). • Riparian areas are especially important refuges during drought (Gordon *et al.* 1988). • Threats include urbanisation, habitat clearance and fragmentation, drought, climate change, and feral predators (Natural Resources Management Ministerial Council 2009).	Scats from koalas were recorded in River Red Gum woodland along Tallarenha Creek. Koalas are likely to be thinly distributed across favourable habitat elsewhere in the SGCP area.

Table 20-2 Likelihood of Occurrence of Threatened and Near Threatened Fauna Species in the SGCP Area (cont)

Scientific Name	Common Name	*EPBC Act* Status	Likelihood of Presence	Distribution, Ecology and Habitat Preference	Background Information and Results of Field Assessments
Mammals					
Nyctophilus corbeni	South-eastern Long-eared Bat	V	Possible	• The South-eastern Long-eared Bat roosts solitarily under exfoliated bark and in the crevices on trees. During maternity, females are believed to form roosting colonies in larger tree cavities. • In Queensland, the species is mainly recorded in the Brigalow Belt South Bioregion, extending eastwards to the Bunya Mountains National Park. The species is rare throughout most of its distribution. • The South-eastern Long-eared Bat occurs in a range of inland woodland vegetation types, including box, ironbark and cypress pine woodlands. • Threats include habitat loss and fragmentation, fire, forestry activities, overgrazing, predation by feral species, tree hollow competition, exposure to agrichemicals and climate change.	The EPBC Protected Matters search (50 km buffer) identified that this species or its habitat may occur within the area. No local records from specimen or observation-based databases were present. Suitable habitat is present within the SGCP area and it is therefore possible that this species occurs within the site, despite a lack of local records. The nearest publicly available record of this species is west of Taroom, approximately 320 km away.

Table 20-2 Likelihood of Occurrence of Threatened and Near Threatened Fauna Species in the SGCP Area (cont)

Scientific Name	Common Name	*EPBC Act* Status	Likelihood of Presence	Distribution, Ecology and Habitat Preference	Background Information and Results of Field Assessments
Reptiles					
Delma torquata	Collared Delma	V	Possible	• Endemic to Queensland. • Normally inhabits Eucalypt-dominated woodlands and open forests. • Threats include habitat loss through clearing for agriculture, habitat degradation by overgrazing by stock, removal of rocks, coarse woody debris and ground litter, use of agricultural chemicals, predation by Feral Cats and Foxes and weed invasion.	The EPBC Protected Matters search (50 km buffer) identified that this species or its habitat may occur within the area. No local records from specimen or observation-based databases were present. Suitable habitat is present within the SGCP area and it is therefore possible that this species occurs within the site, despite a lack of local records. The nearest record of this species is at Blackdown Tableland National Park, more than 250 km east of the SGCP area.
Denisonia maculata	Ornamental Snake	V	Likely	• The species is known only from the Brigalow Belt. • Habitat includes woodlands and open forests associated with moist areas, particularly gilgai mounds and depressions. • Threats include habitat loss through clearing, habitat fragmentation, alternation of landscape hydrology and water quality, Cane Toad, predation by feral species and invasive weeds.	The SGCP area is within the known distribution of the Ornamental Snake (SEWPaC, 2011a) and there is high quality habitat within the SGCP area.
Egernia rugosa	Yakka Skink	V	Likely	• The Yakka Skink is known to occur in open dry sclerophyll forest, woodland and scrub. • The core habitat of this species is within the Mulga Lands and Brigalow Belt South Bioregions. • The main threats are habitat reduction and degradation.	The SGCP contains likely or known habitat for the Yakka Skink (SEWPaC, 2011a). The nearest record of this species is from Bogantungan, approximately 60 km from the SGCP area.

Table 20-2 Likelihood of Occurrence of Threatened and Near Threatened Fauna Species in the SGCP Area (cont)

Scientific Name	Common Name	*EPBC Act* Status	Likelihood of Presence	Distribution, Ecology and Habitat Preference	Background Information and Results of Field Assessments
Furina dunmalli	Dunmall's Snake	V	Likely	Dunmall's Snake has been found in a broad range of habitats, including: • forests and woodlands on black alluvial cracking clay and clay loams dominated by Brigalow, other Acacias, native Cypress or Bull-oak • various Blue Spotted Gum, Ironbark, White Cypress Pine and Bull-oak open forest and woodland associations on sandstone derived soils. • Threats include clearing of habitat, overgrazing of habitat by domestic stock, loss of fallen timber and ground litter, e.g. fuel reduction burns, firewood collection, invasion of habitat by predatory animals and introduced weeds and possible drainage of swamps.	The *EPBC Act* Protected Matters search (50 km buffer) identified that this species or its habitat may occur within the area. Ideal habitat for this species is present within the SGCP area. It is therefore considered likely that the species may occur, despite the lack of local records.
Paradelma orientalis	Brigalow Scaly-foot	V	Confirmed	• Known to occur only in Queensland. • The species is found in a wide variety of remnant and non-remnant open forest to woodland habitats. • Known to persist in highly disturbed vegetation types, including areas invaded by Buffel Grass, *Parthenium* and other weeds. • Threats include vegetation clearance, inappropriate roadside management, feral animals and inappropriate fire regimes.	The April 2010 survey conducted by MET Serve caught one specimen of this species in a patch of *Callitris* forest towards the east of the mine survey area. This is the first record of this species within the local area and is outside of the recognised distribution of this species (SEWPaC, 2011a).

Table 20-2 Likelihood of Occurrence of Threatened and Near Threatened Fauna Species in the SGCP Area (cont)

Scientific Name	Common Name	*EPBC Act* Status	Likelihood of Presence	Distribution, Ecology and Habitat Preference	Background Information and Results of Field Assessments
Rheodytes leukops	Fitzroy River Turtle	V	Unlikely	• The Fitzroy River Turtle is found in rivers with large deep pools with rocky, gravelly or sandy substrates, connected by shallow riffles. • Turtles often associate with logs in deeper water, and may sit on the downstream side or under rocks in fast flowing riffles. • Threats include egg predation and nest destruction and habitat modification and degradation.	The *EPBC Act* Protected Matters search (50 km buffer) identified that this species or its habitat may occur within the area. No local records from specimen or observation-backed databases were present. Permanent water is absent from Alpha Creek in the SGCP area or nearby and therefore it is considered unlikely that this species will occur.
Birds					
Geophaps scripta scripta	Squatter Pigeon	V	Likely	• The Squatter Pigeon occurs on the inland slopes of the Great Dividing Range. • Occurs mainly in grassy woodlands and open forests dominated by eucalypts. • Commonly observed in habitats that are located close to bodies of water. • Threats include loss of habitat due to clearing, degradation of habitat by grazing herbivores and excessive predation.	The *EPBC Act* Protected Matters search (50 km buffer) identified that this species or its habitat may occur within the area. No local records from specimen or observation-backed databases were present. Suitable habitat for the species is widespread throughout both remnant and non-remnant habitats. However, the SGCP area is near the western limit of the species' distribution, and may thus consist of marginal habitat. Given that the species is relatively obvious when present, local populations (if present) are probably small and/or only utilise the SGCP area sporadically. While Squatter Pigeons may not be frequent or resident, this species is likely to occur in the SGCP area in a transient capacity.

Table 20-2 Likelihood of Occurrence of Threatened and Near Threatened Fauna Species in the SGCP Area (cont)

Scientific Name	Common Name	*EPBC Act* Status	Likelihood of Presence	Distribution, Ecology and Habitat Preference	Background Information and Results of Field Assessments
Neochmia ruficauda ruficauda	Star Finch (sth)	E	Unlikely	• Occurs mainly in grasslands and grassy woodlands that are located close to bodies of fresh water. It also occurs in cleared or suburban areas such as along roadsides and in towns. • Threats include habitat degradation through livestock overgrazing and invasion by weeds, prolonged drought and historical collection for the bird trade.	The *EPBC Act* Protected Matters search (50 km buffer) identified that this species or its habitat may occur within the area. No local records from specimen or observation-backed databases were present and hence the species may not occur within the local area. An inhabitant of open native grasslands and woodlands, particularly those associated with watercourses, the species is extremely uncommon in the local area and rarely detected. Buffel Grass infestations and grazing of wetland edges renders habitat unsuitable. The lack of records from the local area or region, and its general scarcity, strongly suggest the species is unlikely to occur in the SGCP area.

Table 20-2 Likelihood of Occurrence of Threatened and Near Threatened Fauna Species in the SGCP Area (cont)

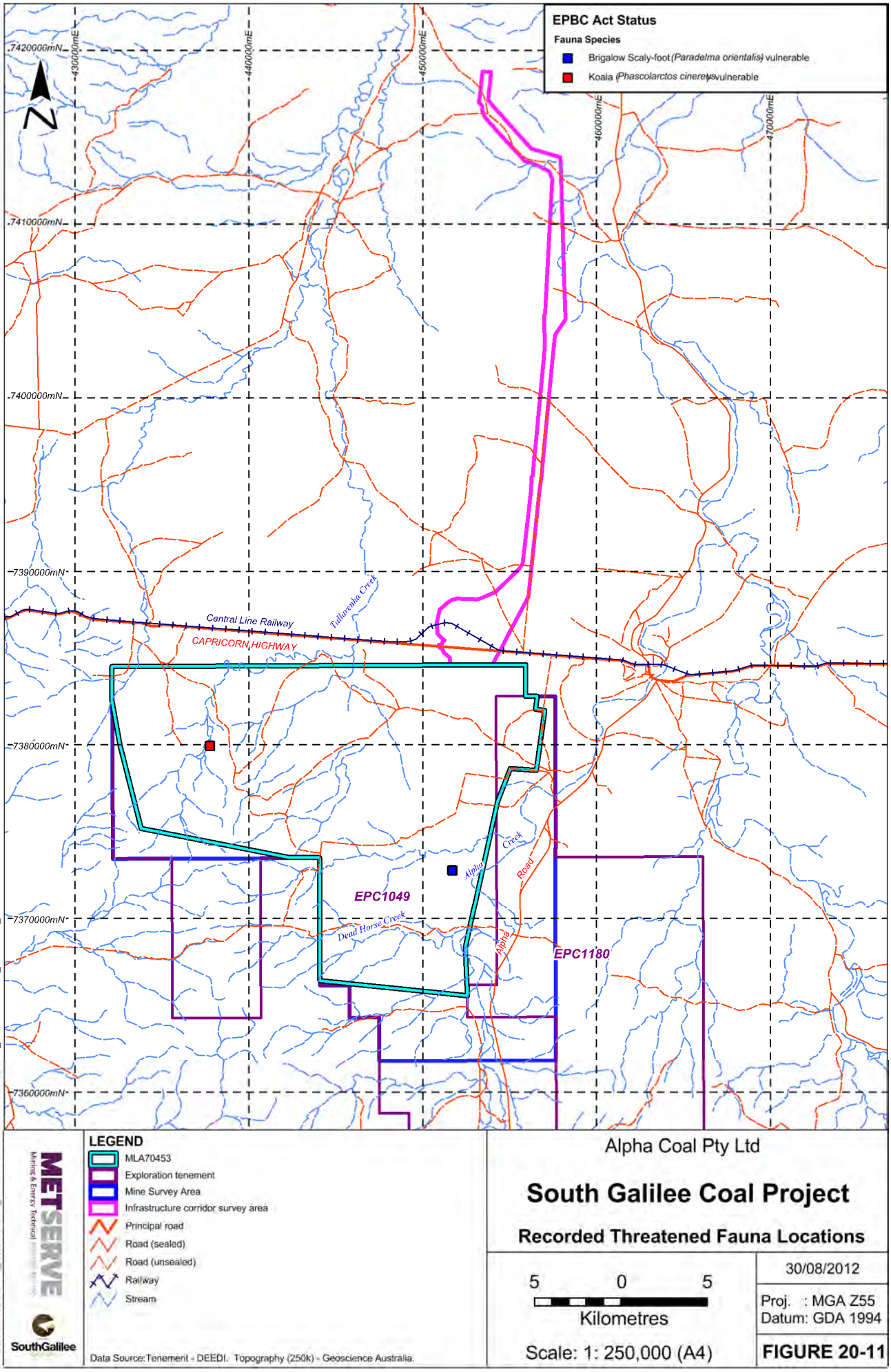
Scientific Name	Common Name	*EPBC Act* Status	Likelihood of Presence	Distribution, Ecology and Habitat Preference	Background Information and Results of Field Assessments
Poephila cincta cincta	Black-throated Finch (sth)	E	Likely	• Sedentary bird which nests in loose colonies. • The Black-throated Finch (southern) occurs in the Townsville region and at scattered sites in central-eastern Queensland, including north of Alpha at Bimblebox Nature Reserve. • Occurs mainly in grassy, open woodlands and forests, typically dominated by Eucalyptus, Corymbia and Melaleuca, and occasionally in tussock grasslands or other habitats (DEWHA, 2009a. • Species requires access to water sources, grass seeds and trees, providing suitable nesting habitat (DEWHA, 2009a). • Threats include land clearance, habitat fragmentation and degradation, alteration of habitat by fire regimes, exotic weeds, illegal trapping, predation by introduced pests and hybridisation with the northern subspecies.	The *EPBC Act* Protected Matters search (50 km buffer) identified that this species or its habitat may occur within the area. No local records from specimen or observation-backed databases were present. The Black-throated Finch may have historically occurred in the SGCP area, but has suffered a significant range contraction over the last 50 years, and has largely disappeared from south of Belyando Crossing (180 km north-northwest of the SGCP area). An isolated population at Bimblebox Nature Refuge, 25 km north-west of the infrastructure corridor survey area has been recently identified (Agnew, 2011), indicating that the species may still persist locally. Surveys failed to detect Black-throated Finches within the SGCP area. These surveys were effective at detecting large numbers of other finch species (Zebra Finch, Double-barred Finch, Plum-headed Finch), indicating that survey methods were likely adequate for detecting the Black-throated Finch, if it was present. Nevertheless, potential habitat for the Black-throated Finch does occur in the SGCP area. The species inhabits a variety of remnant vegetation types with native grassy understories. Black-throated Finches also require nearby permanent water sources, as well as hollow trees for breeding sites. While potential habitat exists and is widespread in the SGCP area, grazing and the invasion of Buffel Grass have meant that most habitat is suboptimal. Nevertheless, given the SGCP's proximity to a known population, it is considered likely that low densities of Black-throated Finch may utilise the site, even if only in a transitory capacity.

Table 20-2 Likelihood of Occurrence of Threatened and Near Threatened Fauna Species in the SGCP Area (cont)

Scientific Name	Common Name	*EPBC Act* Status	Likelihood of Presence	Distribution, Ecology and Habitat Preference	Background Information and Results of Field Assessments
Rostratula australis	Australian Painted Snipe	V	Possible	• Recorded at wetlands in all states of Australia. • Generally inhabits shallow terrestrial freshwater wetlands, including temporary and permanent lakes, swamps and claypans. • Breeding habitat requirements are believed to be quite specific (i.e. shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby). • Threats include loss and degradation of habitat, prolonged drought, overgrazing, changes to fire regimes, invasion of weed species and predation by feral animals.	The *EPBC Act* Protected Matters search (50 km buffer) identified that this species or its habitat may occur within the area. No local records from specimen or observation-backed databases were present. Australian Painted Snipes preferentially inhabit ephemeral and semi-ephemeral wetlands with emergent aquatic and semi-aquatic vegetation. Within the SGCP area, there is little or no suitable habitat for this species in most years. Suitable habitat may occur intermittently in flooded areas during years of extreme rainfall, and at these times Australian Painted Snipe may utilise the SGCP area. However, under such conditions habitat is rarely limiting for the species, and it is unlikely that the SGCP area is significant for the Australian Painted Snipe.

* **Unlikely** = Habitat not present and no local records. **Possible** = Suitable habitat or local records were present; or where potential habitat was widespread but specific habitat features were absent and extensive targeted surveys did not reveal the presence of the species or where suitable habitat was present by very limited in extent and targeted did not reveal the presence of the species. **Likely** = Species known from area and suitable habitat is present

Status: **E** = endangered **V** = vulnerable



S:\PROJECTS\AM001_STHGALILEE_EIS\PUBLIC\OUTGOING\20120108_FIGURES\SECT_20\AM001_FIG 20-11 RECORDED THREATENED FAUNA LOCATIONS.WOR

METSERVE
Mining & Energy Technical

SouthGalilee

LEGEND

- MLA70453
- Exploration tenement
- Mine Survey Area
- Infrastructure corridor survey area
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- Stream

Data Source: Tenement - DEEDI. Topography (250k) - Geoscience Australia.

Alpha Coal Pty Ltd

South Galilee Coal Project

Recorded Threatened Fauna Locations

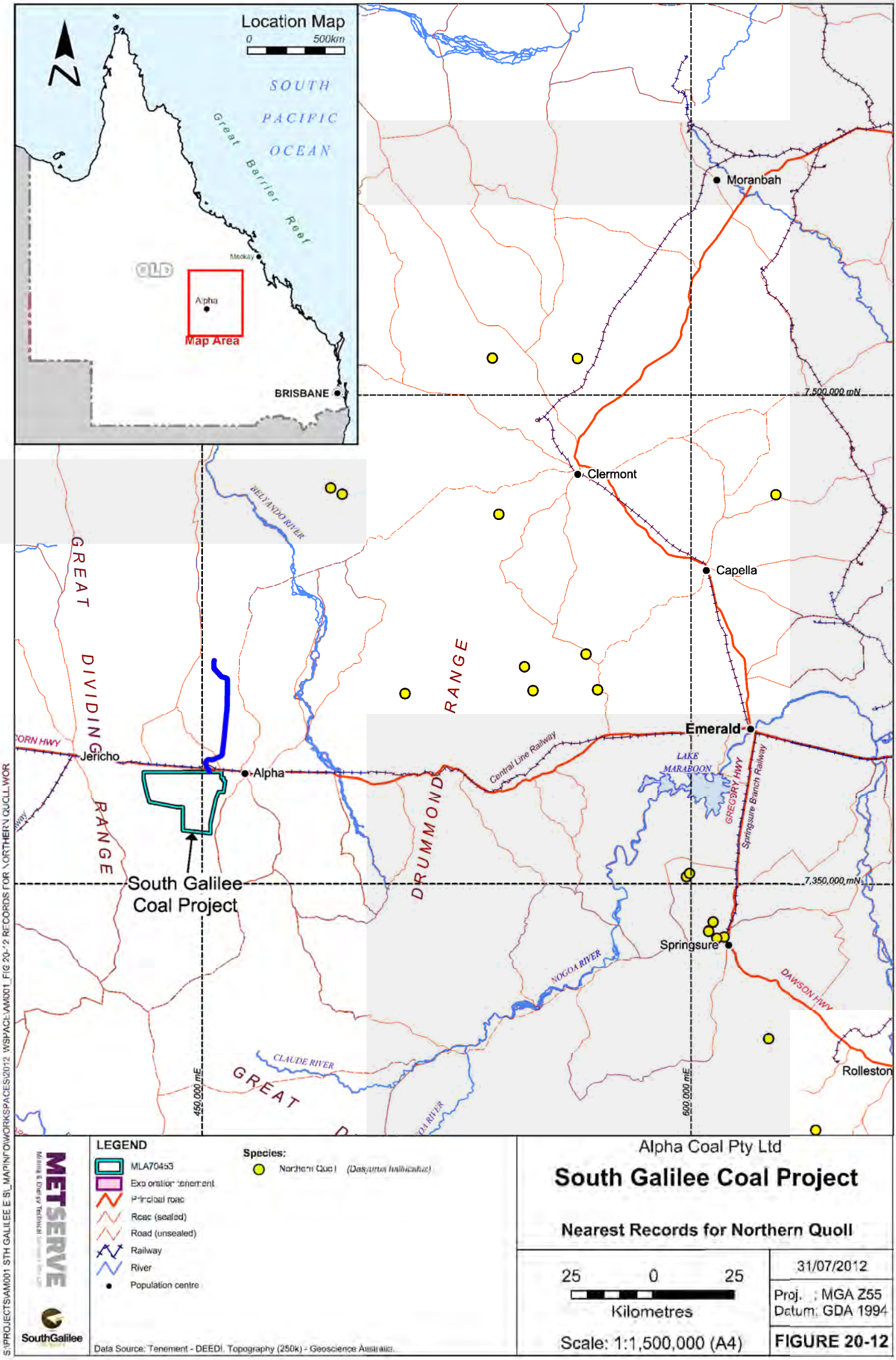
5 0 5
Kilometres

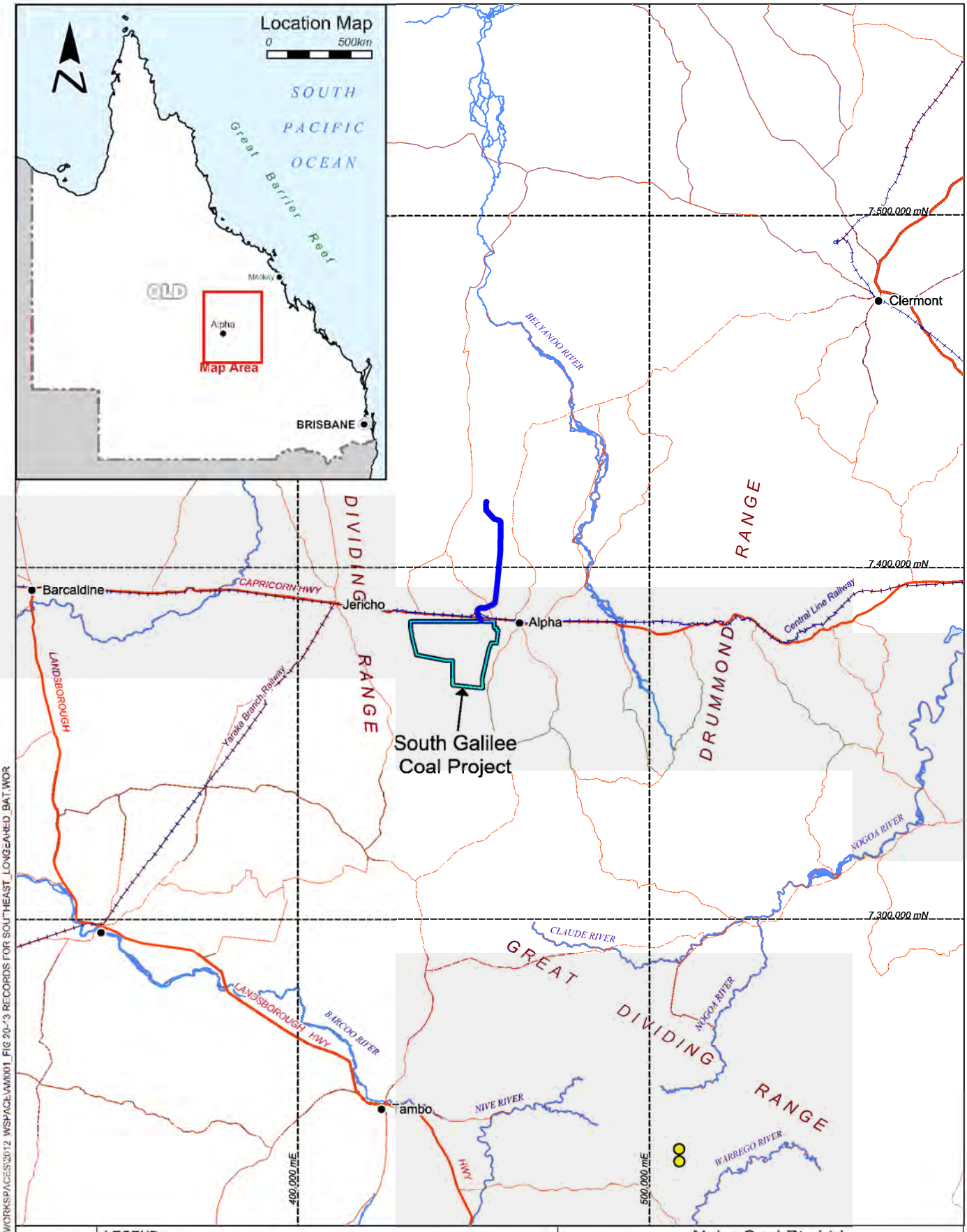
Scale: 1: 250,000 (A4)

30/08/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-11


Location Map
0 500km
SOUTH PACIFIC OCEAN
Great Barrier Reef
QLD
Mackay
Alpha
Map Area
BRISBANE
Moranbah
Clermont
Capella
Emerald
Jericho
Alpha
Springsure
Rolleston
GREAT DIVIDING RANGE
DRUMMOND RANGE
BELYANDO RIVER
Central Line Railway
LAKE MARABOON
GREGORY HWY
Springsure Branch Railway
NOGOA RIVER
DAWSON HWY
CLAUDE RIVER
7,500,000 mN
7,350,000 mN
450,000 mE
600,000 mE
South Galilee Coal Project
LEGEND
MLA70453
Exploration tenement
Principal road
Road (sealed)
Road (unsealed)
Railway
River
Population centre
Species:
Northern Quoll (Dasyurus hallucatus)
Data Source: Tenement - DEEDI, Topography (250k) - Geoscience Australia.
METSERVE
SouthGalilee
Alpha Coal Pty Ltd
South Galilee Coal Project
Nearest Records for Northern Quoll
25 0 25
Kilometres
Scale: 1:1,500,000 (A4)
31/07/2012
Proj. : MGA Z55
Datum: GDA 1994
FIGURE 20-12
S:\PROJECTS\AM001 STH GALILEE E SL_MAPINFO\WORKSPACES\2012 WSPACE\AM001_FIG 20-12 RECORDS FOR NORTHERN QUOLL.WOR



S:\PROJECTS\AM001 STH GALILEE E SL_MAPINFO\WORKSPACES\2012 WSPACE\AM001_FIG 20-13 RECORDS FOR SOUTHEAST_LONGEARED_BAT.WOR

METSERVE

SouthGalilee

LEGEND

- MLA70453
- Exploration tenement
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- River
- Population centre

Species:

- South eastern Long eared Bat (*Nyctophilus corbeni*)

Data Source: Tenement - DEEDI, Topography (250k) - Geoscience Australia.

Alpha Coal Pty Ltd

South Galilee Coal Project

Nearest Records for South-eastern Long-eared Bat

25 0 25

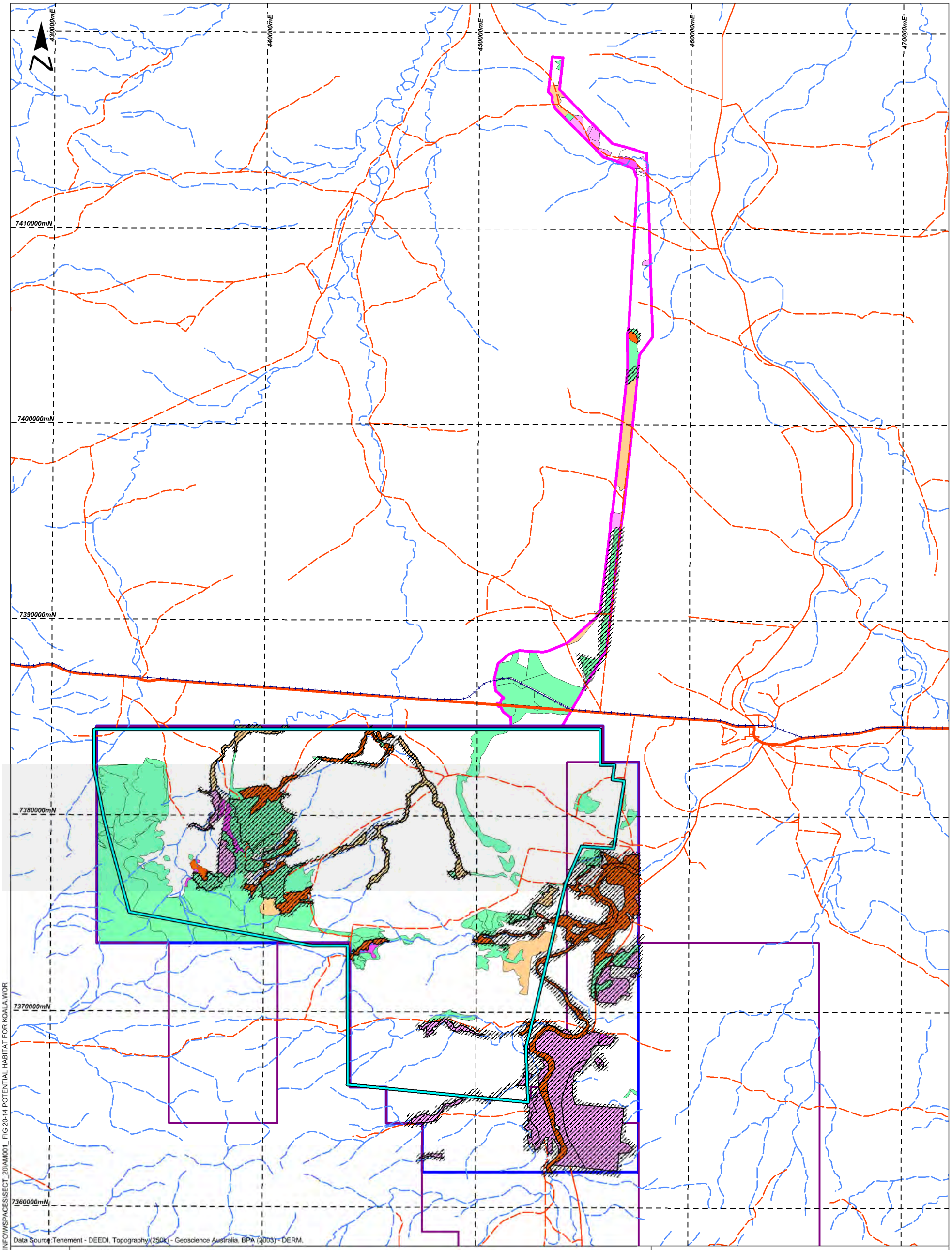
Kilometres

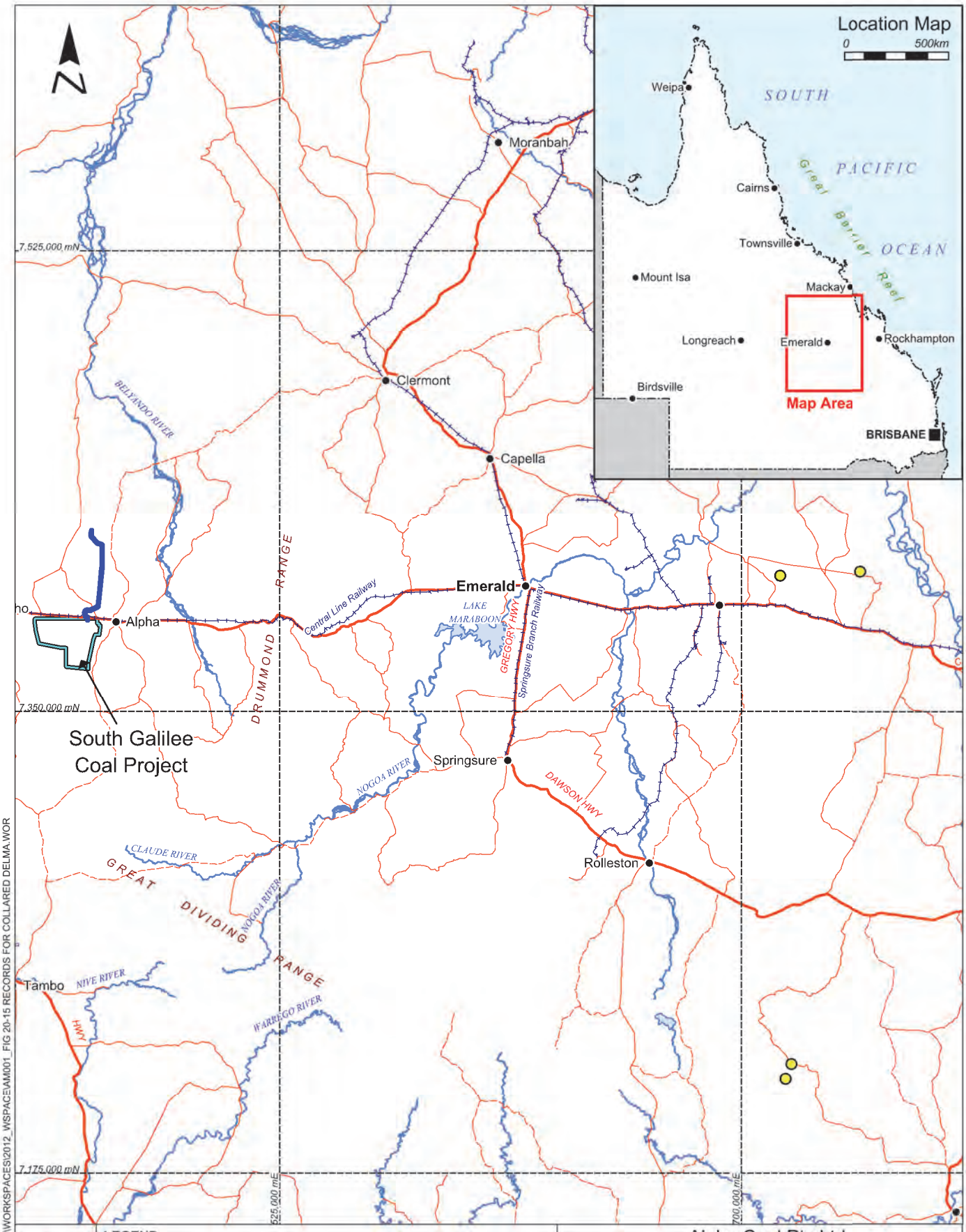
Scale: 1:1,500,000 (A4)

31/07/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-13


430000mE
440000mE
450000mE
460000mE
470000mN
7410000mN
7400000mN
7390000mN
7380000mN
7370000mN
7360000mN
Data Source:Tenement - DEEDI. Topography (250k) - Geoscience Australia. BPA (2003) - DERM.
LEGEND
MLA70453
Exploration lenement
SGCP infrastructure rail corridor
Mine survey area
Infrastructure corridor survey area
Principal road
Road (sealed)
Road (unsealed)
Railway
Stream
Biodiversity Status
Endangered (dominant)
Endangered (sub-dominant)
Of Concern (dominant)
Of Concern (sub-dominant)
Not of Concern
Non-remnant
Potential Habitat
Potential Habitat for Koala
METSERVE
Mining & Energy Technical Services
SouthGalilee
Alpha Coal Pty Ltd
South Galilee Coal Project
Potential Habitat for Koala
0
5
Kilometres
Scale: 1:75,000 (A3)
09/08/2012
Proj. : MGA Z55
Datum: GDA 1994
FIGURE 20-14
S:\PROJECTS\AM001_STHGALILEE_EIS\GIS_MAPINFO\WSPACES\SECT_20\AM001_FIG 20-14 POTENTIAL HABITAT FOR KOALA.WOR



LEGEND

- MLA70453
- Exploration tenement
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- River
- Population centre

Species:

- Collared Delma *(Delma torquata)*

Data Source: Tenement - DEEDI. Topography (250k) - Geoscience Australia.

METSERVE Mining & Energy Technology

SouthGalilee

Alpha Coal Pty Ltd

South Galilee Coal Project

Nearest Records for Collared Delma

50 0 50

Kilometres

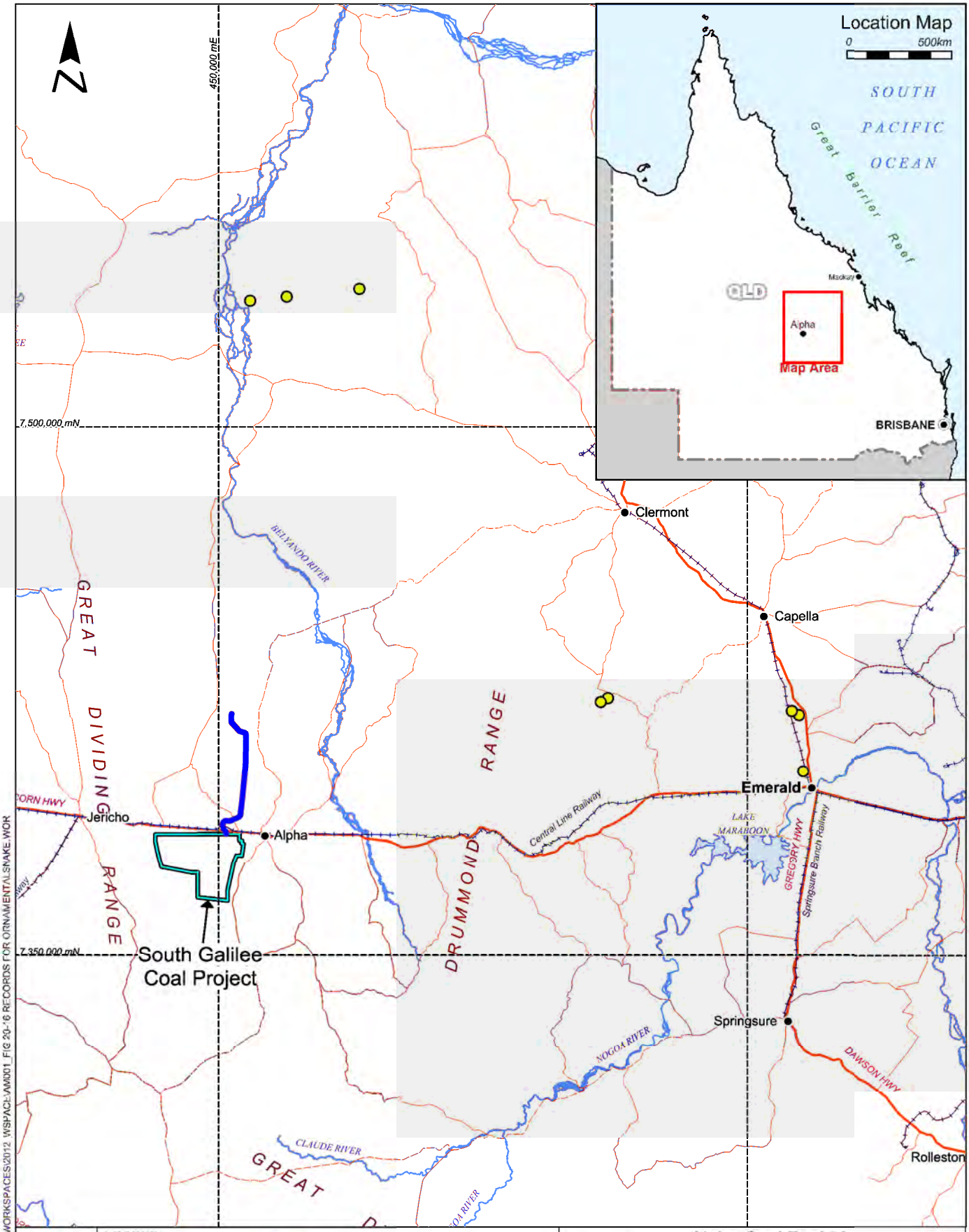
Scale: 1:2,000,000 (A4)

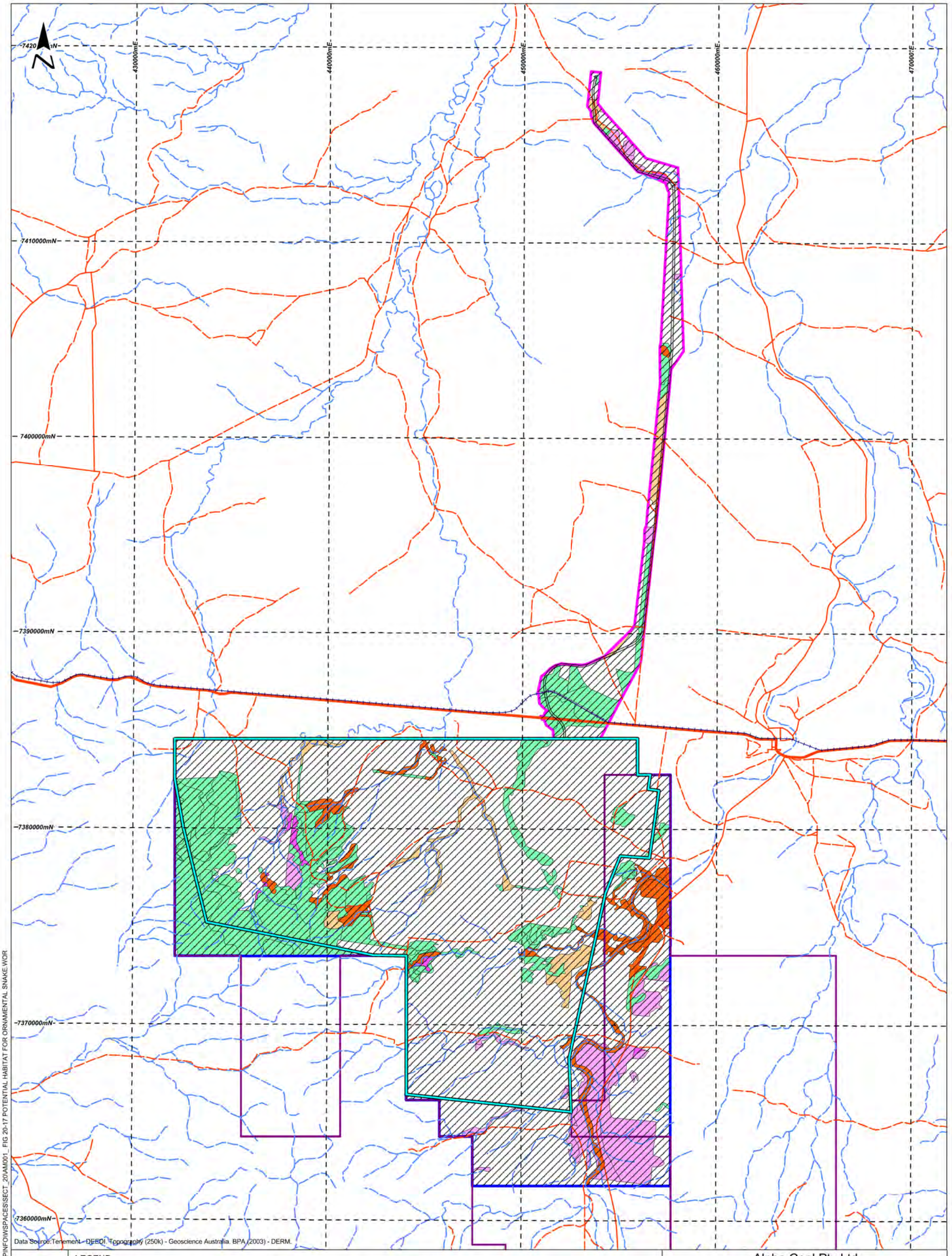
01/08/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-15

S:\PROJECTS\AM001 STH GALILEE EIS_MAPINFO\WORKSPACES\2012_WSPACE\AM001_FIG 20-15 RECORDS FOR COLLARED DELMA.WOR


Location Map
0 500km
SOUTH PACIFIC OCEAN
Great Barrier Reef
QLD
Alpha
Map Area
BRISBANE
450,000 mE
7,500,000 mN
7,350,000 mN
Clermont
Capella
Emerald
Springsure
Rolleston
Alpha
Jicho
Jericho
BELYANDO RIVER
GREAT DIVIDING RANGE
DRUMMOND RANGE
RANGE
Central Line Railway
LAKE MARAROON
GREGORY HWY
Springsure Branch Railway
NOGOA RIVER
DAWSON HWY
CLAUDE RIVER
South Galilee Coal Project
LEGEND
MLA70453
Exploration tenement
Principal road
Road (sealed)
Road (unsealed)
Railway
River
Population centre
Species:
Ornamental Snake (Denisonia maculata)
Data Source: Tenement - DEEDI, Topography (250k) - Geoscience Australia.
METSERVE
SouthGalilee
Alpha Coal Pty Ltd
South Galilee Coal Project
Nearest Records for Ornamental Snake
25 0 25
Kilometres
Scale: 1:1,500,000 (A4)
31/07/2012
Proj. ; MGA Z55
Datum: GDA 1994
FIGURE 20-16
S:\PROJECTS\AM001 STH GALILEE E SL_MAPINFO\WORKSPACES\2012 WSPACE\AM001_FIG 20-16 RECORDS FOR ORNAMENTALSNAKE.WOR



Alpha Coal Pty Ltd

South Galilee Coal Project

Potential Habitat for Ornamental Snake

0 5

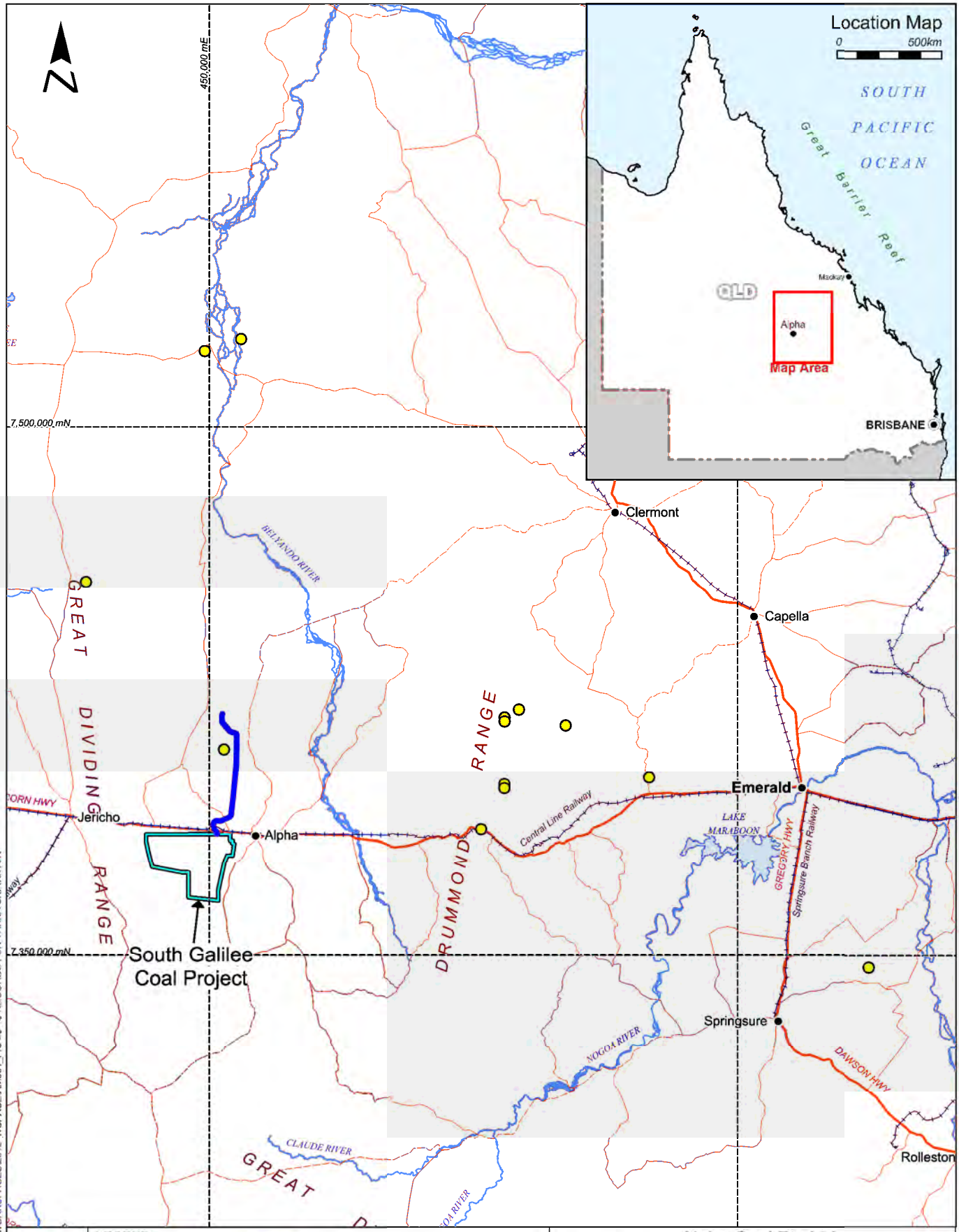
Kilometres

Scale: 1:175,000 (A3)

07/08/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-17



LEGEND

- MLA70453
- Exploration tenement
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- River
- Population centre

Species:

- Yakka Skink (*Egernia rugosa*)

Data Source: Tenement - DEEDI, Topography (250k) - Geoscience Australia.

Alpha Coal Pty Ltd

South Galilee Coal Project

Nearest Records for Yakka Skink

25 0 25
Kilometres

Scale: 1:1,500,000 (A4)

31/07/2012

Proj. ; MGA Z55
Datum: GDA 1994

FIGURE 20-18

S:\PROJECTS\AM001 STH GALILEE E SL_MAPINFO\WORKSPACES\2012 WSPACE\AM001_FIG 20-16 RECORDS FOR YAKKA SKINK.WOR

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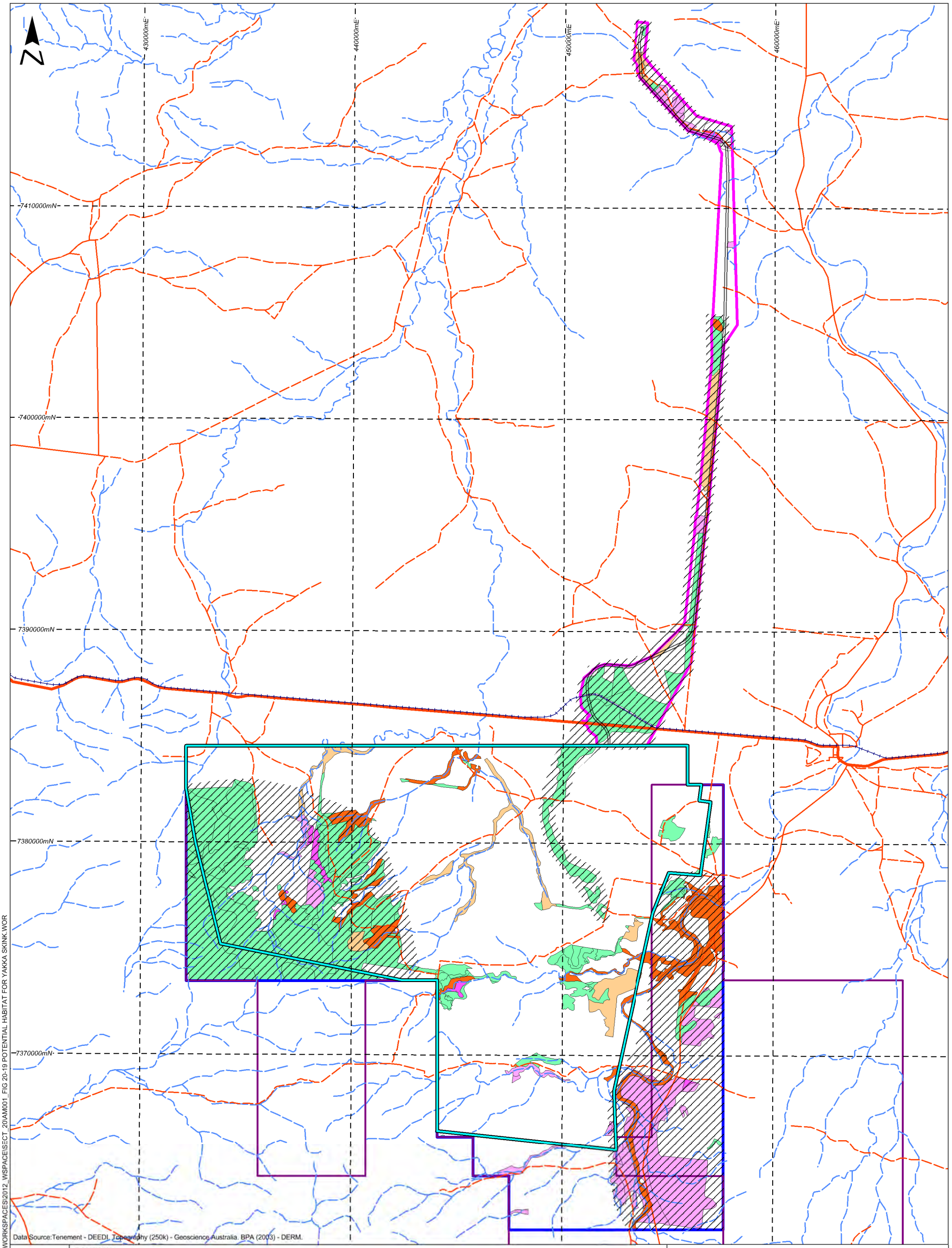


Alpha Coal Pty Ltd

South Galilee Coal Project

Potential Habitat for Yakka Skink

0 5

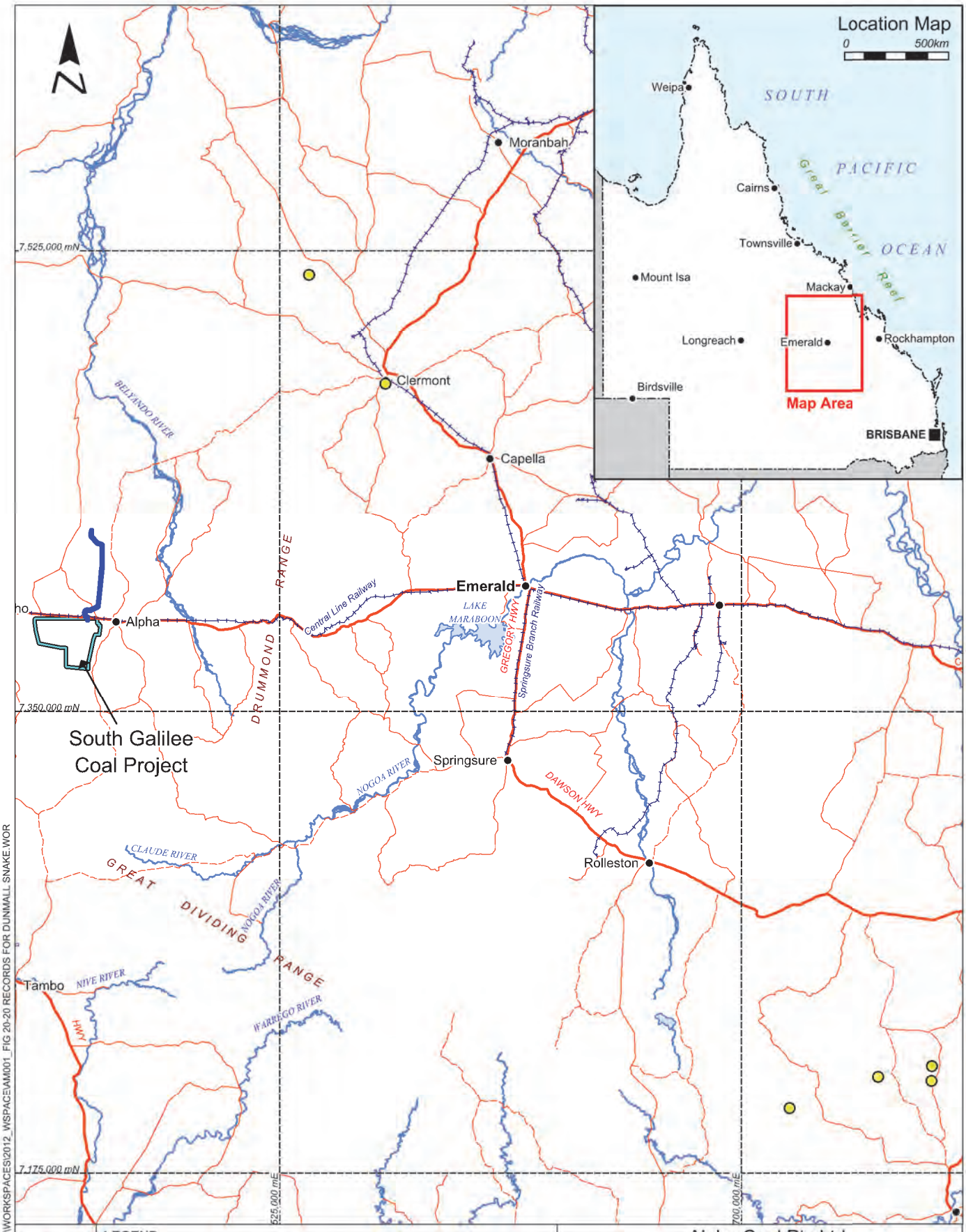
Kilometres

Scale: 1:175,000 (A3)

30/08/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-19



LEGEND

- MLA70453
- Exploration tenement
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- River
- Population centre

Species:

- Dunmall's Snake *(Furina dunmalli)*

Data Source: Tenement - DEEDI. Topography (250k) - Geoscience Australia.

Alpha Coal Pty Ltd

South Galilee Coal Project

Nearest Records for Dunmall's Snake

50 0 50

Kilometres

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

01/08/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-20

S:\PROJECTS\AM001 STH GALILEE EIS_MAPINFO\WORKSPACES\2012_WSPACE\AM001_FIG 20-20 RECORDS FOR DUNMALL SNAKE.WOR

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430000mE
440000mE
450000mE
460000mE
470000mE
7420000mN
7410000mN
7400000mN
7390000mN
7380000mN
7370000mN
7360000mN

Data Source:Tenement - DEEDI, Topography (250k) - Geoscience Australia, BPA (2003) - DERM.

S:\PROJECTS\AM001_STHGALILEE_EIS\GIS_MAP\NFO\WSPACES\SECT_20\AM001_FIG 20-19 POTENTIAL HABITAT FOR YAKKA SKINK.WOR

METSERVE
Mining & Energy Technical Services Pty Ltd

SouthGalilee

LEGEND

- MLA70453
- Exploration tenement
- SGCP infrastructure rail corridor
- Mine survey area
- Infrastructure corridor survey area
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- Stream

Biodiversity Status

- Endangered (dominant)
- Endangered (sub-dominant)
- Of Concern (dominant)
- Of Concern (sub-dominant)
- Not of Concern
- Non-remnant

Potential Habitat

- Potential Habitat for Dummall;s Snake

Alpha Coal Pty Ltd

South Galilee Coal Project

Potential Habitat for Dummall's Snake

07/08/2012

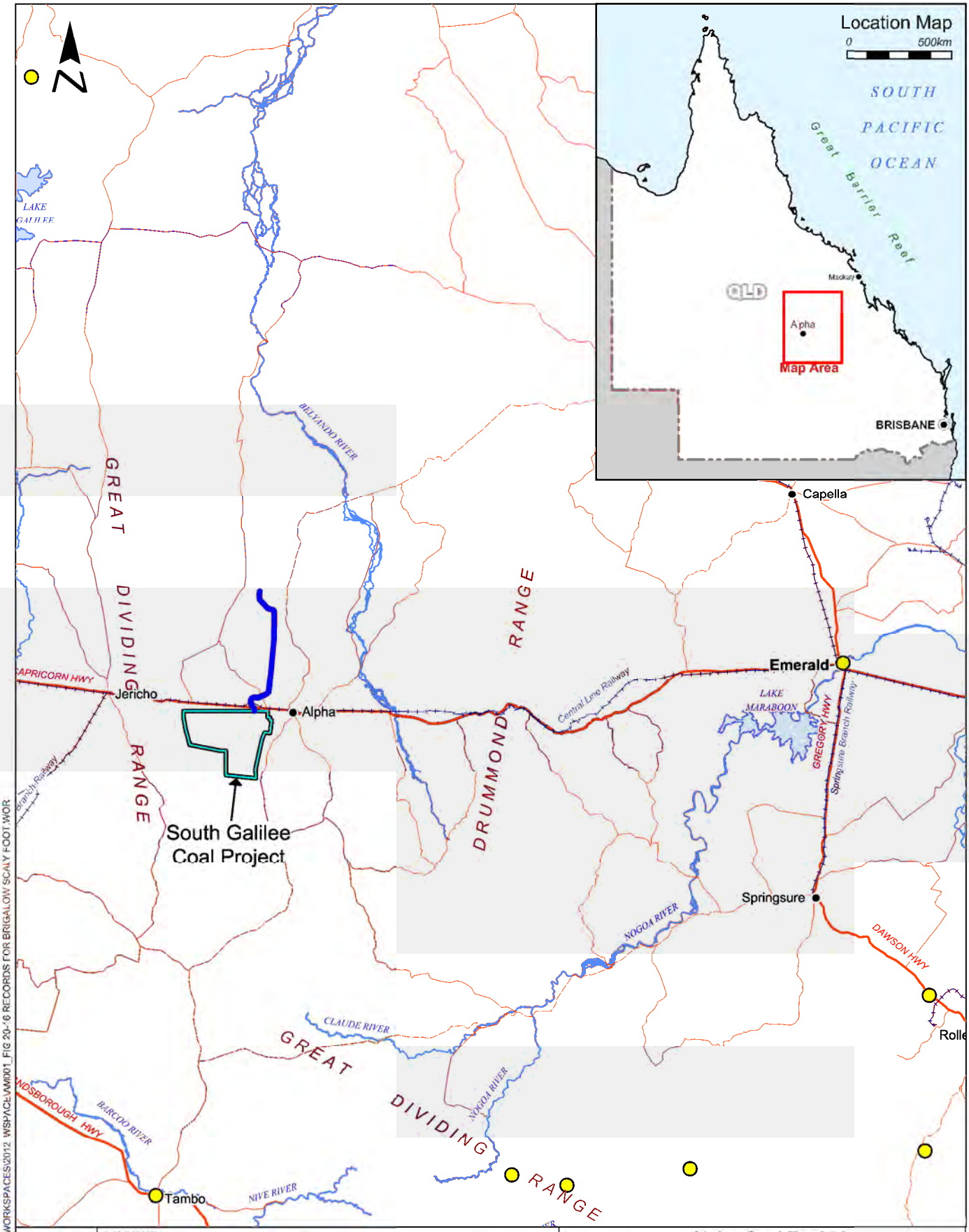
0 5

Kilometres

Scale: 1:175,000 (A3)

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-21



LEGEND

- MLA70453
- Exploration tenement
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- River
- Population centre

Species:

- Brigalow Scaly foot (*Paradelma orientalis*)

Data Source: Tenement - DEEDI, Topography (250k) - Geoscience Australia.

Alpha Coal Pty Ltd

South Galilee Coal Project

Nearest Records for Brigalow Scaly-foot

25 0 25
Kilometres

Scale: 1:1,500,000 (A4)

31/07/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-22

S:\PROJECTS\AM001 STH GALILEE E SL_MAPINFO\WORKSPACES\2012 WSP\ACELVM001_FIG 20-16 RECORDS FOR BRIGALOW SCALY FOOT.WOR

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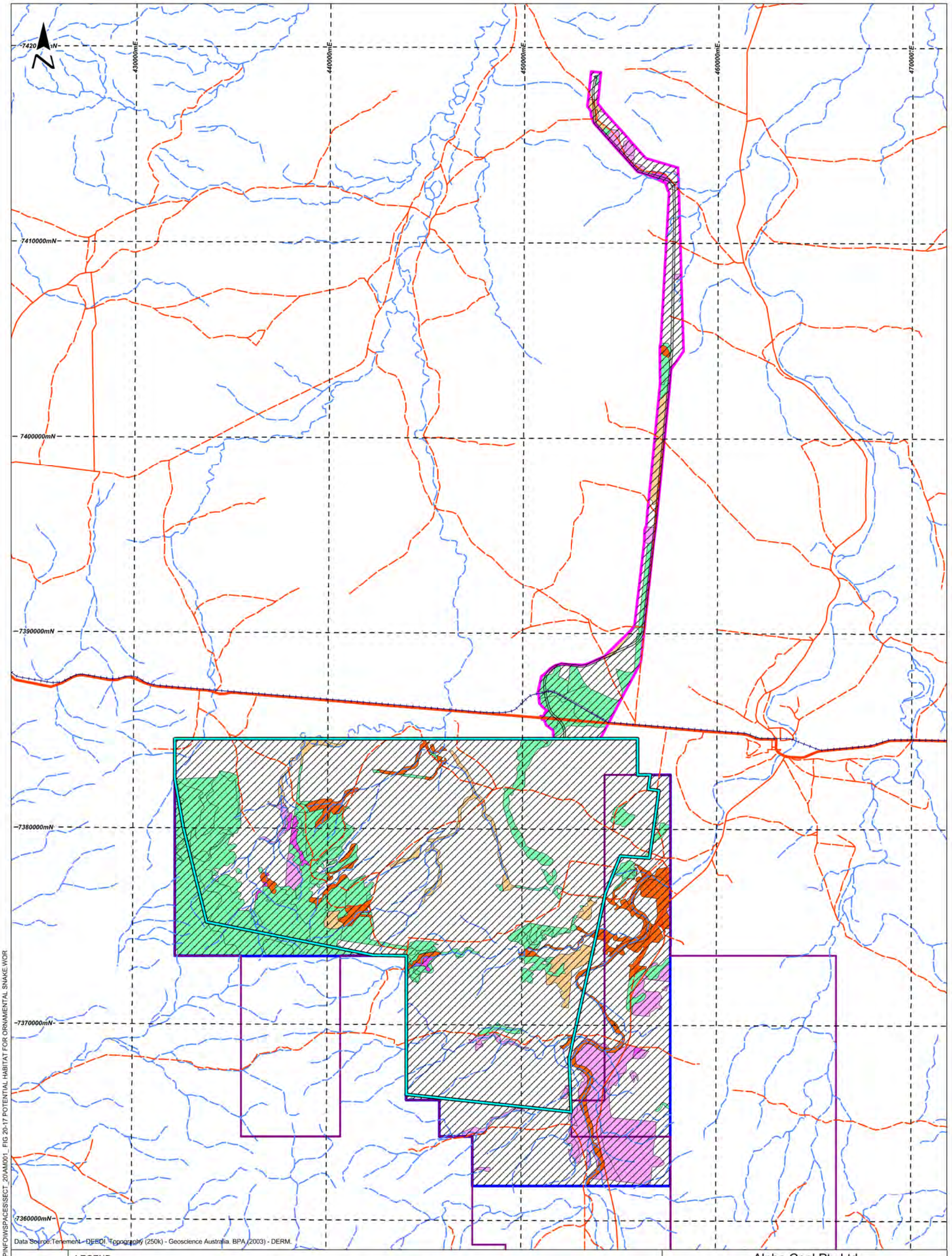
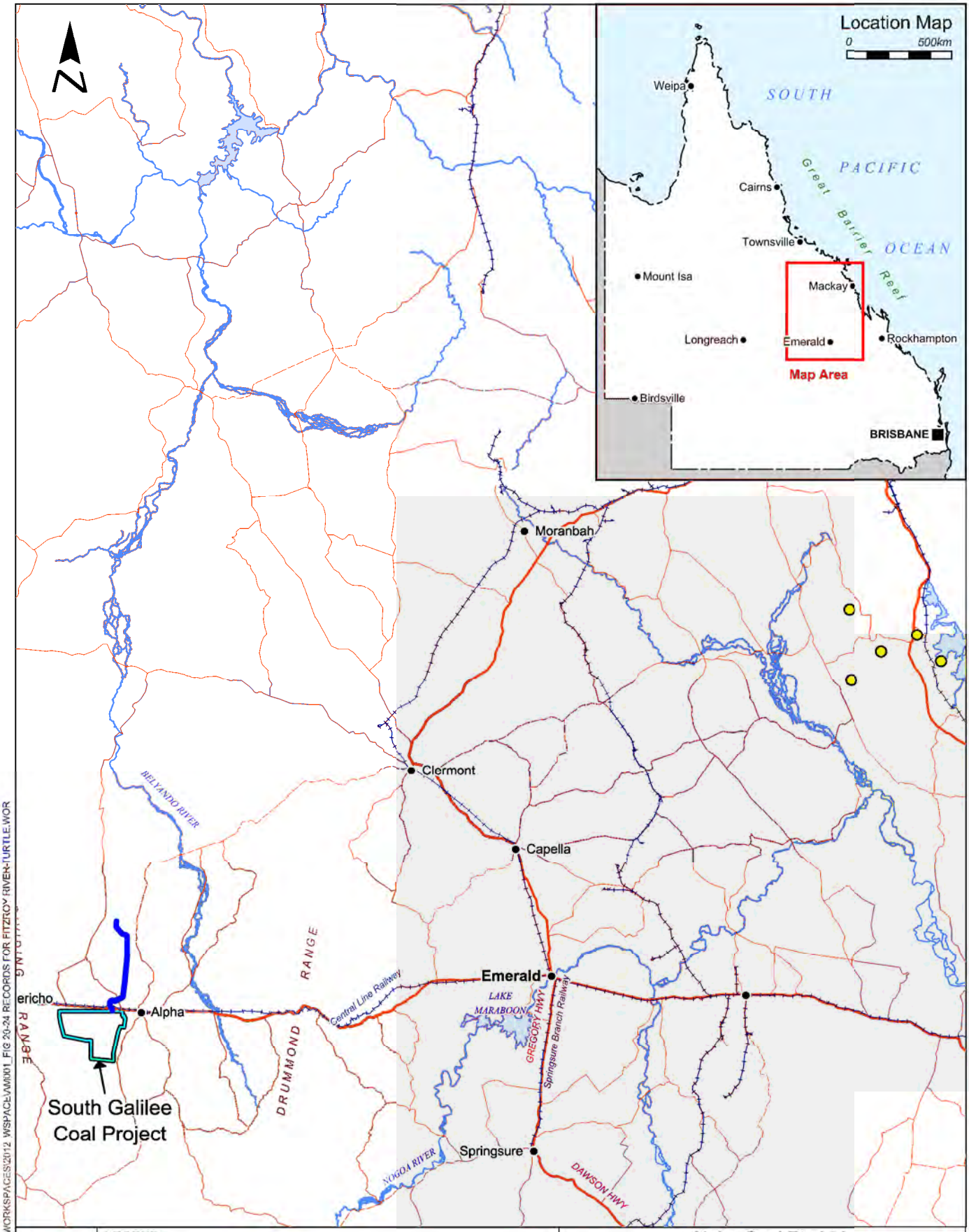

7420000mN
430000mE
440000mE
450000mE
460000mE
470000mE
7410000mN
7400000mN
7390000mN
7380000mN
7370000mN
7360000mN
Data Source:Tenement - DEEDI, Topography (250k) - Geoscience Australia, BPA (2003) - DERM.
LEGEND
MLA70453
Exploration tenement
SGCP infrastructure rail corridor
Mine survey area
Infrastructure corridor survey area
Principal road
Road (sealed)
Road (unsealed)
Railway
Stream
Biodiversity Status
Endangered (dominant)
Endangered (sub-dominant)
Of Concern (dominant)
Of Concern (sub-dominant)
Not of Concern
Non-remnant
Potential Habitat
Potential Habitat for Brigalow Scaly-Foot
METSERVE
Mining & Energy Technical Services Pty Ltd
SouthGalilee
Alpha Coal Pty Ltd
South Galilee Coal Project
Potential Habitat for Brigalow Scaly-Foot
0
5
Kilometres
Scale: 1:175,000 (A3)
07/08/2012
Proj. : MGA Z55
Datum: GDA 1994
FIGURE 20-23
S:\PROJECTS\AM001_STHGALILEE_EIS\GIS_MAPINFO\WSPACES\SECT_20\AM001_FIG 20-17 POTENTIAL HABITAT FOR ORNAMENTAL SNAKE.WOR



LEGEND

- MLA70453
- Exploration tenement
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- River
- Population centre

Species:

- Fitzroy river turtle (*Rheodytes leukops*)

Data Source: Tenement - DEEDI, Topography (250k) - Geoscience Australia.

Alpha Coal Pty Ltd

South Galilee Coal Project

Nearest Records for Fitzroy River-turle

50 0 50

Kilometres

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

31/07/2012

Proj. ; MGA Z55
Datum: GDA 1994

FIGURE 20-24

METSERVE

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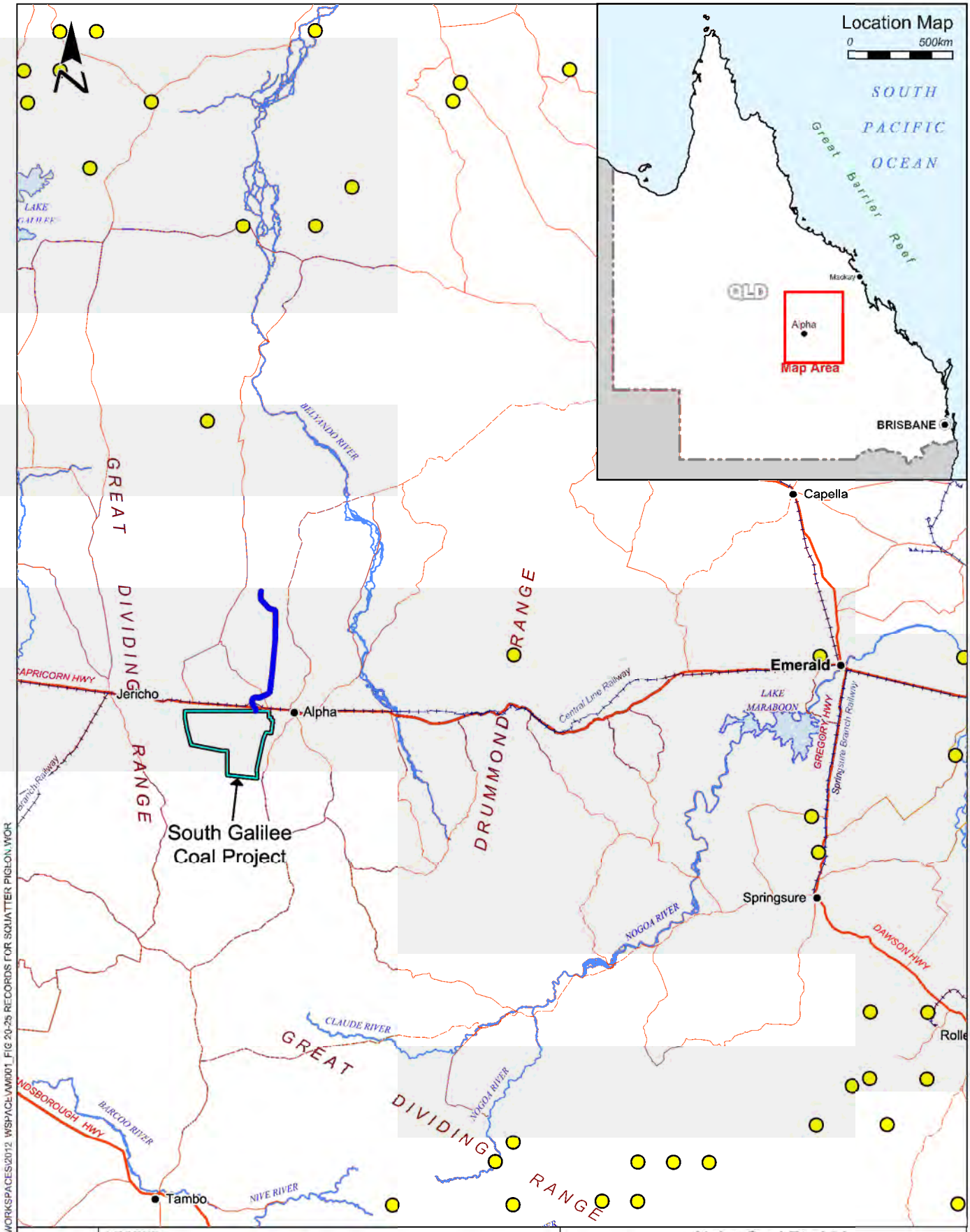
S:\PROJECTS\AM001 STH GALILEE E SL_MAPINFO\WORKSPACES\2012 WSPACE\AM001_FIG 20-24 RECORDS FOR FITZROY RIVER-TURTLE.WOR



S:\PROJECTS\AM001 STH GALILEE E SL_MAPINFO\WORKSPACES\2012 WSPACE\AM001_FIG 20-25 RECORDS FOR SQUATTER PIGEON.WOR

METSERVE
Mining & Environmental Consultants

SouthGalilee

LEGEND

- MLA70453
- Exploration Tenement
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- River
- Population centre

Species:

- Squatter Pigeon *(Geophaps scripta scripta)*

Data Source: Tenement - DEEDI, Topography (250k) - Geoscience Australia.

Alpha Coal Pty Ltd

South Galilee Coal Project

Nearest Records for Squatter Pigeon

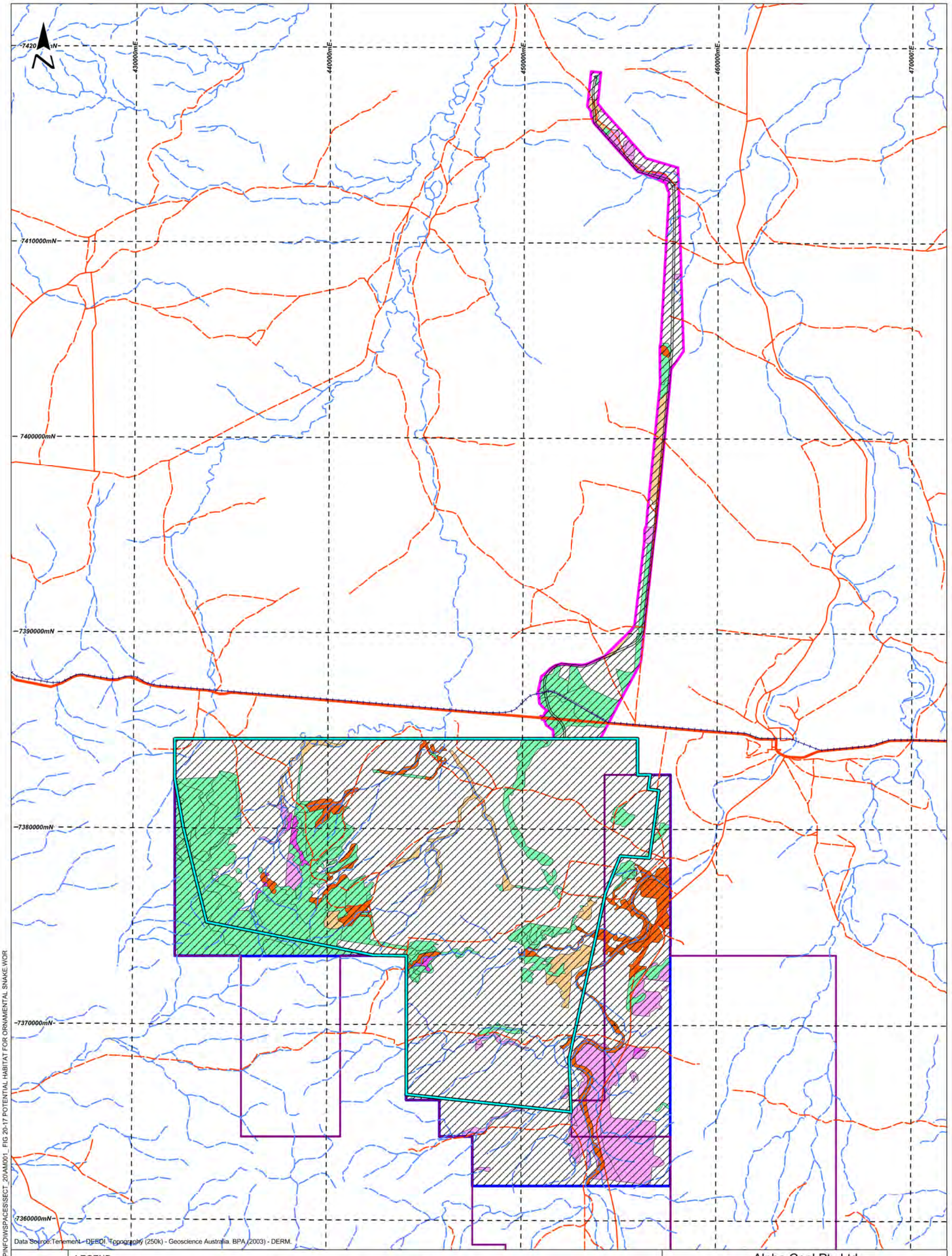
25 0 25
Kilometres

Scale: 1:1,500,000 (A4)

31/07/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-25



Alpha Coal Pty Ltd

South Galilee Coal Project

Potential Habitat for Squatter Pigeon

0 5

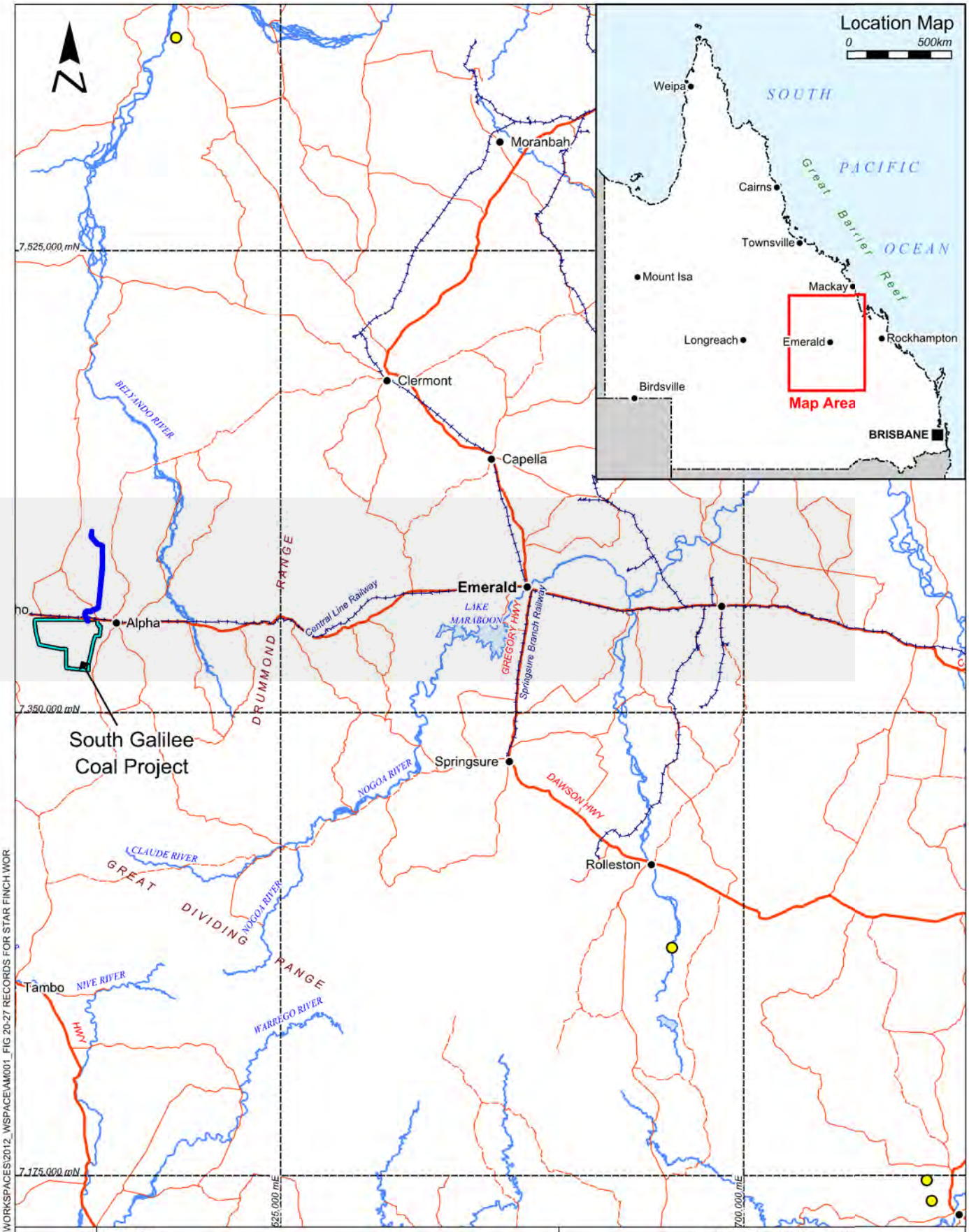
Kilometres

Scale: 1:175,000 (A3)

07/08/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-26



LEGEND

- MLA70453
- Exploration tenement
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- River
- Population centre

Species:

- Star finch *(Neochmia ruficauda ruficauda)*

Data Source: Tenement - DEEDI. Topography (250k) - Geoscience Australia.

Alpha Coal Pty Ltd

South Galilee Coal Project

Nearest Records for Star Finch

50 0 50

Kilometres

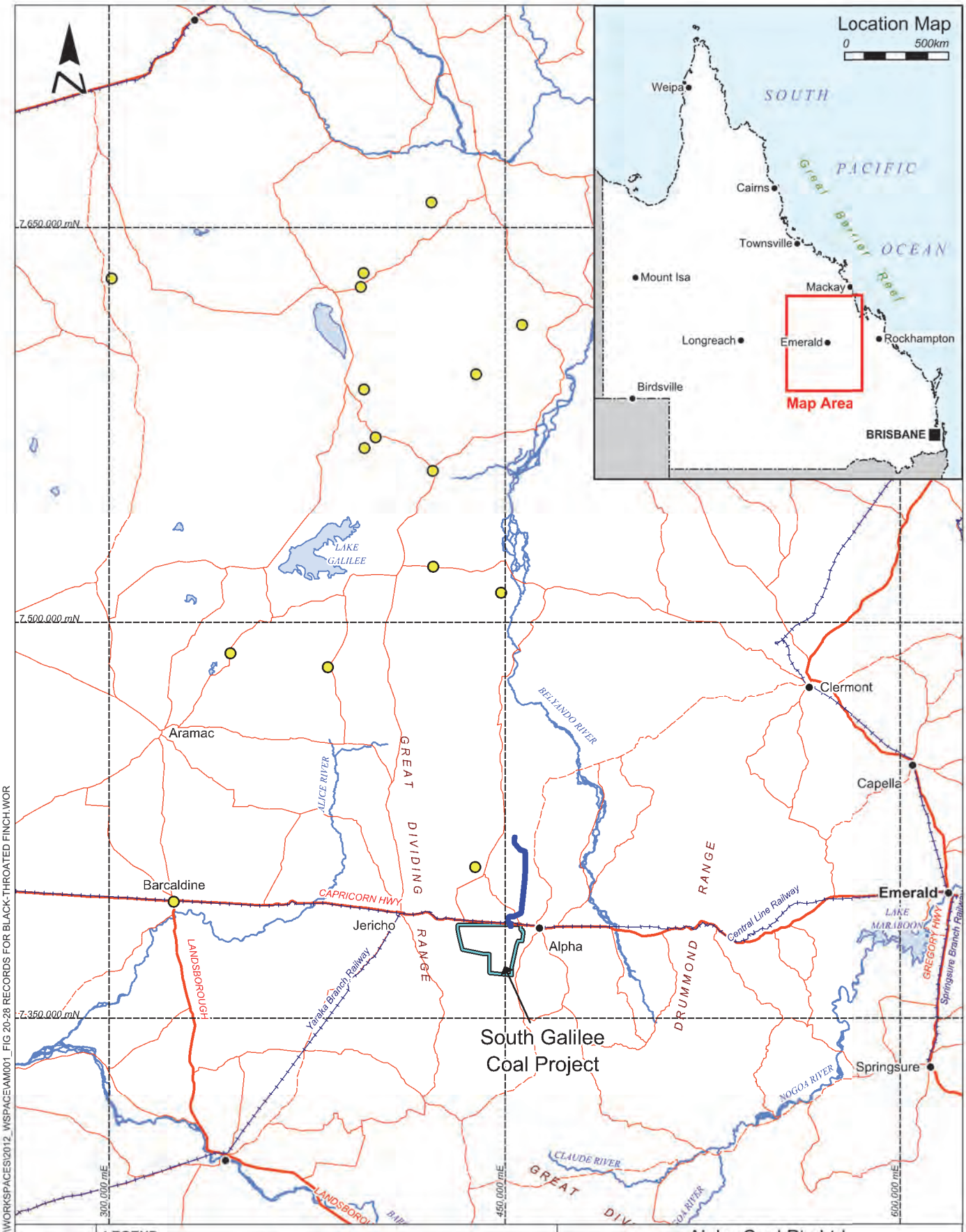
Scale: 1:2,000,000 (A4)

01/08/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-27

S:\PROJECTS\AM001 STH GALILEE EIS_MAPINFO\WORKSPACES\2012_WSPACE\AM001_FIG 20-27 RECORDS FOR STAR FINCH WOR



S:\PROJECTS\AM001 STH GALILEE EIS_MAPINFO\WORKSPACES\2012_WSPACE\AM001_FIG 20-28 RECORDS FOR BLACK-THROATED FINCH.WOR

METSERVE Mining & Energy Technology

SouthGalilee

LEGEND

- MLA70453
- Exploration tenement
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- River
- Population centre

Species:

- Black-throated Finch *(Poephila cincta cincta)*

Data Source: Tenement - DEEDI. Topography (250k) - Geoscience Australia.

Alpha Coal Pty Ltd

South Galilee Coal Project

Nearest Records for Black-throated Finch

50 0 50

Kilometres

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

01/08/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-28

430000mE
440000mE
450000mE
460000mE
470000mE
7420000mN
7410000mN
7400000mN
7390000mN
7380000mN
7370000mN
7360000mN

Data Source:Tenement - DEEDI. Topography (250k) - Geoscience Australia. BPA (2003) - DERM.

LEGEND

- MLA70453
- Exploration tenement
- SGCP infrastructure rail corridor
- Mine survey area
- Infrastructure corridor survey area
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- Stream

Biodiversity Status

- Endangered (dominant)
- Endangered (sub-dominant)
- Of Concern (dominant)
- Of Concern (sub-dominant)
- Not of Concern
- Non-remnant

Potential Habitat

- Potential Habitat for Black Throated Finch

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Alpha Coal Pty Ltd

South Galilee Coal Project

Potential Habitat for Black Throated Finch

0 5

Kilometres

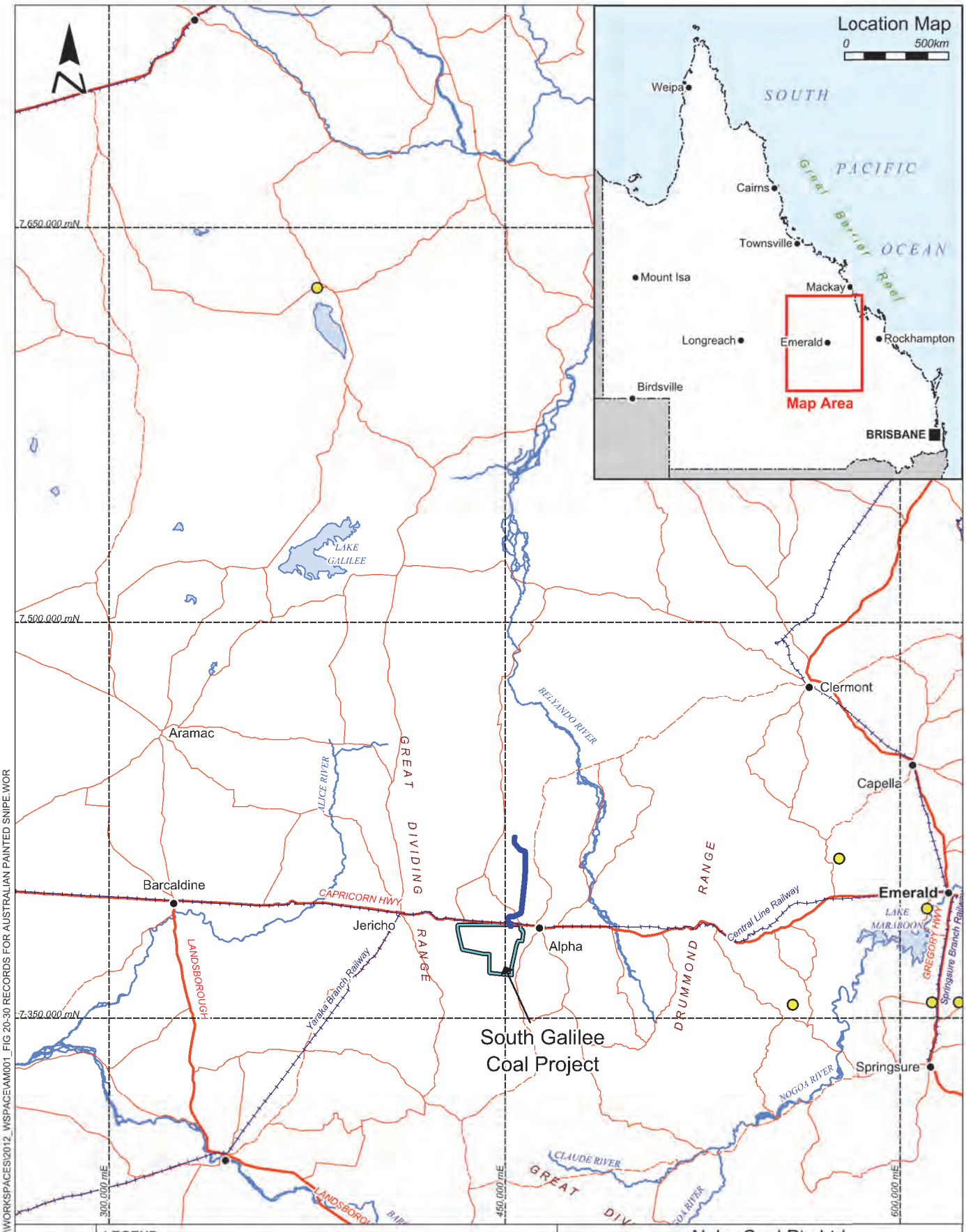
Scale: 1:175,000 (A3)

07/08/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-29

S:\PROJECTS\AM001_STHGALILEE_EIS\GIS_MAP\NFO\WSPACES\SECT_20\AM001_FIG 20-19 POTENTIAL HABITAT FOR YAKKA SKINK.WOR


Location Map
0
500km
Weipa
SOUTH
PACIFIC
OCEAN
Great Barrier Reef
Cairns
Townsville
Mount Isa
Mackay
Longreach
Emerald
Rockhampton
Birdsville
Map Area
BRISBANE
7,650,000 mN
7,500,000 mN
7,350,000 mN
300,000 mE
450,000 mE
600,000 mE
LAKE GALILEE
Clermont
Aramac
Capella
Barcaldine
Jericho
Alpha
Emerald
Springsure
BELYANDO RIVER
ALICE RIVER
GREAT DIVIDING RANGE
DRUMMOND RANGE
CAPRICORN HWY
Central Line Railway
Yarraka Branch Railway
LANDSBOROUGH
GREGORY HWY
LAKE MARABOON
Springsure Branch Railway
NOGOA RIVER
CLAUDE RIVER
South Galilee Coal Project
LEGEND
MLA70453
Exploration tenement
Principal road
Road (sealed)
Road (unsealed)
Railway
River
Population centre
Species:
Australian Painted Snipe (Rostratula australis)
Data Source: Tenement - DEEDI. Topography (250k) - Geoscience Australia.
METSERVE
Mining & Energy Technology
SouthGalilee
S:\PROJECTS\AM001 STH GALILEE EIS_MAPINFO\WORKSPACES\2012_WSPACE\AM001_FIG 20-30 RECORDS FOR AUSTRALIAN PAINTED SNIPE.WOR
Alpha Coal Pty Ltd
South Galilee Coal Project
Nearest Records for Australian Painted Snipe
50 0 50
Kilometres
Scale: 1:2,000,000 (A4)
01/08/2012
Proj. : MGA Z55
Datum: GDA 1994
FIGURE 20-30

20.2.1.2.3. Aquatic Ecology

None of the aquatic species recorded during the SGCP aquatic ecology surveys or historically known to the Belyando catchment are listed as threatened species under the *EPBC Act*.

20.2.1.2.4. Subterranean Fauna

Stygofauna

No stygofauna were collected from the SGCP stygofauna survey. Three common surface water aquatic macroinvertebrate taxa were collected during the stygofauna monitoring program: one beetle (*Coleoptera: Hydraenidae*), one worm (*Oligochaeata: Naididae*) and one springtail (*Collembola*). The bores from which these taxa were recorded were uncovered and it is possible that surface water ingress could have occurred during recent rainfall.

Salinity is a major determinant of stygofauna species presence. The groundwater quality survey results indicate that salinity in the SGCP area is within the range where stygofauna may be found. Water temperature was normal, although pH tended to be higher than optimal for the presence of stygofauna.

The absence of stygofauna from the groundwater bores sampled suggests that the presence of stygofauna in the SGCP area is unlikely.

Troglofauna

All taxa collected from the SGCP troglofauna traps are commonly encountered in soil habitats and this is likely to be the origin of these animals, either by falling into the bore, or by being already present in the leaf litter within traps despite pre-treatment.

20.2.2. Listed Threatened Ecological Communities

As described in **Section 20.2.1**, a search of the *EPBC Act* Protected Matters Search Tool was undertaken for the SGCP area. The search results indicated that four Threatened Ecological Communities (TECs) listed under the *EPBC Act* may be potentially present within the SGCP area. One of these involves species dependent on natural discharge of groundwater from the Great Artesian Basin, and was not considered to be potentially present as the SGCP area lies just outside of the Great Artesian Basin area. The *EPBC Act* listed TECs considered to be potentially present within the SGCP area include:

- Brigalow (*Acacia harpophylla* dominant and co-dominant) (Brigalow TEC) – endangered
- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin – endangered
- Weeping Myall Woodlands – endangered.

20.2.2.1. Survey Effort

Field surveys were conducted to determine the presence/absence of the TECs identified by the *EPBC Act* Protected Matters search. A detailed description of surveys undertaken to identify TECs is provided in **Section 5.1** of **Appendix N—Terrestrial Ecology Technical Report** and a summary is provided below.

Field flora surveys were undertaken within the mine survey area in April and October 2009 and within the infrastructure corridor area in May/June and September 2011. Survey techniques included community-level vegetation assessments.

Quaternary site surveys were on-ground visual assessments to ground truth vegetation types and to confirm the location of vegetation unit boundaries across the SGCP area. Surveys involved traversing the SGCP area, both by vehicle and on foot. Surveys were undertaken at 272 quaternary-level vegetation sites within or adjacent to the mine survey area and 567 quaternary-level vegetation sites within or adjacent to the infrastructure corridor survey area.

Sixteen secondary sites were assessed within the mine survey area during October 2009 at randomly determined locations within representative vegetation communities identified during the wet season survey. In addition, six secondary survey sites were assessed in the infrastructure corridor survey area in May and September 2011. At each secondary site, a 50 x 10 m plot was used to assess the flora species and vegetation communities present.

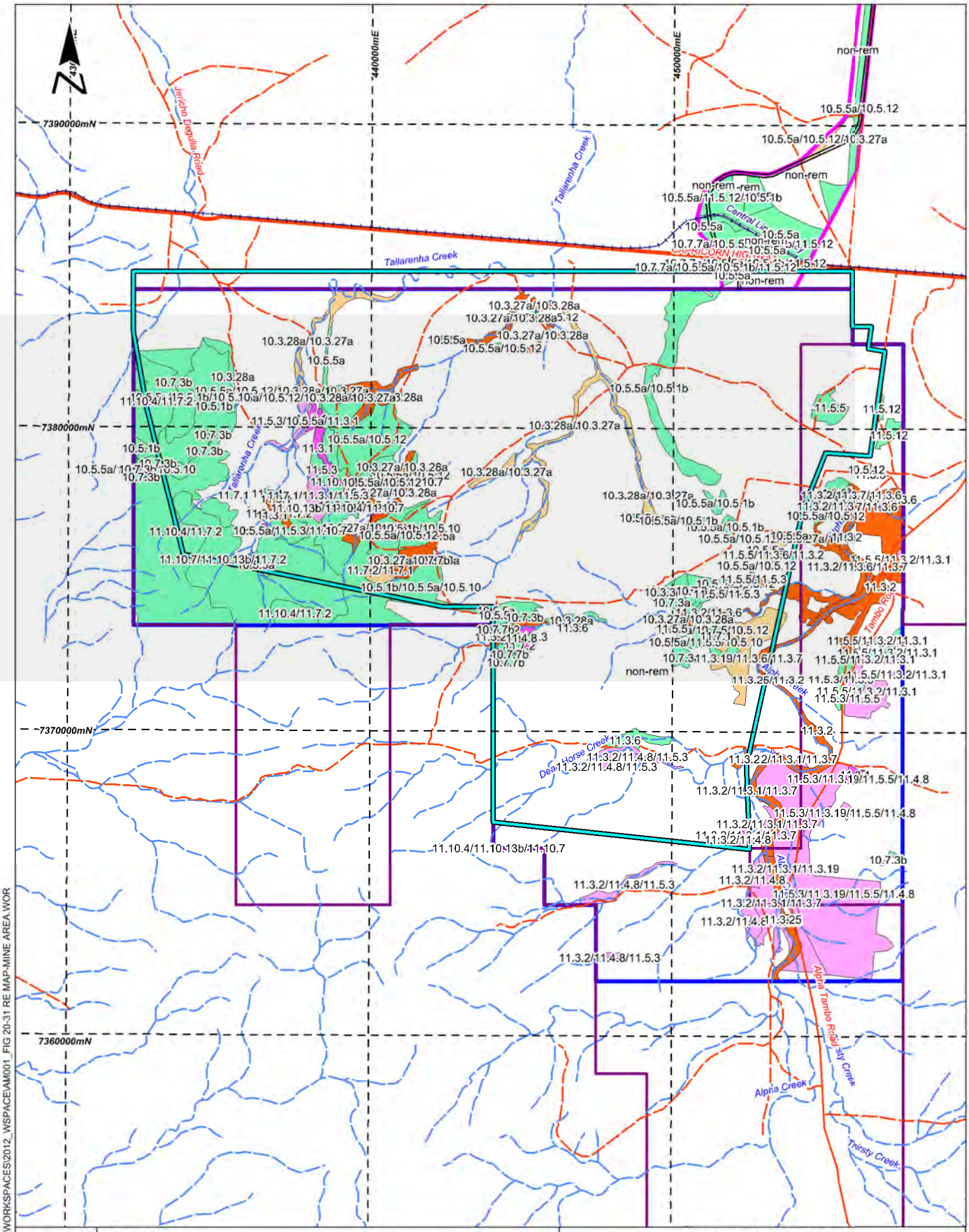
The flora assessment site locations are shown on **Figure 20-1**.

20.2.2.2. Survey Results

Field-verified vegetation mapping found that the SGCP area contains approximately 14,533 ha of remnant vegetation, consisting of 33 distinct regional ecosystems (REs), and approximately 32,052 ha of non-remnant vegetation. Results from secondary and quaternary field surveys were used to produce a map of the vegetation communities present within the SGCP area (refer to **Figure 20-31** and **Figure 20-32**). Refinements to the RE mapping were made to reflect the findings of the field assessments, including modifications of polygon boundaries and changes to the designations of many communities.

Of the three potentially present TECs (refer to **Table 20-3**), Brigalow (*Acacia harpophylla* dominant and co-dominant) was confirmed in the SGCP area. This TEC was comprised of two Endangered Regional Ecosystems (REs); *Acacia harpophylla* [brigalow] and/or *Casuarina cristata* [belah] open forest on alluvial plains (RE 11.3.1), and *Eucalyptus cambageana* [Dawson gum] woodland to open forest with *Acacia harpophylla* [Brigalow] or *A. argyrodendron* [blackwood] on Cainozoic clay plains (RE 11.4.8).

RE 11.3.1 and 11.4.8 covered approximately 579 ha of the mine and infrastructure corridor survey areas. These REs are within the western, central and southern portions of the mine survey area, as well as being patchily distributed near the central and northern portions of the infrastructure corridor survey area. The infrastructure corridor survey area had one large mosaic polygon with RE 11.4.8 accounting for approximately 21 ha. RE 11.3.1 occurred in much smaller mosaic polygons, over an area of <12 ha.



LEGEND

- MLA70453
- Exploration tenement
- Mine survey area
- Infrastructure corridor survey area
- SGCP infrastructure corridor
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- Stream

Biodiversity Status

- Endangered (dominant)
- Endangered (sub-dominant)
- Of Concern (dominant)
- Of Concern (sub-dominant)
- Not of Concern
- Non-remnant

Data Source :Tenement - DEEDI, Topography (250k) - Geoscience Australia.

METSERVE Mining & Energy Technical Services

SouthGalilee

Alpha Coal Pty Ltd

South Galilee Coal Project

Field Verified Remnant Vegetation Regional Ecosystems and Biodiversity Status-Mining Area

0 5 Kilometres

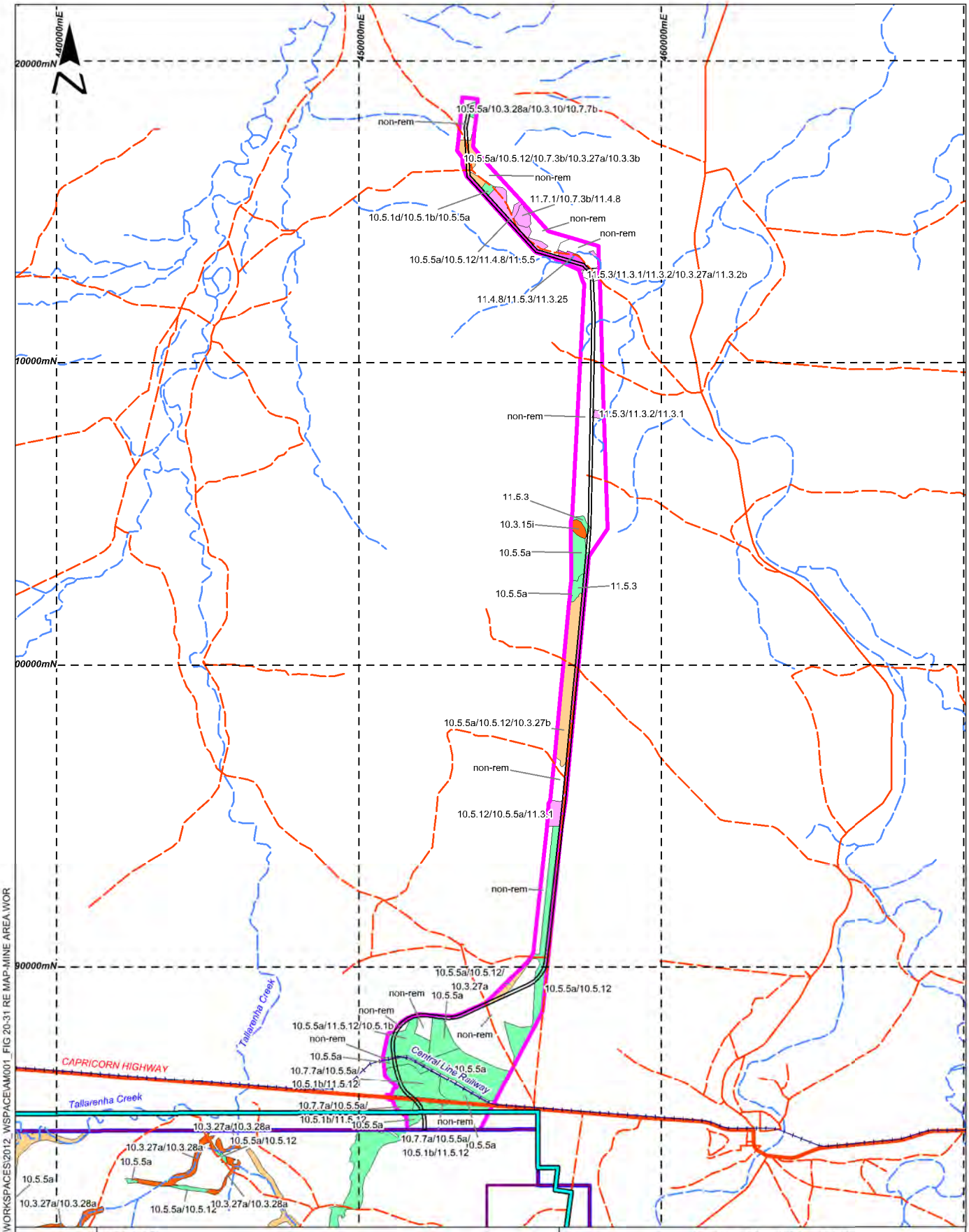
Scale: 1:175,000 (A4)

03/08/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-31

S:\PROJECTS\AM001 STH GALILEE EIS_MAPINFO\WORKSPACES\2012_WSPACE\AM001_FIG 20-31 RE MAP-MINE AREA.WOR



S:\PROJECTS\AM001 STH GALILEE EIS_MAPINFO\WORKSPACES\2012_WSPACE\AM001_FIG 20-31 RE MAP-MINE AREA.WOR

LEGEND

- MLA70453
- Exploration tenement
- Mine survey area
- Infrastructure corridor survey area
- SGCP infrastructure corridor
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- Stream

Biodiversity Status

- Endangered (dominant)
- Endangered (sub-dominant)
- Of Concern (dominant)
- Of Concern (sub-dominant)
- Not of Concern
- Non-remnant

Data Source :Tenement - DEEDI, Topography (250k) - Geoscience Australia.

METSERVE Mining & Energy Technical

SouthGalilee

Alpha Coal Pty Ltd

South Galilee Coal Project

Field Verified Remnant Vegetation Regional Ecosystems and Biodiversity Status - Infrastructure Corridor

0 5

Kilometres

Scale: 1:175,000 (A4)

03/08/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-32

Larger areas of the Brigalow TEC occurred as a 28 ha area of RE 11.4.8 in the central western portion of the mine survey area and two areas of 67 ha and 17 ha of RE 11.3.1 in the central western portion of the mine survey area. Smaller areas of approximately 5 ha consisting of RE 11.3.1 were present to the south of the aforementioned larger areas. All other instances of the Brigalow TEC within the SGCP area occurred as mosaics with other communities dominated variously by *Eucalyptus*, *Corymbia*, *Acacia* and *Callitris* species. These were particularly extensive in the southern portion of the SGCP area, with some large patches also in the central west of the mine survey area (refer to **Figure 20-31** and **Figure 20-32**).

The Biodiversity Assessment and Mapping Methodology (BAMM) (developed by the Queensland Department of Environment and Heritage Protection (DEHP), formerly the Department of Environment and Resource Management)) provides an approach for assessing biodiversity values at the landscape scale in Queensland using vegetation mapping data. The BAMM diagnostic criteria include the 'condition' of remnant vegetation. According to Criterion E of the BAMM, the condition of all remnant vegetation in the mine survey area and infrastructure corridor is very high (refer to Appendix A of **Appendix N—Terrestrial Ecology Technical Report**).

Brigalow TEC is threatened by any activities that further reduce its extent, potentially causing a decline in the vegetation condition or impeding its recovery from past disturbance (SEWPaC, 2012d). The threats to the Brigalow TEC include (SEWPaC, 2012d):

- land clearing for cropping and/or pasture
- fragmentation and edge effects
- altered fire regimes
- weed and pest animal impacts
- grazing pressure
- lack of knowledge.

Table 20-3 Assessment of Potentially Present TECs

TEC	*EPBC Act* Status	Present/Absent	Notes
Brigalow (*Acacia harpophylla* dominant and co-dominant)	E	Present	Site surveys confirmed the presence of this TEC in both the mine survey area and the infrastructure corridor survey area. Within the SGCP area, the TEC consists of REs 11.3.1 and 11.4.8.
Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin	E	Absent	Site surveys did not encounter this TEC. All areas of grassland are non-remnant and derived from cleared woodlands.
Weeping Myall Woodlands	E	Absent	Site surveys did not encounter this TEC. While one RE (11.3.2) known to contain this TEC is present within the SGCP area, no areas are dominated by Weeping Myall (*Acacia pendula*).

Abbreviations: E = endangered

20.2.3. Listed Migratory Species

As described in **Section 20.2.1**, a search of the *EPBC Act* Protected Matters Search Tool was undertaken for the SGCP area. The search results indicated that ten migratory species listed under the *EPBC Act* may be potentially present within the SGCP area. The *EPBC Act* listed migratory species considered to be potentially present within the SGCP area include:

- White-bellied Sea Eagle (*Haliaeetus leucogaster*)
- White-throated Needletail (*Hirundapus caudacutus*)
- Rainbow Bee-eater (*Merops ornatus*)
- Eastern Great Egret (*Ardea alba modesta*)
- Cattle Egret (*Ardea ibis*)
- Cotton Pygmy-goose (Nettapus coromandelianus albipennis)
- Latham's Snipe (Gallinago hardwickii)
- Australian Painted Snipe (*Rostratula australis*)
- Fork-tailed Swift (*Apus pacificus*)
- Magpie Goose (Anseranas semipalmata).

20.2.3.1. Survey Effort

The survey effort for fauna species is described in **Section 20.2.1.1.2** and **Section 5.2.3** of **Appendix N—Terrestrial Ecology Technical Report**.

20.2.3.2. Survey Results

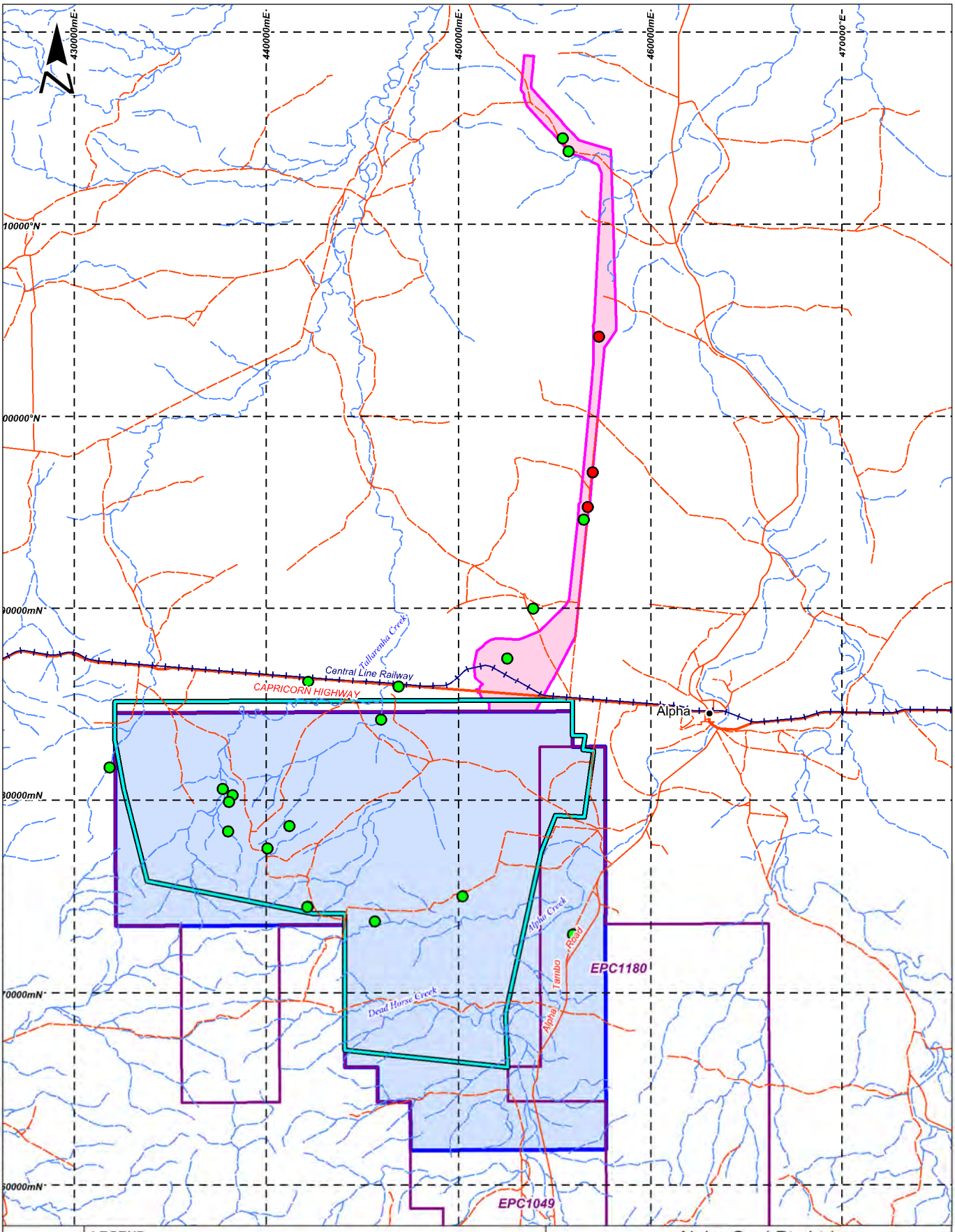
Of the ten potentially present migratory species, two species listed under the *EPBC Act* have been identified within the SGCP area (refer to **Section 20.2.3**):

- Rainbow Bee-eater (*Merops ornatus*)
- Eastern Great Egret (*Ardea alba modesta*).

The Rainbow Bee-eater was commonly observed within remnant vegetation, along tracks and within open grazing pasture. This species was not recorded in the April or May surveys, suggesting that they are summer breeding visitors. Nesting birds were observed in central parts of the mine survey area, although these nesting sites are outside the currently proposed mine disturbance area. Rainbow Bee-eaters are likely to be common within most areas of the SGCP area and are abundant in the local area.

The Eastern Great Egret was observed on multiple occasions, usually at farm dams. This species is likely to occur wherever similar water bodies are found within the SGCP and local areas. The species is highly dispersive, and often moves towards the coast during the dry season (Marchant and Higgins, 1990). The Eastern Great Egret has been recorded from numerous sites across the SGCP area, and is likely to be relatively common.

Migratory species not expected to occur, but identified in the literature review phase, are discussed in **Table 20-4**. The recorded migratory species locations are shown in **Figure 20-33**. The potential habitat for migratory species is shown on **Figures 20-34** to **20-36**.



S:\PROJECTS\AM001_STHGALILEE_EIS\GIS_MAP\INFO\WSPACESISECT_20\AM001_M442A FIG 20-35 RECORDED MIGRATORY SP.WOR

LEGEND

- MLA70453
- Exploration tenement
- Mine survey area
- Infrastructure corridor survey area
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- Stream
- Population centre

Location of Migratory Species

- Eastern Great Egret
- Rainbow Bee-eater

Data Source:Tenement - DEEDI, Topography (250k) - Geoscience Australia.

Alpha Coal Pty Ltd

South Galilee Coal Project

Recorded Migratory Species Locations

5 0 5
Kilometres

Scale: 1:275,000 (A4)

06/08/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-33

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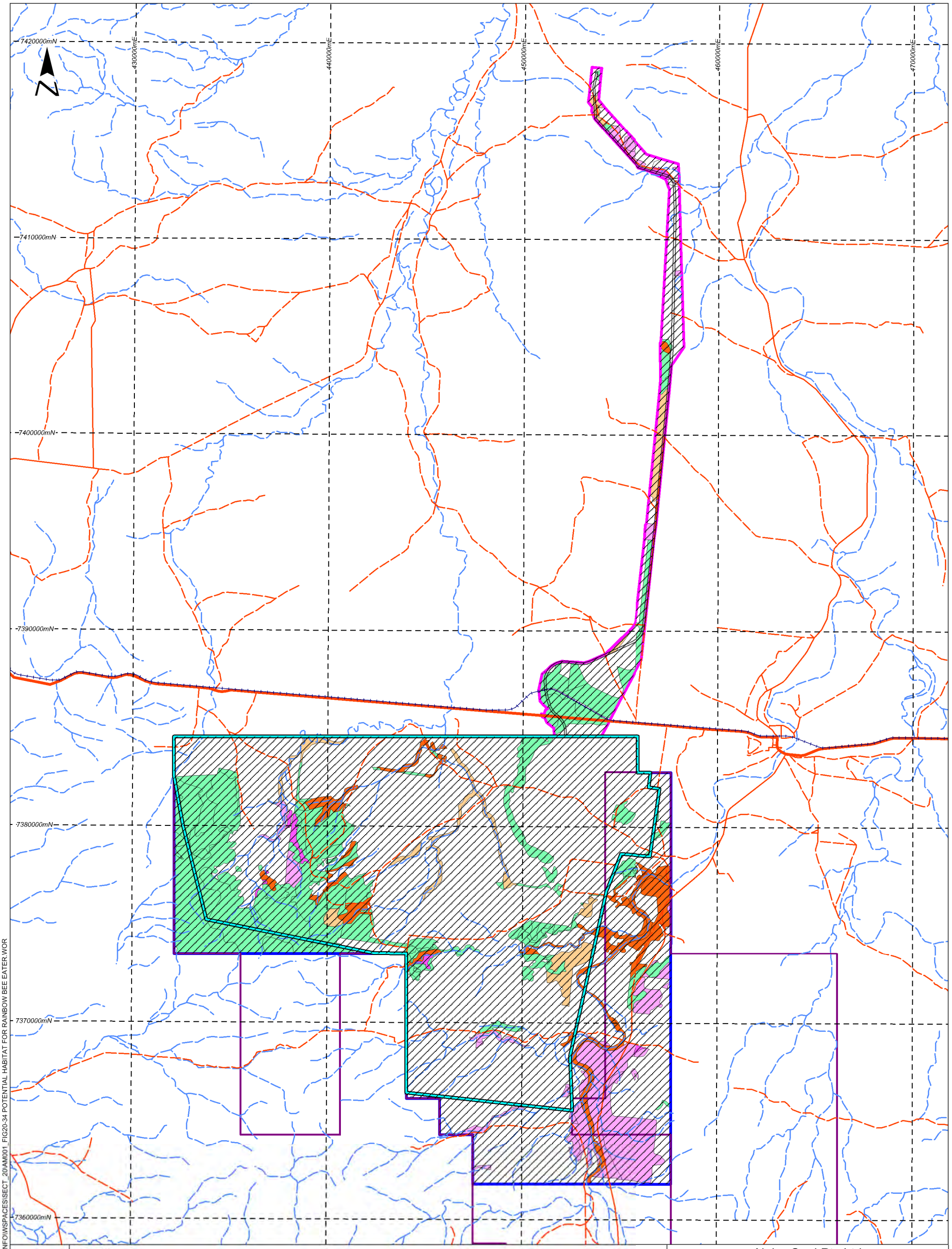

7420000mN
7410000mN
7400000mN
7390000mN
7380000mN
7370000mN
7360000mN
430000mE
440000mE
450000mE
460000mE
470000mE
N
S:\PROJECTS\AM001_STHGALILEE_EIS\GIS_MAPINFO\WSPACES\SECT_20\AM001_FIG20-34 POTENTIAL HABITAT FOR RAINBOW BEE EATER.WOR
LEGEND
MLA70453
Exploration tenement
SGCP infrastructure rail corridor
Mine survey area
Infrastructure corridor survey area
Principal road
Road (sealed)
Road (unsealed)
Railway
Stream
Biodiversity Status
Endangered (dominant)
Endangered (sub-dominant)
Of Concern (dominant)
Of Concern (sub-dominant)
Not of Concern
Non-remnant
Potential Habitat
Potential Habitat for Rainbow Bee Eater
METSERVE
Mining & Energy Technical
SouthGalilee
Alpha Coal Pty Ltd
South Galilee Coal Project
Potential Habitat for Rainbow Bee Eater
0
5
Kilometres
Scale: 1:175,000 (A3)
30/08/2012
Proj. : MGA Z55
Datum: GDA 1994
FIGURE 20-34

7420000mN
7410000mN
7400000mN
7390000mN
7380000mN
7370000mN
7360000mN
430000mE
440000mE
450000mE
460000mE
470000mE
N

S:\PROJECTS\AM001_STHGALILEE_EIS\GIS_MAPINFOWSPACES\SECT_20\AM001_FIG 20-35 POTENTIAL HABITAT FOR EASTERN GREAT EGRET.WOR

METSERVE
Mining & Energy Technical
SouthGalilee

LEGEND

- MLA70453
- Exploration tenement
- SGCP infrastructure rail corridor
- Mine survey area
- Infrastructure corridor survey area
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- Stream

Biodiversity Status
- Endangered (dominant)
- Endangered (sub-dominant)
- Of Concern (dominant)
- Of Concern (sub-dominant)
- Not of Concern
- Non-remnant

Potential Habitat
- Potential Habitat for Eastern Great Egret

Alpha Coal Pty Ltd

South Galilee Coal Project

Potential Habitat for Eastern Great Egret

0 5
Kilometres

Scale: 1:175,000 (A3)

30/08/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-35

7420000mN
7410000mN
7400000mN
7390000mN
7380000mN
7370000mN
7360000mN
430000mE
440000mE
450000mE
460000mE
470000mE
N

S:\PROJECTS\AM001_STHGALILEE_EIS\GIS_MAPINFO\WSPACES\SECT_20\AM001_FIG 20-36 POTENTIAL HABITAT FOR COTTONPYGMY GOOSE.WOR

LEGEND

- MLA70453
- Exploration tenement
- SGCP infrastructure rail corridor
- Mine survey area
- Infrastructure corridor survey area
- Principal road
- Road (sealed)
- Road (unsealed)
- Railway
- Stream

Biodiversity Status

- Endangered (dominant)
- Endangered (sub-dominant)
- Of Concern (dominant)
- Of Concern (sub-dominant)
- Not of Concern
- Non-remnant

Potential Habitat

- Potential Habitat for Cotton Pygmy Goose

METSERVE Mining & Energy Technical

SouthGalilee

Alpha Coal Pty Ltd

South Galilee Coal Project

Potential Habitat for Cotton Pygmy Goose

0 5

Kilometres

Scale: 1:175,000 (A3)

30/08/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-36

Table 20-4 Migratory Species Present or Potentially Present in the SGCP Area

Species Name	Distribution, Ecology and Habitat Preference	Likelihood and Comments
White-bellied Sea Eagle (*Haliaeetus leucogaster*)	• The White-bellied Sea Eagle is distributed along the coastline of mainland Australia and Tasmania and is described as a breeding resident throughout much of its range. • Found in coastal habitats characterised by large areas of open water (e.g. larger rivers, swamps, lakes, sea). • Threats include loss of habitat due to land clearance and development, disturbance of nesting pairs, ingestion of poison, shooting, reduction in the quality or availability of inland water systems.	Possible. Being primarily restricted to coastlines and large inland waterways, it is unlikely that the SGCP area contains important habitat. May occasionally occur in water-bodies in the SGCP area.
White-throated Needletail (*Hirundapus caudacutus*)	• The White-throated Needletail is widespread in eastern and south-eastern Australia. • The species is almost exclusively aerial. • Roosts in trees in forests and woodlands. • Breeds in wooded lowlands and sparsely vegetated hills as well as mountains covered with coniferous forests. • There appear to be few threats to the species.	Possible. The SGCP area is unlikely to represent important habitat for the species, as it lies at the western edge of its range. The SGCP is unlikely to render local habitat unsuitable for this species.
Rainbow Bee-eater (*Merops ornatus*)	• The Rainbow Bee-eater is distributed across much of mainland Australia. • Occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats often in close proximity to permanent water. • Threats include reduction in breeding success caused by the introduced Cane Toad (*Bufo marinus*).	Confirmed. Common in local area. Mining will avoid known breeding locations.
Eastern Great Egret (*Ardea alba modesta*)	• Widespread in Australia and recorded from a wide range of wetland habitats. • Threats include loss and/or degradation of foraging and breeding habitat through alteration of water flows, drainage and/or clearing of wetlands, frequent burning of wetland vegetation used as nest sites, salinisation and invasion by exotic plants or fishes.	Confirmed. Common in local area.
Cattle Egret (*Ardea ibis*)	• Widespread and common, typically found in tropical and temperate grasslands, wooded lands and terrestrial wetlands. • Threats include persecution of large colonies in urban areas, loss of breeding habitat through wetland degradation and destruction, predation by Feral Cats and overseas hunting.	Possible. The SGCP area lies further west than the Cattle Egret's regular central Queensland distribution, and it is unlikely to represent important habitat for the species.
Cotton Pygmy-goose (*Nettapus coromandelianus albipennis*)	• Cotton Pygmy-geese are found on freshwater lakes, swamps and large water impoundments. • They congregate in flocks on permanent water-bodies during the dry season. • Threats include the drainage of wetlands or their invasion by introduced weeds.	Likely. Little suitable habitat occurs in the SGCP area, but the species may occasionally use artificial dams within the SGCP area.

Table 20-4 Migratory Species Present or Potentially Present in the SGCP Area (cont)

Species Name	Distribution, Ecology and Habitat Preference	Likelihood and Comments
Latham's Snipe (*Gallinago hardwickii*)	• Latham's Snipe is a non-breeding visitor to south-eastern Australia, and is a passage migrant through northern Australia. • Latham's Snipe occurs in permanent and ephemeral wetlands up to 2,000 m above sea-level. • Usually inhabits open, freshwater wetlands with low, dense vegetation. • Threats include loss of habitat caused by the drainage and modification of wetlands.	Possible. Recorded from local area.
Australian Painted Snipe (*Rostratula australis*)	• Australian Painted Snipe has been recorded at wetlands in all states of Australia and generally inhabits shallow terrestrial freshwater wetlands. Australian Painted Snipe breeding habitat requirements may be quite specific: shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby. • Threats include loss and alteration of wetland habitat and predation by feral animals.	Possible. Little suitable habitat occurs in SGCP area, but the species may utilise flooded pasture during years of exceptional rainfall.
Fork-tailed Swift (*Apus pacificus*)	• The Fork-tailed Swift is a non-breeding visitor to all states and territories of Australia. • Almost exclusively an aerial species, typically occurring over inland plains but sometimes above foothills or in coastal areas. • No significant threats to the species.	Possible. The SGCP area is unlikely to represent important habitat for the species. The SGCP is unlikely to render local habitat unsuitable for this species.
Magpie Goose (*Anseranas semipalmata*)	• The Magpie Goose is widespread throughout coastal northern and eastern Australia. • Occurs in floodplains and wet grasslands. • Threats include land clearing for agriculture and introduction of weed species.	Possible. The SGCP area is unlikely to represent important habitat for the species.

20.3. RELEVANT POTENTIAL IMPACTS

A summary of the key threatening processes listed under the *EPBC Act* and their relevance to the SGCP is provided in **Table 20-5**.

Table 20-5 Potential Impacts for *EPBC Act* Threatening Processes and SGCP Relevance

Key Threatening Process	Description	Relevance to the SGCP
Competition and land degradation by rabbits	Rabbits are considered to be one of Australia's most serious vertebrate pests and severely affect native flora and fauna, vegetation communities, landforms, geomorphic processes and sensitive sites, as well as primary industries.	Relevant to the SGCP (refer to **Section 20.3.4**).
Competition and land degradation by unmanaged goats	Unmanaged goats can be a serious pest because of their ability to severely affect native flora and fauna by grazing on native vegetation, thereby preventing regeneration; by overgrazing, which causes soil erosion; by competing for food and shelter; by introducing weeds through seeds carried in their dung; and by fouling waterholes.	Not relevant to the SGCP as goats have not been recorded within the Project area. With the adoption of the proposed mitigation and management measures for pest fauna in **Section 20.3.4**, the SGCP is considered unlikely to have a significant impact on this key threatening process.
Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*)	Many fungi are known to cause root-rot disease in Australian flora species, but the introduced *P. cinnamomi* has had the greatest effect and poses the greatest threat.	Not considered relevant to the SGCP given no instances of *Phytophthora cinnamomi* infection has been observed on-site. With the adoption of the proposed mitigation and management measures for pest fauna in **Section 20.4**, the SGCP is considered unlikely to have a significant impact on this key threatening process.
Incidental catch (bycatch) of sea turtle during coastal otter-trawling operations within Australian waters north of 28 degrees South	Incidental catch (bycatch) of sea turtles during coastal trawling operations in Australian waters north of 28°S'.	Not relevant to the SGCP.
Incidental catch (or bycatch) of seabirds during oceanic longline fishing operations	Incidental catch (or bycatch) of native seabird species during oceanic longline fishing operations.	Not relevant to the SGCP.
Infection of amphibians with chytrid fungus resulting in chytridiomycosis	The infection of amphibians with chytrid fungus resulting in the disease chytridiomycosis. *Chytridiomycosis* is an infectious disease affecting amphibians worldwide.	Not relevant to the SGCP as no *EPBC Act* listed amphibians have been recorded in the SGCP area.
Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris	Entanglement in, and ingestion of, harmful marine debris (including land sourced plastic garbage, fishing gear from recreational and commercial fishing abandoned into the sea, and ship sourced, solid non-biodegradable floating materials disposed of at sea).	Not relevant to the SGCP.

Table 20-5 Potential Impacts for *EPBC Act* Threatening Processes and SGCP Relevance (cont)

Key Threatening Process	Description	Relevance to the SGCP
Invasion of northern Australia by Gamba Grass and other introduced grasses	Ecosystem degradation, habitat loss and species decline due to invasion of northern Australia by introduced Gamba Grass (*Andropogon gayanus*), Para Grass (*Urochloa mutica*), olive hymenachne (*Hymenachne amplexicaulis*), Mission Grass (*Pennisetum polystachion)* and annual mission grass (*Pennisetum pedicellatum*).	Para Grass occurs around two small dams in the SGCP area. Due to the limited habitat for Para Grass, and with the adoption of the proposed mitigation and management measures for weeds in **Section 20.3.4**, the SGCP is considered unlikely to have a significant impact on this key threatening process.
Land clearance	Land clearing consists of the destruction of the above ground biomass of native vegetation and its substantial replacement by non-local species or by human artefacts.	Relevant to the SGCP (refer to **Section 20.3.1**).
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.	The homogenisation of the global flora and fauna through the mass movement of species.	No exotic plants will be introduced to the SGCP area from the Project. With the adoption of the proposed mitigation and management measures for pest fauna in **Section 20.3.4**, the SGCP is considered unlikely to have a significant impact on this key threatening process.
Loss of biodiversity and ecosystem integrity following invasion by the Yellow Crazy Ant (*Anoplolepis gracilipes*) on Christmas Island, Indian Ocean.	The loss of biodiversity and ecosystem integrity following invasion by the Yellow Crazy Ant on Christmas Island results from its rapid increase to high populations or supercolonies, its rapid spread, its association with outbreaks of scale insects, and its broad foraging range and generalist feeding habits.	Not relevant to the SGCP.
Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases	Reductions in the bioclimatic range within which a given species or ecological community exists due to emissions induced by human activities of greenhouse gases.	Not relevant to the SGCP. Emissions from the SGCP are minor compared to Australian total emissions.
Predation by European Red Fox	Foxes have direct impacts on a range of native animal species. They prey particularly on small to medium-sized, ground-dwelling and semi-arboreal mammals, ground-nesting birds and chelid tortoises.	Not considered relevant to the SGCP given that the European Red Fox has not been recorded within the Project area. With the adoption of the proposed mitigation and management measures for pest fauna in **Section 20.3.4**, the SGCP is considered unlikely to have a significant impact on this key threatening process.

Table 20-5 Potential Impacts for *EPBC Act* Threatening Processes and SGCP Relevance (cont)

Key Threatening Process	Description	Relevance to the SGCP
Predation by exotic rats on Australian offshore islands of less than 1000 km^2 (100,000 ha)	Exotic rats are opportunistic feeders; known to prey primarily on birds, small mammals, tortoises, lizards, large insects, land molluscs and plant seeds and seedlings. There is considerable concern over the impact of exotic rats on Australian native species through predation. They may also have an indirect impact on the abundance of other native predators, through competition.	Not relevant to the SGCP.
Predation by feral cats	Feral cats are a serious vertebrate pest in Australia, and have severe effects on native fauna through predation. They are thought to have contributed to the extinction of many small to medium-sized mammals and ground-nesting birds in the arid zone, and to have seriously affected populations of Bilby, Mala and Numbat.	Relevant to the SGCP (refer to **Section 20.3.4**).
Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs	Predation, habitat loss, competition and disease transmission by feral pigs includes the impacts on native ecosystems, flora and fauna due to the presence of feral pigs, their movement, rooting, wallowing, trampling, tusking or rubbing trees, and consumption of water, animals, plants and soil organisms.	Relevant to the SGCP (refer to **Section 20.3.4**). Pigs will be controlled on site in accordance with a pest animal management plan.
Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species	Psittacine Circoviral Disease is a disease affecting parrots and their allies. It is often fatal to birds that contract it, and most species do not respond to treatment.	Not considered relevant to the SGCP as none of the affected psittacine species have been recorded in the Project area.
The biological effects, including lethal toxic ingestion, caused by Cane Toads (*Bufo marinus*).	Cane Toads eat a wide variety of prey, breed opportunistically, have a far greater fecundity than native anurans and develop rapidly particularly in warmer waters. The Cane Toad impacts on native species through predation and competition. Most significantly, Cane Toads possess highly toxic chemical predator defences.	Relevant to the SGCP (refer to **Section 20.3.4**). Creation of new cane toad breeding areas will be mitigated in accordance with the SGCP pest animal management plan.
The reduction in the biodiversity of Australian native fauna and flora due to the red imported fire ant, *Solenopsis invicta* (fire ant)	The reduction in the biodiversity of Australian native fauna and flora due to the red imported Fire Ant.	Not considered relevant to the SGCP given that the Fire Ant has not been recorded within the Project area.

20.3.1. Land Clearing

The clearing of vegetation is one of the most significant impacts on biodiversity and land clearance and is listed as a key threatening process under the *EPBC Act*.

Some species avoid areas in which specific habitat features have been removed. Removal of vegetation for the SGCP will impact on local biodiversity through habitat loss, individual mortality, and indirect effects on hydrology. Habitat loss directly reduces the viability of an area for threatened species. Habitat loss exacerbates fragmentation and edge effects which impact on threatened species' ability to persist adjacent to cleared areas. Indirect effects of vegetation clearing may include impacts on surface and groundwater hydrology (refer to **Section 20.3.3**).

Within MLA 70453, clearing will be primarily associated with the open-cut mining areas and waste rock emplacements. Smaller areas will be cleared for water management infrastructure, roads, stockpiles and other ancillary infrastructure. All clearing within the infrastructure corridor survey area is associated with the activities of the infrastructure corridor.

Approximately 585 ha of remnant vegetation will be cleared to accommodate the mine and associated infrastructure. Mine plans were purposefully designed to minimise impacts on TECs, such that 97.6 % of the 579 ha of Brigalow found on-site will not be cleared by proposed activities.

Clearing will result in increased landscape fragmentation. Fragmentation will result in a reduction of core habitat values of these areas. The removal of any existing vegetation within the SGCP area may impact *EPBC Act* listed species (e.g. Brigalow Scaly-foot). Vegetation clearing should be undertaken in accordance with the mitigation measures described in **Section 20.4** to minimise the potential impact.

Fragmentation is a key threat to the persistence of biodiversity (Cox, Dickman and Hunter, 2003; Fletcher, 2005). Even small, linear cleared strips that bisect native vegetation impede the passage of native species and cause fragmentation (Goosem and Marsh, 1997; Carthew, Horner and Jones, 2009). The SGCP will increase fragmentation of remnant vegetation.

Remnant vegetation within the SGCP region is already highly fragmented and several other mining projects are proposed in the Galilee Basin. In fragmented landscapes, further clearing of vegetation has the potential to exacerbate impacts on ecosystems and species that are already under pressure from existing fragmentation (Souli *et al*., 2004; McIntyre, McIvor and Heard, 2002).

Although portions of this landscape, particularly in the east, have been subjected to fragmentation as a result of existing agricultural activities, some areas (most notably in the west of the mine survey area) still maintain significant corridor values. The SGCP is not expected to significantly impact on major corridors.

Edge effects increase the fragmentation of landscapes (Fletcher, 2005) and occur as a result of environmental and ecological changes along the perimeter of a disturbed area of vegetation. Weed infestations are a common edge effect due to increased light availability in cleared areas coupled with the lack of competition by native plants. Weeds often establish along edges of cleared areas and then spread into the existing uncleared vegetation. Changes to the microclimate (temperature, soil, moisture, humidity) along edges can impede native plant species growth and seed viability.

Edge effects impact on fauna species in terms of changes to microclimates and habitats (Garden *et al*., 2007). Changes to the thermal environment along edges alter the suite of species that may utilise edge areas, and may increase the susceptibility to predation, further reducing the biodiversity values of fragmented area (Andren and Anglestam, 1988; May and Norton, 1996; Webb, Shine and Pringle, 2005).

Edge effects are expected to occur as a result of the SGCP where there is clearing of remnant vegetation. However, edge effects will be avoided to a large extent by the positioning of the mine outside of remnant vegetation as much as practicable. The SGCP is to be situated predominantly in non-remnant vegetation and will avoid most TECs in the area.

Vegetation along Alpha Creek in the east of the SGCP area provides important connectivity with larger expanses of remnant vegetation to the west, south and north-east. This vegetation will remain largely intact.

Some patches of remnant vegetation may become isolated during the SGCP development. These patches would be expected to still have ecological value (acting as stepping stones for fauna moving between Alpha Creek and other areas of remnant vegetation) and should be retained, and where practicable, expanded to form larger connected areas.

Clearing of vegetation may also have indirect impacts through direct mortality, changed fire regimes and dust. These are discussed further in **Sections 20.3.6**, **20.3.7** and **20.3.8.**

20.3.2. Subsidence Impacts

20.3.2.1. Historical Underground Coal Mining Techniques in Australia

Coal was first discovered in Australia in 1791 at the mouth of the Hunter River in New South Wales (NSW), where the first coal mining settlement was established in 1801 (Australian Coal Association [ACA], 2008).

Coal was discovered in Queensland in the mid-1820s, and the first coal mine opened at Redbank in 1843 (ACA, 2008).

Shortwall mining was utilised in the late 1960s to take advantage of the development of hydraulic longwall supports, continuous miners and shuttle cars (University of Wollongong, undated b). The coal face width in shortwall operations was generally less than 90 metres (m) wide. Typically, shortwalls were used as a transition stage while changing a mine to full longwall, or where seam discontinuities or mine geometry made the use of full longwalls impractical (University of Wollongong, undated b). Shortwall mining using continuous miners has now ceased in Australia, due to low production methods, high production costs and inherent risk (Mitchell, 2009).

Highwall mining was introduced into Australia in the early 1990s and uses the void left by open-cut mining to employ remote underground mining equipment to extract coal (Geoscience Australia, 2011). Australia's first punch longwall mining operation commenced in the late 1990s using conventional longwall equipment to mine coal from blocks developed directly from an open-cut final highwall (Geoscience Australia, 2011).

Two methods of underground coal mining are currently utilised Australia, including (Geoscience Australia, 2011):

- bord and pillar mining (and subsequent pillar extraction)
- longwall mining.

In bord and pillar operations, coal is extracted in a series of parallel tunnels (bords) cut at right angles by another series (cut-throughs). In Australia, bord widths are limited to approximately 6 m (NSW Department of Planning [DoP], 2008). Due to cost and productivity considerations, bord and pillar mining is uneconomic as a primary production method at most locations in Australia (DoP, 2008).

The residual pillars of coal left after bord and pillar first workings may be extracted at a later stage of mine life by partial or full 'pillar extraction' (ACA, 2008; DoP, 2008). The pillar width is typically either one tenth of the depth of cover, or 10 m (DoP, 2008). As no roof or side support is installed for pillar extraction, it is considered hazardous and consequently its use has declined over the past 20 years (DoP, 2008).

Longwall mining involves total extraction of large blocks of coal and is described further in **Section 20.3.2.2**.

20.3.2.2. Longwall Mining

Mechanised longwall mining was first introduced to Australia in 1963 (University of Wollongong, undated a). Longwall mining is considered one of the safest forms of underground coal mining and offers high coal recovery rates (Geoscience Australia, 2011).

Large rectangular blocks or 'panels' of coal are defined during the development stage and are then extracted in a single continuous operation (University of Wollongong, undated a). Each defined panel is created by driving a set of headings from main or trunk roadways in the mine, some distance into the panel. These roadways are then joined to form the starting face of longwall coal face.

Mechanised shearers are used to cut and remove the coal at the face, which can vary in width from 100-400 m. As the coal is cut, the longwall face and roof are temporarily supported by self-advancing hydraulic supports to provide a safe working environment (ACA, 2008). After mining, the roof over the area behind the face, from which the coal has been removed, is allowed to collapse or "goaf" (ACA, 2008). Pillars of coal referred to as 'chain pillars' are left in place between longwall panels for stability.
There are two methods of longwall mining used throughout the world, retreat and advance longwall mining (University of Wollongong, undated (a)).

20.3.2.3. Subsidence Process

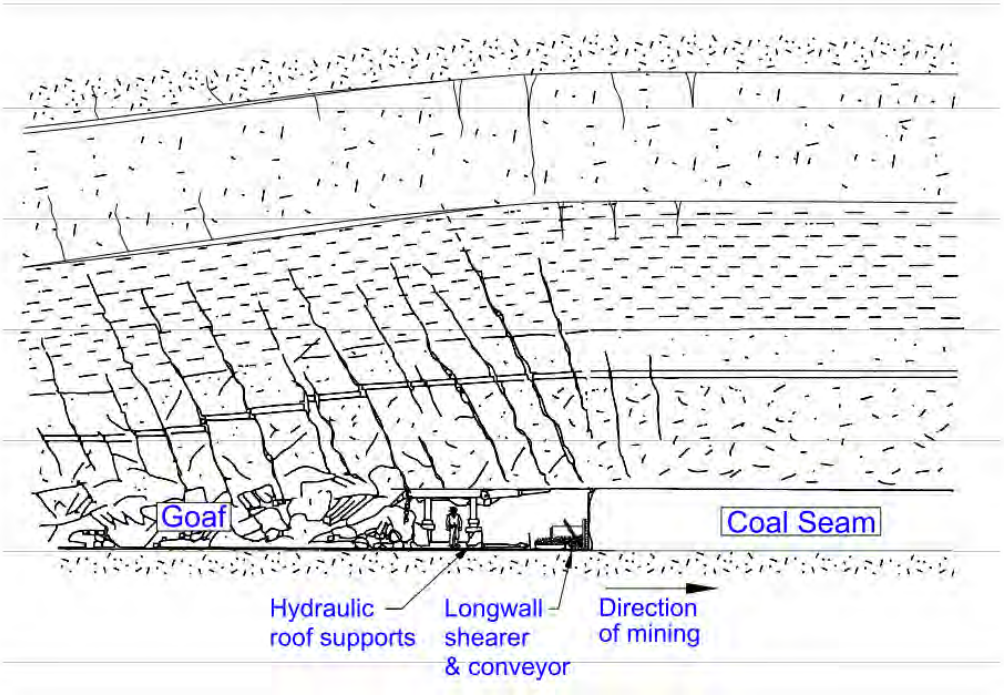
Surface subsidence is considered the principal surface impact of underground coal mining. The subsidence effects associated with the underground mining methods described in **Section 20.3.2.2** are described below.

Subsidence associated with bord and pillar mining results from a combination of sagging of the roof strata between the pillars and compression of the coal pillars and surrounding strata due to the weight of the overburden (DoP, 2008).

Strata disturbance associated with bord and pillar mining is generally negligible, resulting in less than 5 mm of vertical displacement at the surface (DoP, 2008).

Pillar extraction operations result in increased load being transferred onto the coal pillars, which increases sag of the overlying strata and compression of the pillars themselves (DoP, 2008).

As described in **Section 20.3.2.2**, 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". Above this is a progressively narrower zone where the overlying beds remain generally intact with fracturing along the sides of the zone. 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) (refer to **Figure 20-37**). The amount of subsidence reduces towards the surface (MSEC, 2007).



Source: MSEC (2010)

Figure 20-37 Cross-section of a Typical Longwall Face

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).

The subsidence which develops above a set of longwalls can be greater than the sum of the subsidence above each panel. This is particularly the case at large depths of cover or where the roof and floor strata are particularly low strength and stiffness.

The subsidence above a chain pillar results from the increase in the stresses applied to the pillars as the longwall extraction proceeds. The increased stresses cause compression of the immediate roof and floor rocks, compression of the coal seam and particularly any yielding of the coal pillars.

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)).

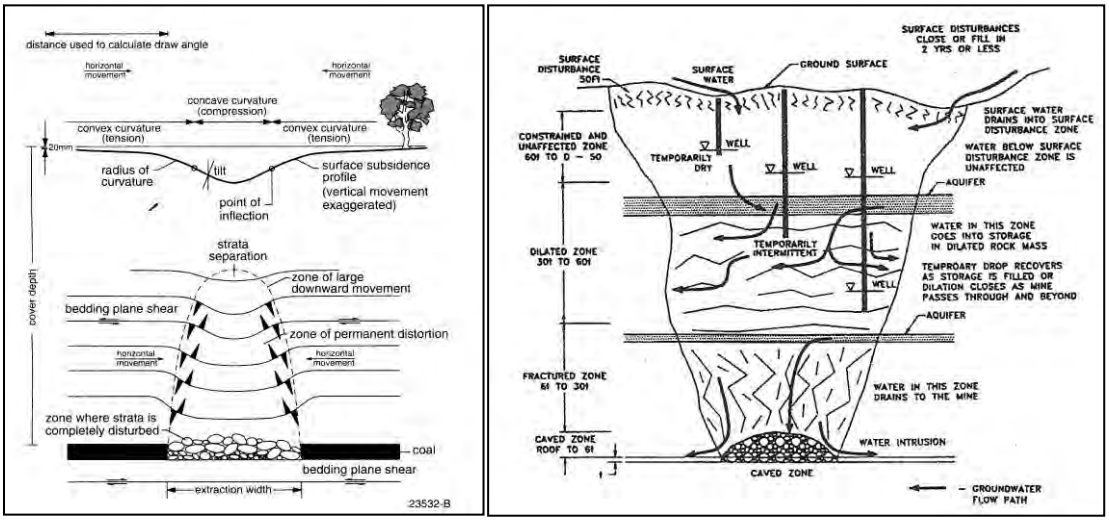
Upsidence is another surface phenomenon associated with underground mining, observed where workings pass beneath a gorge or similar surface feature.

Mining in these areas may concentrate horizontal stress in the strata between the bottom of the feature and the top of any goaf cavity causing strata beds close to the surface to bend upwards and possibly fracture (University of Wollongong, undated (b)).

20.3.2.4. Potential Subsidence Impacts

The extent and magnitude of surface subsidence effects depends on the amount of subsidence, surface topography, the location of surface structures relative to the edges of extracted areas and the presence of any geological structures (University of Wollongong, undated b).

A summary of potential impacts associated with mine subsidence (refer to **Figure 20-38**) based on a desktop literature review is provided below.



(a) Deformations and fracturing (b) hydrogeological

Figure 20-38 Conceptual Illustration of Subsidence Process

The subsidence effects above a set of longwalls may be more than the addition of the subsidence of each panel. This is particularly the case at large depths of cover or where the roof and floor strata are particularly low strength and stiffness.

The relatively shallow depths of cover at the SGCP allow a prediction based on the cumulative addition of isolated panels.

20.3.2.4.1. Subsidence Effects on Hydrology

Potential effects of subsidence on hydrology include the following (Sidle et. al., 1998; Seedsman Geotechnics Pty Ltd, 2002; Dawkins, 2003; Department of Environment and Conservation, 2005; NSW Department of Primary Industries [DPI], 2006; DoP, 2008; Cardno, 2009; Thompson et. al., 2010):

- localised short to medium term diversion of surface water flow to the underlying groundwater system if surface cracking connects to an underlying aquifer. This does not typically occur in mines which underlie relatively flat topography and the surface water flows would be expected to be restored once the water fills the increased bedrock void space (assuming there is no discharge route from the groundwater system)
- reduced flows into pools as a result of upstream diversion of surface flow into the groundwater system
- diversion of surface water flow to the underground workings if fracturing connects with surface fracturing
- reduced period for streams to dry out after creek flow stops, as water may fill the underlying bedrock void space
- potential water quality changes, including:
- minor increases in salinity due to enhanced connection to the underlying bedrock and groundwater discharge to streams
- lowered dissolved oxygen and pH levels
- increased temperature where water depth is reduced
- elevated concentrations of metals through weathering of newly exposed rock faces
- increased stream turbidity, although this tends to be a more significant issue in perennial streams rather than in ephemeral streams like those found in the SGCP area
- dissolution of salts due to erosion
- potential gaseous emissions into the water column

- upstream of the overall subsidence region, headward bed erosion and bank stabilisation and/or widening generally occurs as the stream responds to changes in bed gradient, and attempts to re-establish a new stable state
- the downstream 'edge' of the subsidence region may experience an increase in sedimentation which typically reduces over time as streams regain their original gradient and energy regime
- possible re-direction of overland flow or surface ponding due to altered topography and flow regimes
- possible increases in the incidence of flooding
- destabilisation of creek beds and banks.

20.3.2.4.2. Subsidence Effects on Hydrogeology

Potential effects of subsidence on hydrogeology include the following (Booth et. al., 1998; Seedsman Geotechnics Pty Ltd, 2002; Singh, 2003):

- potential transfer of a portion of surface water flows to the underlying groundwater system
- potential lowering of groundwater levels or hydrostatic head (and therefore reduced groundwater supply) due to fracturing in the strata above underground mine workings leading to mine inflow
- possible short-term reduction in groundwater levels immediately after subsidence, with subsequent recovery of standing water levels when the newly formed voids are filled
- surface fracturing may cause local changes to shallow perched water tables
- increased 'lag' time for shallow groundwater to respond to recharge
- potential water quality changes due to inflow of surface water and exposure/weathering of fractured rock.

20.3.2.4.3. Subsidence Effects on Freshwater Ecosystems

Potential effects of subsidence on freshwater ecosystems include the following (Seedsman Geotechnics Pty Ltd, 2002; Dawkins, 2003; Department of Environment and Climate Change, 2008; DoP, 2008; NSW DPI, 2006; Resource Strategies Pty Ltd, 2008; Cardno, 2009):

- potential short to medium term transfer of a portion of surface water flows to the underlying groundwater system or underground mining workings
- increased frequency, duration and magnitude of drying aquatic habitats

- reduced period for the creek to dry out after creek flow stops as water may fill the underlying bedrock void space
- reduction in longitudinal connectivity between aquatic habitats, particularly during periods of low flow
- potential reduction in fish habitat availability and connectively due to altered stream hydrology, impeding fish passage
- localised impacts on assemblages of aquatic macroinvertebrates as a result of changes in habitat
- potential water quality changes, including:
- minor increases in salinity due to enhanced connection to the underlying bedrock and groundwater discharge to streams
- lowered dissolved oxygen and pH levels
- increased temperature where water depth is reduced
- elevated concentrations of metals through weathering of newly exposed rock faces
- increased stream turbidity, although this tends to be a more significant issue in perennial streams rather than in ephemeral streams like those found in the SGCP area
- dissolution of salts due to erosion
- potential gaseous emissions into the water column
- destabilisation of creek beds and banks
- possible increases to natural stream gradient and therefore flow rate and erosion
- impacts on in-stream habitat due to erosion, accretion of sediment and increased turbidity (e.g. a reduced light availability in the water column)
- potential loss of riparian vegetation due to undercutting and loss of riparian habitat
- stygofauna and troglofauna impacts due to fracturing impacts on groundwater level and quality
- changes in hydrology as a result of mine subsidence have the potential to impact on aquatic plants through exposure and desiccation
- altered flows and stream chemistry may have an impact on the lifecycle, diversity and abundance of aquatic species and riparian vegetation.

20.3.2.4.4. Subsidence Effects on Terrestrial Ecosystems

Potential effects of subsidence on terrestrial ecosystems include the following (Department of Environment and Conservation, 2005; DoP, 2008; Resource Strategies Pty Ltd, 2008):

- impacts on groundwater dependent ecosystems due to changes in the water table and water chemistry
- impacts on terrestrial vegetation due to altered surface hydrology and soil moisture regime
- gas emissions may result in localised plant death as anaerobic conditions are created within the soil
- predominantly localised, limited and temporary impacts on the condition of riparian vegetation
- potential for surface cracking to 'trap' ground dwelling fauna species
- altered overland flow regimes and ponding of surface water
- potential reduction in riparian habitat available to terrestrial fauna
- altered stream hydrology may impact on the availability of drinking water for some terrestrial fauna species.

20.3.2.5. SGCP Predicted Subsidence Impacts

A subsidence assessment was conducted for the SGCP by Seedsman Geotechnics Pty Ltd and is presented in **Appendix H—Subsidence**. Subsidence was modelled using the Surface Deformation Prediction System (SDPS), which was developed in the United States of America. SDPS allows the visualisation of the subsidence bowls using a Gaussian function.

Although the default values for SDPS are not directly applicable to Australian conditions, the assessment for the SGCP has used values developed for the Bowen Basin. SDPS has been applied extensively to coal mines in the nearby Bowen Basin in Queensland and after calibration has been found to produce very sound predictions of subsidence.

The input parameters for SDPS include:

- maximum vertical subsidence (derived from seam thickness and the subsidence factor);
- goaf edge offset, or the distance of the point of inflexion from a vertical projection of the edge of the longwall extraction (based on back analysis of data from the Bowen Basin, the goaf edge offset is assumed to be 0.20 of the depth of cover);
- the tangent of the influence angle (a parameter that controls the maximum tilt that develops on a subsidence crossline) (4.4);

- a strain coefficient, a value that is used to convert curvature to strain (a value of 0.20 has been found to give reasonable estimates of the maximum strain);
- no specific analysis of pillar deformations; and
- multiple seam deformations based on addition of the two seams.

A key point to highlight is that none of these parameters can be determined analytically from the overburden geology. The state of the art is based on empirically-derived values – values measured from longwall mines in what are assessed to be appropriately similar. Obviously, there is no precedent in the Galilee Basin, so engineering judgement is required.

As described in **Appendix H—Subsidence**, there has been very little multiple seam longwall mining in Australia to date, although many operations are being planned or are in the early stages of development. The subsidence modelling approach adopted for the SGCP is consistent with common practice and involved adding the subsidence from each seam and recognising the scientific uncertainty until more data is available.

Surface subsidence typically does not occur suddenly but develops progressively as the coal is extracted (MSEC, 2007). When the extraction of coal commences, there is no immediate surface subsidence, but as the coal within the panel is extracted and the size of the void increases, subsidence develops gradually above the goaf area in the form of a wave (MSEC, 2007).

As mining proceeds within a longwall panel, a point is reached where a maximum value of subsidence occurs and despite further mining within the panel, this level of subsidence is not increased (MSEC, 2007). However, as adjacent longwall panels are subsequently mined, additional subsidence may be experienced above previously mined panel/s. However, a point is also reached where a maximum value of subsidence is observed over the series of panels irrespective of whether more panels are later extracted (MSEC, 2007).

As described in **Section 20.3.2.3**, at large depths of cover or where the roof and floor strata are particularly low strength/stiffness, the subsidence which develops above a set of longwalls can be greater than the sum of the subsidence above each panel. However, for most of the SGCP, the relatively shallow depths of cover allow a prediction based on the cumulative addition of isolated panels. An analysis of pillar compression has not been conducted for SGCP.

As subsidence deformations are spatially distributed, prediction is complex and requires estimates of values (vertical movement, tilt, strain) at a very large number of specific eastings and northings. Due to the number of variables affecting subsidence propagation, 'accuracy' in a scientific measurement sense is not possible; instead reliable predictions can be made which acknowledge the uncertainties in subsidence behaviour and allow engineering responses. It is evident that subsidence impacts at the surface are the result of very complex mechanisms and the cumulative effect of a number of separate movements.

The presence of geological features such as faults has the potential to affect the level of subsidence. No significant faulting has been recorded during the exploration program undertaken to date in the open-cut mining area. Similarly, there is no evidence of large-scale regional folding or structural faulting.

Notwithstanding, the presence of faults and other geological structures cannot be discounted and such features may have adverse implications for the design of the underground mining area and the level and magnitude of subsidence.

Systematic subsidence movements are described by the following parameters (MSEC, 2007; **Appendix H—Subsidence**):

- Subsidence – refers to the vertical and horizontal displacement of a point (expressed in millimetres [mm]). This may be significant in terms of flooding low lying areas.
- Tilt – refers to the slope of the subsidence profile and is calculated as the change in subsidence between two points, divided by the distance between the points (expressed in mm/m). This may alter the direction of flow in drainage channels.
- Strain – caused by bending and differential horizontal movements in the strata (expressed in mm/m). High levels of tensile strain can cause cracking in either the overburden rocks or the surface soils.

The predicted subsidence associated with the underground mining of the D1 and D2 coal seams is presented in **Table 20-6**. The subsidence predictions presented in **Table 20-6** include the incremental predictions for extraction of each coal seam and the cumulative subsidence predicted to occur as a result of all underground mining operations at the SGCP.

For the D1 seam in isolation, the maximum vertical subsidence is 2.55 m, the maximum tilt is 78 mm/m, and the maximum strains are 24 mm/m. For the D2 seam in isolation, the maximum vertical subsidence is 1.5 m, the maximum tilt is 44 mm/m and the maximum strains are 14 mm/m. For the combined layout of both the D1 and D2 seams, the predicted maximum vertical subsidence is 4.2 m, the maximum tilt is 112 mm/m, and the maximum strain is 35 mm/m (tensile or compressive).

As shown on **Figure 20-39** to **Figure 20-41**, the majority of the subsidence occurs over the centre of each longwall and tapers off around the perimeter of the longwall. The maximum tensile strains occur towards the sides of the panel whilst the maximum compressive strains occur towards the bottom of the subsidence trough. For this reason, structures or surface features located on the perimeter of the subsidence trough are only slightly affected, will suffer little settlement and will have little residual tilt or strain. Structures or surface features located at the positions of maximum curvature and strain would generally suffer the greatest impact.

Table 20-6 Maximum Subsidence Parameters

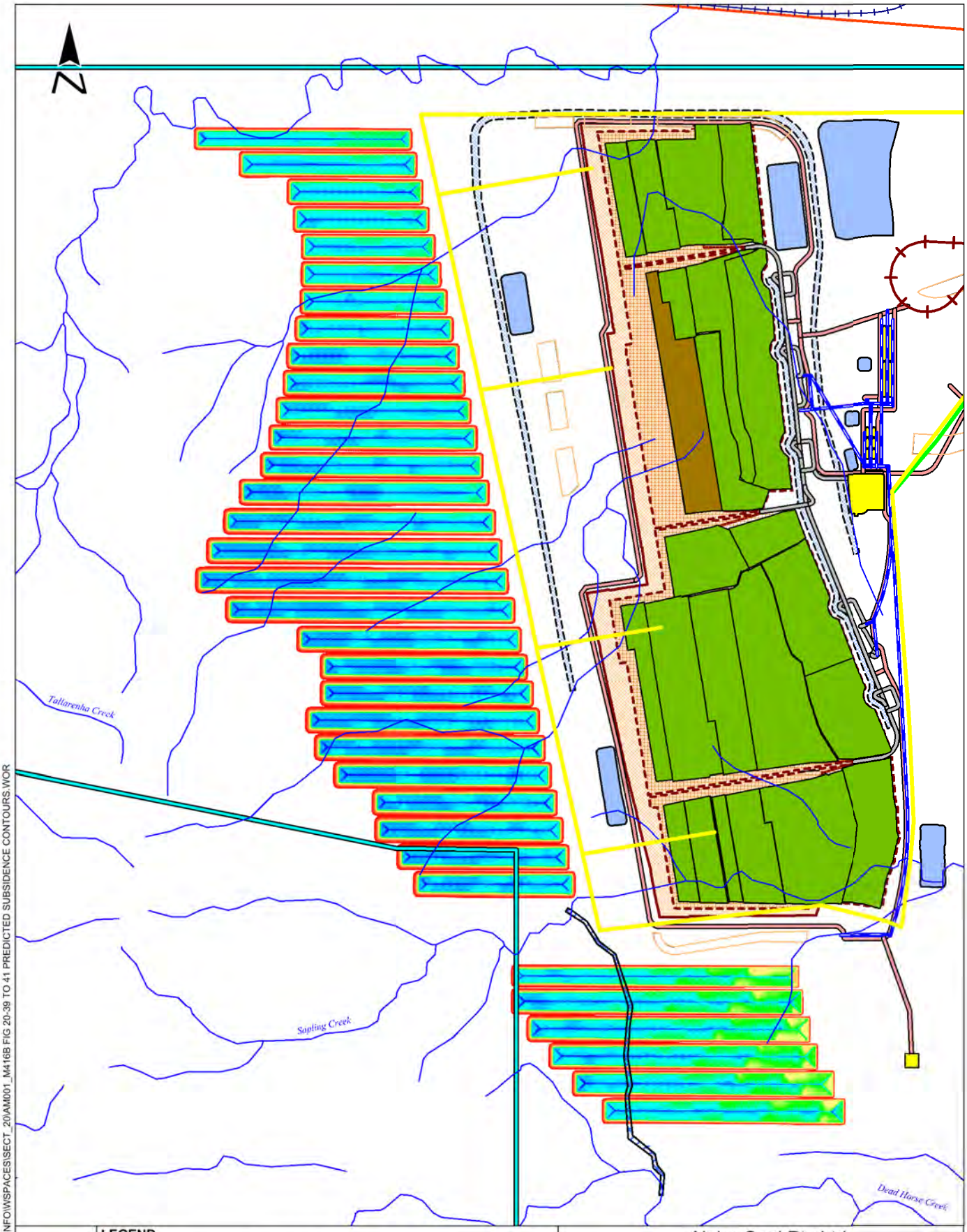
Coal Seam	Maximum Vertical Subsidence (m)	Maximum Tilt (mm/m)	Maximum Strain (mm/m)
D1	2.55	78	24
D2	1.5	44	14
D1 and D2	4.2	112	35

Source: **Appendix H—Subsidence**

For the D1 seam, the maximum vertical subsidence is 2.55 m, the maximum tilt is 78 mm/m and the maximum strains are 24 mm/m (refer to **Figure 20-39**).

For the D2 seam, the maximum vertical subsidence is 1.5 m, the maximum tilt is 44 mm/m and the maximum strains are 14 mm/m (refer to **Figure 20-40**).

For the D1 and D2 seam, the maximum vertical subsidence is 4.2 m, the maximum tilt is 112 mm/m and the maximum strains are 35 mm/m (refer to **Figure 20-41**).



LEGEND

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

Subsidence (m)

- -0.04
- -1.81
- -2.10
- -2.32
- -2.50

Infrastructure

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

Utilities

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

Mining Activity

- Open pit
- Waste rock emplacement

Data Source :DEEDI. Topography (250k) - Geoscience Australia.

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Predicted Subsidence Contours for the D1 Seam

1 0 1
Kilometres

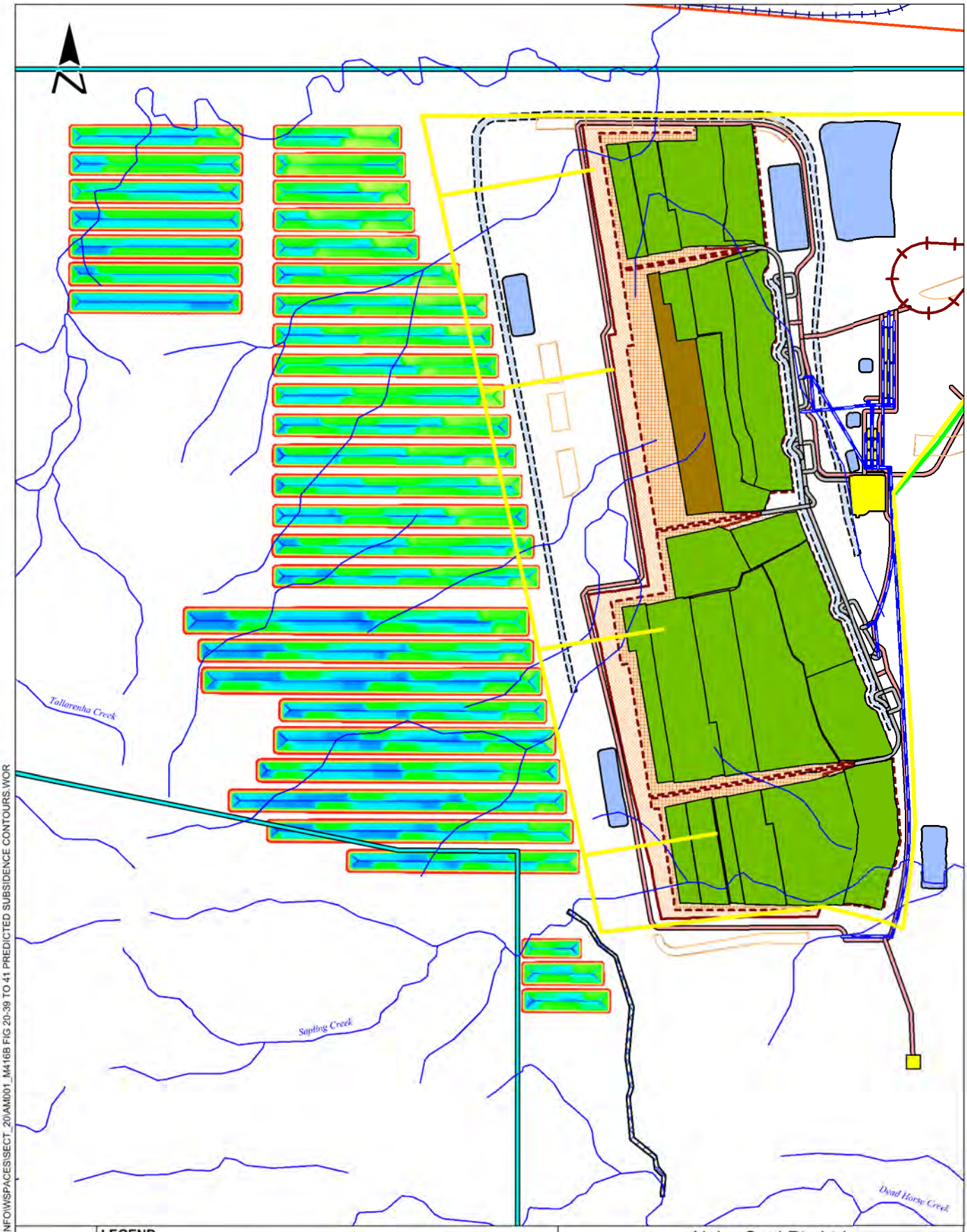
Scale: 1:75,000 (A4)

06/08/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-39

S:\PROJECTS\AM001_STHGALILEE_EIS\GIS_MAPINFO\WSPACESISECT_20\AM001_M416B FIG 20-39 TO 41 PREDICTED SUBSIDENCE CONTOURS.WOR



LEGEND

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

Subsidence (m)

- -0.04
- -1.81
- -2.10
- -2.32
- -2.50

Infrastructure

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

Utilities

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

Mining Activity

- Open pit
- Waste rock emplacement

Data Source :DEEDI. Topography (250k) - Geoscience Australia.

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South Galilee Coal Project

Predicted Subsidence Contours for the D2 Seam

1 0 1
Kilometres

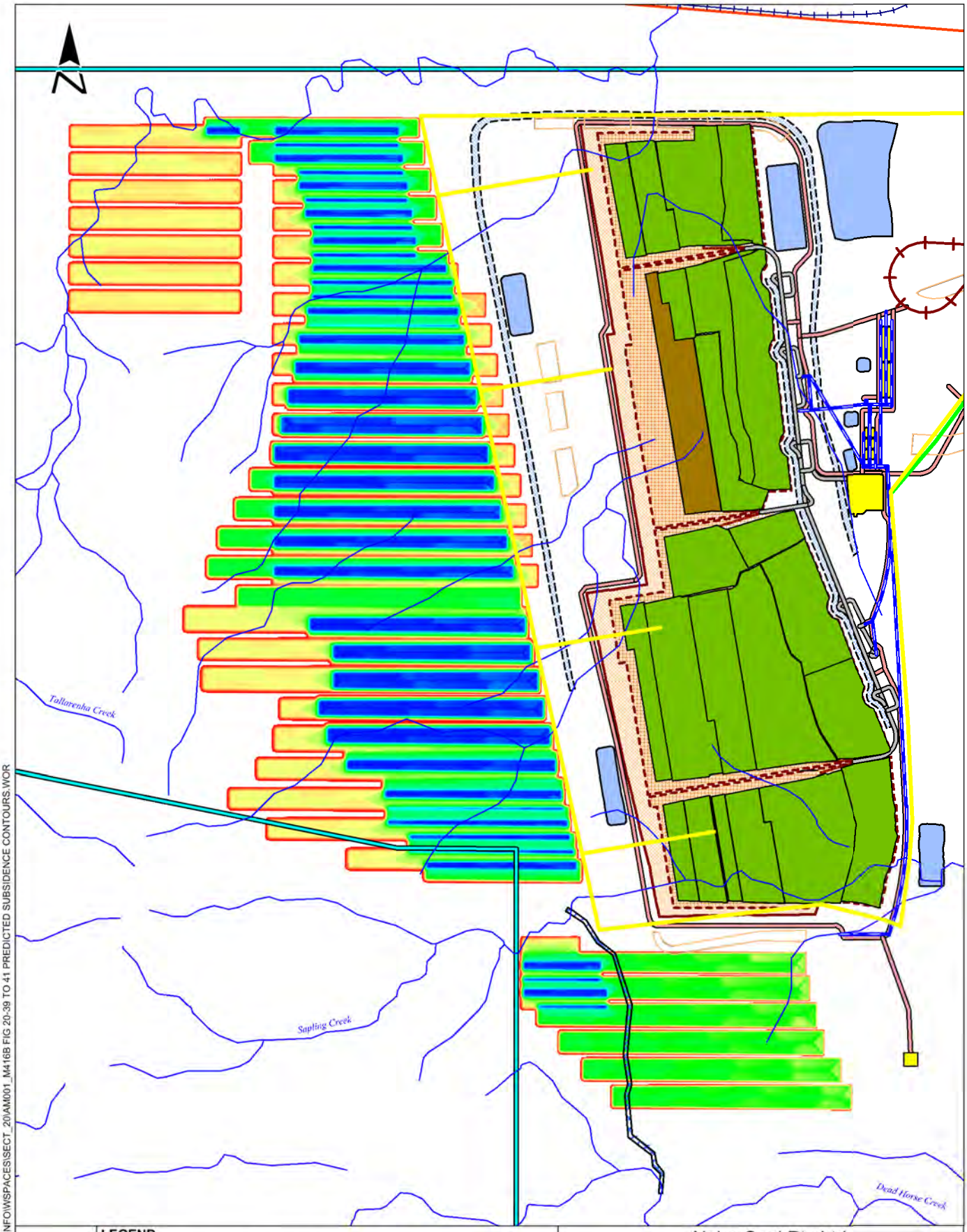
Scale: 1:75,000 (A4)

06/08/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-40

S:\PROJECTS\AM001_STHGALILEE_EIS\GIS_MAPINFO\WSPACES\SECT_20\AM001_M416B FIG 20-39 TO 41 PREDICTED SUBSIDENCE CONTOURS.WOR



LEGEND

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

Subsidence (m)

- -0.04
- -1.81
- -2.10
- -2.32
- -2.50

Infrastructure

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

Utilities

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

Mining Activity

- Open pit
- Waste rock emplacement

Data Source :DEEDI. Topography (250k) - Geoscience Australia.

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South Galilee Coal Project

Predicted Subsidence Contours for the D1 and D2 Seams

1 0 1
Kilometres

Scale: 1:75,000 (A4)

06/08/2012

Proj. : MGA Z55
Datum: GDA 1994

FIGURE 20-41

S:\PROJECTS\AM001_STHGALILEE_EIS\GIS_MAP\INFO\WSPACE\SECT_20\AM001_M416B FIG 20-39 TO 41 PREDICTED SUBSIDENCE CONTOURS.WOR

The flat terrain and the nature of the weathered surface rocks at the SGCP mitigate the likelihood of far field horizontal movements and valley closure effects.

The potential impacts of subsidence on MNES include:

- surface cracking
- transfer of water between surface water and groundwater regimes and inflow of water to underground workings through the fracture network
- water quality impacts
- destabilisation of stream bed and banks
- impacts on groundwater dependent vegetation.

20.3.2.5.1. Surface Cracking

The development of cracking at the surface will depend on the nature of the soils and weathered rocks. There may be a large amount of shallow vertical cracks. Deeper and wider cracking (e.g. in excess of 50 mm wide and 1 m deep) could be associated with tensile strains in excess of 5 mm/m. For the maximum tensile strains being predicted, the widest of the cracks is predicted to be in the order of 100 mm – 200 mm wide and extend to about 10 – 15 m below ground level. Cracks of this nature can be readily remediated as described in **Section 20.3.2.**

To account for potential subsidence-induced fracturing on the ground surface and associated enhanced rainfall recharge, sensitivity analysis has been performed to determine worst-case mine inflows assuming 100 % of annual rainfall infiltrates the fractured zone (refer to **Appendix G—Groundwater**). For mining years 15 through 33, worst case mine inflow could be as much as 87 ML/d for a short period. It is anticipated that the fractures extending to ground surface will seal after the first intense rain event or flooding episode as has been observed at a similar mine in NSW.

20.3.2.5.2. Transfer of Water between Surface Water and Groundwater Regimes

Depending on the depth of the coal seam, subsidence and associated cracking of valley floors and creek lines may cause temporary or permanent loss of water flow (Dawkins, 2003; NSW Scientific Committee, 2008).

Following subsidence, short-term partial loss of surface water may be observed in waterways compared to the baseline conditions, particularly if the groundwater table is depressed after a long dry period. This loss is due to the greater volume of voids filled by surface water recharge. This is usually observed by a greater "lag" time for groundwater levels to recover after subsidence has occurred.

There is a potential for short- to medium-term transfer of surface water to the underlying groundwater system if the surface subsidence cracks connect to an underlying aquifer. The transient tensile strains associated with the subsidence wave may increase the effective pore space in the aquifer and hence there will be a reduction in piezometric head. The increase in bedrock void space may then be filled by surface water flowing into the cracks, temporarily reducing surface overland flow. Provided that there is no discharge route from the groundwater system, surface flows are generally resurrected when the voids are filled. This filling may be by water, or on a more permanent basis by surface soils.

Mine-induced subsidence may result in the formation of new pools within the main channel of Tallarenha Creek and its tributaries. The potential evaporation and seepage from subsidence-induced cracking within the Tallarenha Creek and Sapling Creek catchments could result in enhanced infiltration and subsequent reduction of streamflow in the receiving waters as well as the pattern of flooding.

Catchment surface flow and flood flows could also be trapped in depressions formed by mine-induced subsidence in the floodplain areas. However, it is expected that these areas will be self-healing within one wet season of subsidence occurring. As a result, if free drainage is maintained, it is unlikely that additional infiltration losses will significantly impact on downstream streamflow.

Drainage areas that lie within the west of the SGCP (i.e. Tallarenha Creek headwaters) that will be subject to proposed underground mining areas represent a small area of marginal riparian habitat that has insignificant conservation value. Such effects are expected to be minimal in the SGCP area due to the ephemeral nature of drainage systems.

The Sapling Creek diversion will be undermined by the proposed underground workings. The resultant subsidence may potentially affect flood flows in this diversion.

Both transitory and permanent changes in the transmissive and storage properties of overburden rock will occur as a result of the proposed longwall mining. Above goaf zones permanent changes will occur in fracture porosity and permeability, due to opening up of existing joints, new fractures, and bed separation. At the ground surface, given that mining is dynamic, a leading tensional stress at one location will be followed by a compressional stress, and then another tensional phase. Cracks that might open up in the tensional phase will close at least partially in the compressional phase. Local fracture permeability will increase, and then decrease towards the natural value. Rib areas can be expected to have permanently enhanced permeability, with potential for preferential groundwater flow paths.

For low depths of cover, the separate shallow and deep fracture mechanisms can overlap with connective cracking extending from the longwall panels to the ground surface. This is expected to occur at the SGCP for the 350 m panel width. In that case, fractures will remain open until infilled with sediment mobilised by an intense rain event or flooding.

Changes in hydraulic properties can cause substantial changes in groundwater heads and flow patterns. If the effects reach the surface, baseflow to streams can be reduced. Given the ephemeral nature of the local drainage features, changes in hydraulic properties will be unlikely to reduce baseflow at the SGCP, as the creeks are naturally losing systems most of the time. After heavy rainfall, they are expected to receive some baseflow from perched water tables hosted by local alluvium.

There would be a change in hydraulic properties over the open-cut mine footprint where mine waste rock infills the excavation down to the floor of the D2 coal seam. As mine waste rock would have a higher permeability than any natural material in this area, with the possible exception of alluvium, there would be associated reductions in hydraulic gradients in accordance with Darcy's Law. This will result in the flattening of the hydraulic gradient in the mine waste rock material. Rainfall recharge is expected to be higher in the mine waste rock than in any natural local material.

Above the underground mine, permeability increases will have accompanying reductions in horizontal hydraulic gradients, in accordance with Darcy's Law. As one increases, the other must decrease to maintain the same lateral flow. Changes in groundwater levels and pressures must accompany changes in hydraulic gradients. However, pronounced changes in groundwater levels can occur without any significant drainage into a mine, depending on the integrity of overburden formations. The most pronounced changes in formation properties will take place in the fractured zone above mined longwall panels.

The formation of a fractured zone above the goaf will encourage additional mine inflow as mining progresses. The fractured zone is essentially free draining, and is the primary source of the water that enters the mine. Underground mine inflow for the SGCP is estimated to be generally less than 10 ML/day, with elevated inflow at the commencement of D2 seam mining for 'typical' recharge conditions.

Subsidence may produce a trough-like depression above the mined-out panel (Booth *et al*., 1998). This may cause an increase in surface water pooling, or increased soil moisture content in some locations. This could potentially increase weed abundance (particularly Buffel Grass) which alters habitat structure and renders infested areas less suitable for some native plants. An increase in pooled water due to subsidence may provide breeding habitat for cane toads, which have a deleterious impact on native fauna. An assessment of weeds and pest fauna is provided in **Section 20.3.4**.

20.3.2.5.3. Water Quality Impacts

Water quality (in terms of water chemistry) does not generally change due to subsidence, except for a potential minor increase in salinity through enhanced connection to the underlying bedrock, and/or the increased content of stream bedload and dissolution of salts due to stream bed and bank erosion. Given the recent and Tertiary sediments, the former is unlikely. There can also be increased iron hydroxide precipitates if upwelling groundwater discharges to the stream.

Destabilisation of the stream bed and banks can be a significant effect from subsidence in a stream system as the new, post-mining trough and ridge profile along the stream is not geomorphologically stable. The maximum predicted tilts at the SGCP exceed the current topographic slopes, so this impact should be anticipated.

After subsidence, streams attempt to regain their original gradient and energy regime, which is generally achieved by eroding the stream bed and banks over chain pillars along with sedimentation in subsidence troughs. This also has the effect of increased discharge of suspended sediment downstream of the subsidence region.

Each time the creek flows, the new highs are reduced and the lows are filled in within the overall group of subsided panels. The greatest change in water quality is generally observed during flow periods directly after subsidence occurs, with the erosion/ sedimentation reducing over time as a new stable state is attained.

Upstream of the overall subsidence region, headward bed erosion and bank destabilisation and/or widening can occur as the stream responds to the change in bed gradient, and attempts to re-establish a new stable state.

The downstream "edge" of the subsidence region will generally respond by an increase in sedimentation as the low point fills in an attempt to regain its original bed level.

The movement of sediment through watercourses could be affected by mine subsidence-induced changes to the profile of Tallarenha Creek and the Sapling Creek diversion. However, the proposed channel works will aim to maintain free-draining streams and minimise the restriction of sediment movement following subsidence. The greatest change in water quality is generally observed during flow periods directly after subsidence occurs, with the erosion/sedimentation reducing over time as a new stable state is attained.

Longwall mining has been known to lead to gas emissions resulting in localised plant death as anaerobic conditions are created within the soil (Everett *et al*., 1998). The frequency and intensity of such events is poorly documented. The SGCP Pre-Feasibility Study (AMCI and Bandanna Energy, 2011) indicates that work undertaken on tenements immediately to the north of the SGCP found no economically recoverable reserves of gas therefore methane was not considered to be a likely significant management issue from an operational perspective. No significant indications of gas have been reported during SGCP exploration drilling activities to date (AMCI and Bandanna Energy, 2011).

20.3.2.5.4. Destabilisation of Stream Bed and Banks

A potential impact of subsidence in steep terrain is the modification of channel and drainage morphology. Such changes could affect riparian habitat through channel erosion, sediment delivery and routing in creeks (Sidle *et al*., 2000). Steep terrain is rare within the proposed longwall panels of the SGCP area. The SGCP longwall panels will be situated away from major creeks, and only smaller ephemeral waterways are predicted to experience subsidence impacts.

20.3.2.5.5. Impacts on Groundwater Dependant Vegetation

Subsidence results in surface effects due to vertical displacement of the landscape above the underground mining operations (Singh, 2003). Any changes to the surface hydrology may have indirect effects on vegetation communities through alteration of water availability and flood frequency.

Approximately 1,135 ha of remnant vegetation overlies the proposed longwalls and may be subject to subsidence. Very little of the remnant vegetation overlying longwall panels is groundwater dependant (see **Section 8.6.1.6.**). Two groundwater dependent regional ecosystems may be impacted (see **Section 8.6.1.6.**), but neither are threatened under state legislation or the *EPBC Act*, and both are of limited extent (a total of 84.4 ha). No threatened ecological communities overlie proposed longwall mining.

20.3.3. Water Resources

20.3.3.1. Water Consumption and Supply

As described in **Section 4—Project Description**, up to approximately 900 ML per annum (ML/annum) of raw water is expected to be required for the SGCP during construction and a peak of approximately 3,450 ML/annum during operations.

20.3.3.1.1. Construction

Raw water for construction activities will be sourced from groundwater bores located within MLA 70453, and some surface water harvesting. On-site raw water dams will be constructed to store water from these bores in order to maintain 7-day supply.

An on-site water treatment plant will be constructed to treat groundwater to supply up to approximately 225 ML/annum of potable water for the construction workforce and accommodation facilities.

20.3.3.1.2. Operation

Operational raw water will be sourced from a combination of groundwater, dewatering, surface water harvesting and an external water supply during various stages of the SGCP.

Up to approximately 190 ML/annum of potable water will be required for domestic and underground mining activities. A water treatment plant will be constructed near the Raw Water Dam to supply potable water.

A raw water dam and associated pipelines will be constructed on-site to store and supply raw water during operations.

It is expected that 3,000 ML/annum allocation from the external water supply will be sufficient to meet SGCP water demand until the commencement of Stage 3 operations, after which an additional 450 ML/annum will be sourced from a combination of the following sources:

- rainwater capture/tank water (up to approximately 65 ML/annum)
- runoff from undisturbed areas (up to approximately 1,800 ML/annum)
- runoff from disturbed areas (up to approximately 2,400 ML/annum)
- dewatering from underground (up to approximately 341 ML/annum)
- groundwater (up to approximately 341 ML/annum).

Water resources are discussed in further detail in **Section 9—Water Resources**.

20.3.3.2. Waste Water

An on-site waste water treatment plant will treat waste water and sewage. Approximately 10,000 kilolitres (kL) of treated waste water will be piped to the sediment dam system per day.

All sewage water generated during the SGCP will be collected and treated on-site to Class C effluent standard. Sewage wastewater from across the SGCP area will either be piped or trucked to the wastewater treatment plant depending on its source. Where piping is not practicable, holding tanks will store the sewage water prior to transportation. The solids by-product from the wastewater treatment plant will be periodically removed by a contractor and transported to a licensed disposal facility and the effluent will be reused for industrial usage where practicable.

20.3.3.3. Potential Impacts on Water Resources

Activities associated with the construction phase with the potential to impact on the surface water aquatic ecosystem values in the SGCP include:

- pit construction
- diversion of low order stream habitat within the pit areas
- removal of riparian vegetation from streams both within the infrastructure corridor and the MLA
- instream works associated with road, rail and conveyor crossings
- movement of vehicles and the plant to and from and around the construction site.

Activities associated with the SGCP operational phase that possess the potential to impact on surface water aquatic ecosystem values include:

- pit excavation and dewatering
- underground mine construction
- processing, handling and transport of ore material
- managing water on and off site.

Current information (groundwater level monitoring on-site) indicates no hydraulic connectivity (linkage) between groundwater and the ephemeral surface water resources or perched water tables. Thus any reduction in piezometeric pressure, resulting in decrease in groundwater levels, due to mine depressurisation will not impact on the vegetation communities.

Some species are particularly threatened by impacts on water resources. The eastern great egret is threatened by loss and/or degradation of foraging and breeding habitat through alteration of water flows, drainage of wetlands and salinisation (SEWPaC, 2012e). Species that inhabit wetlands (e.g. Australian Painted Snipe) are vulnerable to processes that reduce the potential for flooding.

20.3.4. Weeds and Pest Fauna

No weeds of national significance were recorded in the SGCP area. As described in **Section 8—Nature Conservation**, three terrestrial weed species listed under the *Queensland Land Protection (Pest and Stock Route Management) Act 2002 (LP Act)* were recorded in the SGCP area during Project surveys, including:

- Harrisia Cactus (*Harrisia martini*)
- Prickly Pear (*Opuntia stricta*)
- Velvety Tree Pear (*Opuntia tomentosa*).

Twenty-five additional weed species were recorded in the SGCP area (refer to **Section 8.2.4.2**).

Weed species have the potential to impact on threatened species through broad scale habitat alteration and competition with native plants that provide food and shelter to fauna species.

Soil disturbance during construction activities and mining operations, coupled with the introduction of weed seeds from outside the SGCP area via vehicular traffic, has the potential to result in the establishment and spread of weeds on-site.

Mitigation measures to control the introduction and/or spread of weed species are described in **Section 20.4.2**.

The four pest fauna species listed under the *LP Act* which were recorded in the SGCP area during Project surveys are described in **Table 20-7**.

Table 20-7 Pest Animal Species Recorded in the SGCP Area

Species	Potential Biological Impacts
Dog (*Canis lupus familiaris*)	• can carry diseases, such as distemper and parvovirus • competes with native fauna for resources and preys upon a wide variety of native animals (particularly medium-sized mammals) • when wild dogs are culled, feral cats may increase in numbers (as such, control measures should target both species concurrently)
Cat (*Felis catus*)	• preys upon a wide variety of native animals and has been implicated in the extinction of a number of native species (Burbidge and Manly, 2000) • competes for resources with native species • predation by feral cats is a key threatening process listed under the *EPBC Act*
Rabbit (*Oryctolagus cuniculus*)	• competes for resources with native species and degrades land through burrowing and grazing • competition and land degradation by rabbits is a key threatening process listed under the *EPBC Act*
Feral Pig (*Sus scrufa*)	• degrades water-bodies through wallowing and foraging, may spread diseases and weeds, preys on nesting ground birds and competes for resources with native species • predation, habitat degradation, competition and disease transmission by feral pigs is a key threatening process listed under the *EPBC Act*

In addition, the Cane Toad (*Rhinella marina*), House Mouse (*Mus musculus*), two introduced fish species (i.e. Mosquitofish [*Gambusia holbrooki*] and Tilapia [*Oreochromis mossambicus*]) and one translocated fish species (i.e. Golden Perch [*Macquaria ambigua*]) were recorded within the SGCP area (refer to **Section 6.2.6** of **Appendix N—Terrestrial Ecology Technical Report** and **Section 3.5.4.6** of **Appendix O—Aquatic Ecology Technical Report**).

Predatory pest animals compete with native species for food and/or directly prey on them. Herbivorous pest animals such as rabbits and domestic livestock contribute to habitat degradation, particularly for species such as Squatter Pigeon and Black-throated Finch.

Cane Toads are a key threatening process due to toxic lethal ingestion and/or predation and competition. Cane Toads also reduce the breeding success and productivity of Rainbow Bee-eaters by feeding on eggs and especially nestlings, and usurping and occupying nesting burrows (SEWPaC, 2012j).

It is not expected that the SGCP will significantly increase the abundance or distribution of terrestrial pest species, with the possible exception of the Cane Toad. Cane Toads require access to permanent water, and the construction of additional water holding facilities may facilitate population expansions. These water holding facilities may also increase habitat for introduced fish species.

Mitigation measures to control the introduction and/or spread of weed species are described in **Section 20.4.2.**

20.3.5. Artificial Lighting

The mine, and associated buildings and roads will increase the amount of artificial light on-site. Little is known regarding the effects of artificial light on fauna and flora (Longcore and Rich 2004). The effects of light are complex, and depend on the visual biology of the species. Possible impacts include:

- Interference with navigation (Salmon *et al.* 1995; Poot *et al.* 2008)
- Interruption of circadian rhythms (Ben-Shlomo and Kyriacou 2010)
- Subtle changes to the timing of dawn singing and other daily activities (Miller 2006; Kempenaers *et al.* 2010)
- Increased densities of insect prey around lights may benefit some vertebrate groups like bats, geckos and frogs (Rydell 1992)
- Greater levels of predation (Davies *et al.* 2012)
- Interference with photosynthesis, flower production or other cell processes in plants (Roman *et al.* 2000; Wang *et al.* 2003).

These impacts are described in further detail in **Section 8.6.2.6.**

While these potential ecological impacts of artificial light have been identified, the severity of these impacts on MNES is typically unknown. With the exception of sea turtles (e.g. Salmon *et al.* 1995), the effects of artificial lighting on Australian fauna of conservation significance has not been investigated. Artifical lighting is not listed in the Australian Government's Species Profile and Threats Database as an important threat to any of the species of conservation significance known from or potentially occurring within the SGCP area. There may be some mortality of the Rainbow Bee-eater associated with collisions with light-bearing structures during migration, although this is predicted to have minimal to no effect on their population (DSEWPaC 2012).

20.3.6. Noise and Air Quality

Increased noise can impact fauna in two ways:

- Loud, novel sounds can induce stress or panicked reactions (Fletcher and Busnel, 1978), which may indirectly increase predation or disease.
- Loud, continuous background noise may interfere with acoustic communication.

The impacts of the former are thought to be low, as repeated exposure to loud sounds (such as mine blasting or 'bird scare guns') can be tolerated by most species (Welch and Welch, 1970). Impacts of the latter are greatest for species with acoustic signals that overlap with mine-generated noise, and are likely to only be important for individuals living in close proximity to the mine area. Overall, the impacts of noise on MNES are likely to be negligible. However, due to limited evidence available on impacts of noise and vibration on Australian species, the true impacts are not predictable.

The amount of airborne dust will be increased by the SGCP, due to clearing, earthworks, vehicle movements, windblown emissions and blasting. Excessive dust reduces photosynthesis and inhibits plant growth (Thompson et al., 1984; Sharifi, Gibson and Rundel, 1997). Pollutants in dust can also impede plant growth (Farmer, 1993; Doley, 2006). It is possible that dust will impact native vegetation within close proximity to the open pit mining area and haulage routes. Because the amount of dust deposited on leaves declines exponentially away from the source (Zhu et al. 2010), these impacts are expected to be highly local in extent. Impacts of dust on MNES are expected to be negligible.

20.3.7. Direct Mortality from Vehicles

Some fauna are vulnerable to injury or mortality from collisions with vehicles. This may occur while clearing vegetation during the development phase of the SGCP, or due to increased vehicular traffic during construction and operation. Road traffic will increase as a result of the SGCP, both within the mining lease and on public roads servicing the mine.

Species most at risk of direct mortality from vehicles include:

- Slow-moving species
- Species that often forage on or beside roads
- Species with favourable habitat adjacent to roads

20.3.8. Changed Fire Regimes

Fire regime can impact MNES in various ways:

- Fires, especially those of high intensity and/or during the breeding season, lead to direct mortality of fauna (Krockenberger *et al.* 2012).
- Frequency and intensity of fires affect the amount of litter and woody debris, used as shelter for fauna.
- Regular fires promote grasses at the expense of a shrub layer. This favours certain fauna species and disadvantages others.
- Fires at inappropriate times of the year can cause a short-term shortage of grass seeds, eaten by fauna (Kutt and Woinarski 2007).
- Fires are necessary for the germination and reproduction of some native plants (Bell *et al*. 1993).
- Some vegetation communities, such as Brigalow, rarely experience fires naturally (DSEWPaC 2012d), while for others fire is important for maintaining ecosystem health and a diversity of habitats (Fensham and Fairfax, 2007; Price, Kutt and McAlpine, 2010).

The SGCP may impact the fire regime experienced by vegetation on-site:

- Clearing favours the growth of grasses, which are highly combustible. This may lead to increased frequency of low-intensity fires.
- Increased human traffic can indirectly lead to an increased rate of uncontrolled fires due to cigarette butts and broken glass acting as additional sources of ignition.
- The construction of new roads may act as fire breaks preventing fires from spreading over broad areas.
- Changes to grazing regimes influences the amount of grass in the understorey, altering fuel loads.

In general, changes to the fire regime due to the SGCP are expected to be minor. Appropriate management of fire will be considered in the management of all MNES on-site.

20.3.9. Potential Impacts to Threatened Species

20.3.9.1. Ornamental Snake

Habitat Loss

Ornamental Snakes inhabit a range of vegetation types, but are most reliant on cracking clay soils with abundant gilgais (Melzer 2012). Such areas usually support Brigalow. Favourable habitat is scarce within the SGCP area, and as the SGCP mostly avoids impacts on Brigalow (see **Section 0**), impacts on the Ornamental Snake are also expected to be limited. Nevertheless, 4989.7 ha of mostly suboptimal habitat (non-remnant vegetation or non-clay substrates) will be cleared to accommodate the open-cut mine and associated infrastructure. Ornamental Snakes may utilise these areas transiently, but are not expected to breed there.

Habitat Fragmentation

Most Brigalow retained on-site will not be further fragmented by proposed activities. Within the mining lease, the largest tracts of Brigalow (in the west and south of the survey area), and their connectivity with other remnant vegetation communities, will be retained. Small units of Brigalow will be fragmented by the infrastructure corridor. However, the 100m-wide clearing is unlikely to constitute a barrier to the movement of this species.

Subsidence

Breeding habitat of this species (i.e., Brigalow communities) will not be impacted by longwall mining.

Artificial Lighting

The impacts of artificial lighting on Ornamental Snakes are unknown. Artificial lighting is not listed among recognised threats to the species (DSEWPaC 2012f).

Noise and Air

Changes to noise and/or air quality as a result of the SGCP are not anticipated to have significant direct impacts on the Ornamental Snake.

Pest Animals

Predation by feral species is a potential threat to Ornamental Snakes (DSEWPaC 2012f). If not managed appropriately, feral cats and dogs may increase in density as a result of the SGCP. Any additional permanent pooled water installed in association with the SGCP may increase the density of Cane Toads. Ornamental Snakes may be lethally poisoned after ingesting Cane Toads (DSEWPaC 2012f). Wallowing feral pigs and cattle can degrade habitat and disrupt the soil cracks used for shelter (Melzer 2012).

Road Mortality

Increased night-time road traffic through high quality habitats causes mortality through collisions with vehicles. The only road to be installed in or near favoured Brigalow habitats is the service road along the infrastructure corridor. This will not be open to the public, and its use will be infrequent and primarily during daylight hours. As such, road mortality of Ornamental Snakes is not expected to be significantly increased as a result of the SGCP.

Direct Mortality During Clearing

Ornamental Snakes are nocturnal, and shelter during the day under logs and in soil cracks (DSEWPaC 2012f). As a result, they are vulnerable to direct injury or death from machinery during clearing. Because of the limited amount of high-quality habitat (i.e., Brigalow) to be cleared, this impact is expected to be minimal.

Changed Fire Regimes

Because Ornamental Snakes utilise deep cracks in clay soils for shelter (DSWEPaC 2012f), and such environments are sheltered from fire, changed fire regimes are not considered an important threat to the species. Nevertheless, inappropriate fire management may reduce the amount of fallen woody debris, which is used as temporary shelter sites (DSEWPaC 2012f).

Weeds

Invasive weeds are listed as a possible threat to Ornamental Snakes (DSEWPaC 2012f). Aquatic weeds that choke waterways and reduce the quality of frog breeding habitat, and thus food for Ornamental Snakes, are likely to be the greatest threat. The SGCP is not expected to elevate the risk of spread of aquatic weeds.

20.3.9.2. Yakka Skink

Habitat Loss

Yakka Skinks inhabit a broad diversity of woodland and shrubland habitats, on a range of soil substrates (Eddie 2012). The species lives in colonies in or under fallen logs, rocks, dense vegetation or rabbit warrens (DSEWPaC 2012j). The understorey complexity required by the species is generally confined to remnant vegetation, although Yakka Skinks may persist in cleared areas if piles of rocks or fallen timber are retained (DSEWPaC 2012j). Such habitat features are generally lacking from non-remnant habitats within the SGCP area. The SGCP mine footprint has been positioned to avoid as much remnant vegetation as practicable. Nevertheless, 584.7 ha of remnant vegetation will be cleared to accommodate the mine and associated infrastructure. While no Yakka Skinks were recorded within the SGCP area, this remnant vegetation represents potential habitat for the species.

Habitat Fragmentation

Most of the remnant vegetation to be removed for the SGCP is comprised of small units within large tracts of non-remnant vegetation. These do not constitute important movement corridors for Yakka Skinks. The connectivity of large tracts of remnant vegetation surrounding the mine footprint will not be compromised by the SGCP.

Potential habitat for Yakka Skinks will be bisected by the infrastructure corridor. However, the 100m-wide clearing is unlikely to constitute an important movement barrier for the species.

Subsidence

The Yakka Skink is not dependent on any of the vegetation communities that may be impacted by subsidence (see **Section 8.6.1.6**).

Artificial Lighting

The impacts of artificial lighting on Yakka Skinks are unknown. Artifical lighting is not listed among recognised threats to the species (DSEWPaC 2012j; Eddie 2012).

Noise and Air

Changes to noise and/or air quality as a result of the SGCP are not anticipated to have significant direct impacts on the Yakka Skink.

Pest Animals

Yakka Skinks are predated by wild dogs, cats and pigs (Eddie 2012). Grazing by cattle removes understorey cover. Inappropriate management of these exotic species as a consequence of the SGCP could impact Yakka Skinks.

Road Mortality

Yakka Skinks typically forage and bask close to their shelter sites, and these shelter sites are utilised for multiple generations (Eddie 2012). This sedentary behaviour ensures a low susceptibility of the species to road-related mortality. The infrastructure corridor will involve the construction of a new unsealed road through potential habitat for the species. This road will serve as access for maintenance of the railway line, and will be closed to the public. As such, use of this road will be infrequent, and will not exceed current traffic by local landholders along existing private tracks. Consequently, the SGCP is not expected to significantly elevate threats of road mortality to Yakka Skinks.

Direct Mortality During Clearing

When threatened, Yakka Skinks retreat to their communal shelter sites (DSEWPaC 2012j), and are thus vulnerable to direct injury or death from machinery during clearing.

Changed Fire Regimes

Due to the dependence of Yakka Skinks on dense understorey vegetation and/or piles of fallen timber, regular and/or intense fires may remove shelter sites (Eddie 2012). Inappropriate fire management as part of the SGCP may therefore degrade habitat for the species.

Weeds

Weeds are not listed as an important threat to Yakka Skinks (DSEWPaC 2012j; Eddie 2012).

20.3.9.3. Dunmall's Snake

Habitat Loss

Dunmall's snake is a very little known species, and its habitat requirements are poorly characterised. It is thought to inhabit a broad range of woodlands and shrublands, usually on heavier soils (Hobson 2012). Given the rarity and difficulty of detecting this species, all suitable remnant and non-remnant habitats near known locations of the species are considered important habitat (DSEWPaC 2012e). There are no records of the species in or near the SGCP area (**Figure 20-19**), and the SGCP area may be outside the geographic range of the species. However, given the paucity of surveys carried out in the general region, the low detectability of the species, and the presence of suitable habitat on-site, Dunmall's Snake may be impacted by habitat loss resulting from the SGCP.

Most of the clearing to be carried out for the SGCP is in non-wooded habitats unsuitable for Dunmall's Snake. Nevertheless, 584.7 ha of potential habitat is to be removed to accommodate the mine and related infrastructure.

Habitat Fragmentation

Most of the remnant vegetation to be removed for the SGCP is comprised of small units within large tracts of open pasture. These are probably not important movement corridors for Dunmall's Snakes. The connectivity of large tracts of remnant vegetation surrounding the mine footprint will not be compromised by the SGCP.

Potential habitat for Dunmall's Snake will be bisected by the infrastructure corridor. However, the 100m-wide clearing is unlikely to constitute an important movement barrier for the species.

Subsidence

The Dunmall's Snake is not dependent on any of the vegetation communities that may be impacted by subsidence (see **Section 8.6.1.6**).

Artificial Lighting

The impacts of artificial lighting on Dunmall's Snake are unknown. Artifical lighting is not listed among recognised threats to the species (DSEWPaC 2012e; Hobson 2012).

Noise and Air

Changes to noise and/or air quality as a result of the SGCP are not anticipated to have significant direct impacts on Dunmall's Snake.

Pest Animals

Dunmall's Snakes are predated by foxes, cats and pigs (Eddie 2012). They are also threatened by extensive overgrazing by livestock (DSEWPaC 2012e). Inappropriate management of these exotic species as a consequence of the SGCP could impact Dunmall's Snakes.

Road Mortality

Many records of this poorly known species come from individuals observed on roads at night (DSEWPaC 2012e). Increased vehicular traffic within the mine site, and between the SGCP and nearby regional centres, increases the risk of mortality of Dunmall's Snakes on roads. Overall, road mortality is not expected to be significantly increased by the SGCP, due to the fact that most roads on-site are to be constructed through non-remnant pasture, which is largely unsuitable as habitat for Dunmall Snakes.

The service road to be constructed along the length of the infrastructure corridor through habitat suitable for Dunmall's Snakes is unlikely to impact on the species, as usage of this road will be infrequent, and restricted to daylight hours, when the species is inactive.

Direct Mortality During Clearing

Dunmall's Snakes shelter under fallen timber and ground litter during the day (DSEWPaC 2012e), and are thus vulnerable to serious injury and death from machinery during clearing.

Changed Fire Regimes

Inappropriate fire regimes may result in the loss of fallen timber and litter, used by the species for shelter (DSEWPaC 2012e).

Weeds

Weeds are listed as a potential threat to Dunmall's Snakes (DSEWPaC 2012e). The impacts of weeds are most likely to be indirect, through increasing fire fuel loads or altering the habitat of prey species. Inappropriate weed management as part of the SGCP could reduce the quality of habitat present locally.

20.3.9.4. Brigalow Scaly-foot

Habitat Loss

The SGCP area contains a known population of the Brigalow Scaly-foot that may be impacted by proposed activities. The Brigalow Scaly-foot inhabits a range of remnant and non-remnant habitats, although its preference for a complex understorey of fallen debris and rock means that remnant habitats are of greatest importance (Peck 2012). The species was detected in the east of the MLA, in a unit of remnant vegetation that is outside the proposed mine footprint. The presence of the species on-site influenced the placement of the mine footprint in mostly non-remnant habitats. Nevertheless, 584.7 ha of remnant vegetation and 4,404.9 ha of non-remnant vegetation will be removed for the SGCP. While this mostly constitutes suboptimal habitat for the species, this clearing will reduce the area of occupancy of the species and may reduce the local population size.

Habitat Fragmentation

Large, continuous tracts of habitat in the Central Queensland sandstone rises are considered important strongholds for the species (DSEWPaC 2012k). Large blocks of remnant vegetation within the western and south-eastern parts of SGCP area are contiguous with the sandstone rises of the Carnarvon Ranges, and serve as important movement corridors. The SGCP will not compromise connectivity within these large blocks.

Most of the remnant vegetation to be removed for the SGCP is comprised of small units within large tracts of open pasture. These are probably not important movement corridors for Brigalow Scaly-foots.

Potential habitat for the Brigalow Scaly-foot will be bisected by the infrastructure corridor. However, the 100m-wide clearing is unlikely to constitute an important movement barrier for the species.

Subsidence

The Brigalow Scaly-foot is not dependent on any of the vegetation communities that may be impacted by subsidence (see **Section 8.6.1.6**).

Artificial Lighting

The impacts of artificial lighting on the Brigalow Scaly-foot are unknown. Roadside lighting has been suggested as a threat to the species on Boyne Island (Tremul 2000). Artificial lighting may elevate the risk of predation of individuals living closest to the open pit.

Noise and Air

Changes to noise and/or air quality as a result of the SGCP are not anticipated to have significant direct impacts on the Brigalow Scaly-foot.

Pest Animals

Predation from feral animals and habitat disturbance from livestock are known threats to the species (DSEWPaC 2012k; Peck 2012). Inappropriate management of these exotic species as a consequence of the SGCP could impact the Brigalow Scaly-foot.

Road Mortality

Some increased mortality through collisions with vehicles is expected as a result of the SGCP. However, this is expected to be minimised by the fact that most roads on-site are to be constructed through non-remnant pasture, which is largely suitable as habitat for the Brigalow Scaly-foot.

The service road to be constructed along the length of the infrastructure corridor through habitat suitable for the Brigalow Scaly-foot is unlikely to impact on the species, as usage of this road will be infrequent, and restricted to daylight hours, when the species is inactive (Peck 2012).

Direct Mortality During Clearing

Brigalow Scaly-foots shelter under sandstone slabs, fallen timber and grass hummocks during the day (DSEWPaC 2012k), and are thus vulnerable to serious injury and death from machinery during clearing.

Changed Fire Regimes

Inappropriate fire regimes may remove shelter sites and food resources of the Brigalow Scaly-foot (DSEWPaC 2012k).

Weeds

Weeds are not listed as an important threat to the Brigalow Scaly-foot (DSEWPaC 2012k; Peck 2012).

20.3.9.5. Koala

Habitat Loss

Habitat loss is the major threat to the Koala in Queensland (Natural Resources Management Ministerial Council 2009). Koalas utilise a broad range of eucalypt forests and woodlands, but tend to show preferences for certain tree species in certain regions (Krockenberger *et al*. 2012). Riparian forests dominated by *Eucalyptus camaldulensis* are important habitats for Koalas in semi-arid Queensland (Gordon *et al.* 1988). Studies of Koalas near Clermont (one of few Brigalow Belt sites studied to date) suggest that *Eucalyptus populnea* also forms a dominant component of their diet (Ellis *et al.* 2002), and it was in this habitat that Koalas were recorded in the SGCP area. The unit of woodland within the SGCP in which Koalas were recorded is outside the proposed mine footprint, although 135.2 ha of woodlands dominated by the food tree species listed above is to be cleared for the SGCP.

Habitat Fragmentation

Clearing of vegetation to accommodate the open pit will break narrow corridors of riparian habitat along tributaries of Tallarenha Creek. While these corridors are not contiguous with remnant vegetation at either end, they may still function in some capacity to facilitate movement of Koalas across the site.

Potential habitat for the Koala will be bisected by the infrastructure corridor. Such linear infrastructure may pose a barrier to movement (Natural Resources Management Ministerial Council 2009).

Subsidence

Riparian woodlands dominated by *Eucalyptus camaldulensis* (i.e., RE 11.3.25) constitute one vegetation type that may be impacted by cracking due to longwall mining (see **Section 8.6.1.6**). This is a key habitat for Koalas. The exact impacts of the SGCP on these riparian woodlands are difficult to predict, and these range from no detectable impacts, to local mortality of *E. camaldulensis* growing above or immediately downstream from longwall panels. A total of 2.1 ha of RE 11.3.25 overlies the proposed longwall panels. Additional downstream habitat may be impacted.

Artificial Lighting

The impacts of artificial lighting on Koalas are unknown. It is not a recognised threat to the species (Natural Resources Management Ministerial Council 2009).

Noise and Air

Changes to noise and/or air quality as a result of the SGCP are not anticipated to have significant direct impacts on the Koala. Constant noise arising from the SGCP could potentially interfere with acoustic communication of the species. However, this impact is expected to be limited to the close proximity of the open pit and processing areas; areas far from the largest tracts of Koala habitat in the south-east and north-west of the mining lease (**Figure 20-14**).

Pest Animals

Attacks from dogs are thought to be a reason for the decline of Koalas in suburban and densely populated rural areas (Natural Resources Management Ministerial Council 2009; Krockenberger *et al.* 2012). Inappropriate management of wild dogs/dingoes as a result of the SGCP could increase the threat to Koalas of predation.

Road Mortality

Road mortality is a serious threat to urban populations of Koalas (Natural Resources Management Ministerial Council 2009; Krockenberger *et al.* 2012). This impact is greatest where there is high night-time vehicular traffic along roads bisecting important movement corridors for the species. While no roads to be constructed on-site bisect riparian lines acting as potential corridors for the species, increased traffic along the Capricorn Highway may lead to increased mortality of Koalas.

Direct Mortality During Clearing

Due to their slow mobility, Koalas are vulnerable to direct injury or mortality from tree-felling. As they are highly visible species, effective measures can be in place to reduce and eliminate this risk.

Changed Fire Regimes

Wildfire can have devastating effects on Koala populations (Krockenberger *et al.* 2012). Inappropriate fire management as part of the SGCP could lead to a greater frequency of high-intensity fires that spread to the canopy and lead to direct mortality of Koalas.

Weeds

Degradation of habitat through the introduction of weeds is a potential threat to Koalas (Natural Resources Management Ministerial Council 2009). This is a problem in coastal areas, where weeds such as Lantana (*Lantana camara*) form dense thickets that inhibit Koala movement, and others such as Camphor Laurel (*Cinnamomum camphora*) compete with eucalypt food trees. No weeds currently found or likely to spread to the SGCP threaten Koala movement or food availability.

20.3.9.6. Squatter Pigeon

Habitat Loss

Squatter Pigeons inhabit grassy woodlands in close proximity to water, including troughs and other artificial sources for livestock. They inhabit a range of remnant and cleared habitats (Reis 2012). Habitat loss due to the SGCP may be incurred through the clearing of vegetation and/or a reduction in water availability. The SGCP lies near the western edge of the species' distribution. Squatter Pigeons are usually a highly detectable species, and the lack of records from the SGCP area suggests that habitat on site may be sub-optimal. Nevertheless, all areas enclosed within the mine footprint (4989.7 ha) could be considered potential habitat for the species.

Habitat Fragmentation

Due to the mobility of Squatter Pigeons, and their ability to utilise a range of remnant and non-remnant habitats widespread within the region, habitat fragmentation is not expected to be an important impact of the SGCP.

Subsidence

Due to their close association with water, any loss of water retention in Tallarenha Creek due to cracking and subsidence induced by longwall mining could impact groups of Squatter Pigeons dependent on the creek as a water source. No Squatter Pigeons were observed in this vicinity (or elsewhere on-site) during surveys. Water sites are widespread and common across the general region, due to the artificial provision of water for livestock, and are unlikely to be limiting for Squatter Pigeons in a local context. Consequently, the impact of subsidence on the species is expected to be negligible.

Artificial Lighting

The impacts of artificial lighting on Squatter Pigeons are unknown. As the species regularly inhabits areas near roads and homesteads (Reis 2012), where artificial lighting is present, it is expected that such lighting has a negligible impact on the species.

Noise and Air

Changes to noise and/or air quality as a result of the SGCP are not anticipated to have significant direct impacts on the Squatter Pigeon. The only impact is the potential for noise to interfere with acoustic communication within groups living in close proximity to the mine pit and processing areas. As no individuals were recorded in this area (or elsewhere within the mining lease), these impacts are expected to be minimal.

Pest Animals

This ground-nesting species is vulnerable to predation from dogs, cats, foxes and pigs. Overgrazing by cattle and rabbits, especially in combination with drought, can lead to local population declines (Reis 2012). Inappropriate management of these exotic species as a result of the SGCP could lead to increased pressure on local populations.

Road Mortality

Squatter Pigeons forage on bare ground between grass tussocks, and while roads constitute favourable foraging habitat for the species (Reis 2012), they also elevate the risk of collisions with vehicles. Increased traffic due to the SGCP may lead to greater mortality of the species on existing roads and roads to be constructed for the project.

Direct Mortality During Clearing

Due to their mobility, Squatter Pigeons are at low risk of direct injury or death from machinery during clearing. The greatest risk of damage is to nests and nestlings.

Changed Fire Regimes

Due to their dependence on native grasses and herbs for food, Squatter Pigeons are threatened by changes in vegetation structure arising through inappropriate fire regimes (Reis 2012). Inappropriate timing of fires (e.g., during breeding) may also threaten the species.

Weeds

Squatter Pigeons are ground-dwelling and feed mostly on seeds from a range of native grasses and herbs (Reis 2012). Replacement of native understorey with exotic pasture species such as Buffel Grass (*Cenchrus ciliaris*) is a threat to the species, as the latter impedes movement and produces unfavourable seeds (Reis 2012). Inappropriate management of Buffel Grass and other weeds as a result of the SGCP degrades habitat for Squatter Pigeons.

20.3.9.7. Black-throated Finch

Habitat Loss

Black-throated Finches are dependent on intact (remnant) grassy woodlands, and are usually found within a kilometre of water (DEWHA 2009). They usually nest within 400 m of water (DEWHA 2009). They may pass through modified habitats if these are less than a kilometre in width (DEWHA 2009). The large expanses of non-remnant vegetation contained within the proposed mining area are not suitable as habitat for Black-throated Finches. Because the 355.1 ha of remnant vegetation contained within the mine footprint are comprised of small, isolated fragments, these are also unlikely to constitute important habitat for the species. While Black-throated Finches were not detected during surveys, potential habitat for the species is located in the west of the mining lease, along Alpha Creek, and within the infrastructure corridor. Of these, only habitat within the infrastructure corridor will be impacted by the SGCP. Here, 229.6 ha of remnant vegetation will be removed as a 100 m-wide strip. A rail corridor through intact vegetation will continue to serve as foraging habitat for Black-throated Finches (Grice 2012). However, the removal of trees reduces available nesting sites for the species. Overall, through the careful placement of the SGCP in habitat that is mostly unsuitable for the species, the impacts of the SGCP on local Black-throated Finch populations are expected to be minimal.

Habitat Fragmentation

Potential habitat for Black-throated Finches is to be bisected by the proposed 100m-wide infrastructure corridor. However, Black-throated Finches are known to utilise such corridors for feeding (Grice 2012), and readily move over clearings up to a kilometre in width (DEWHA 2009). Consequently, the SGCP is not expected to create any barriers to the movement of Black-throated Finches, should they occur on site.

Subsidence

Due to their close association with water (DEWHA 2009), any loss of water retention in Tallarenha Creek due to cracking and subsidence induced by longwall mining could impact populations of Black-throated Finches dependent on this water source. No Black-throated Finches were observed in this vicinity (or elsewhere on-site) during surveys. Furthermore, most habitat along Tallarenha Creek was unsuitable for the species (either non-remnant, or too small and fragmented). The headwaters of some tributaries of Tallarenha Creek occur within remnant vegetation that may constitute potential habitat for Black-throated Finches. Water supply in these drainage lines may be compromised by longwall mining. However, as these drainage lines are highly ephemeral, they are unlikely to constitute important water sources for the species (DEWHA 2009).

Artificial Lighting

The impacts of artificial lighting on the Black-throated Finch are unknown. It is not listed as a current threat to the species (DEWHA 2009). As most lighting to be used for the SGCP is around the mine pit and buildings, and this is away from suitable habitat for Black-throated Finches (large tracts of remnant woodland), impacts of artificial lighting on the species is expected to be negligible.

Noise and Air

Changes to noise and/or air quality as a result of the SGCP are not anticipated to have significant direct impacts on the Black-throated Finch. As potential habitat is located away from the mining and processing areas, any impacts of noise on acoustic communication by the species is expected to be minimal.

Pest Animals

Black-throated Finches feed on grass seeds, and are dependent on year-round supplies of these (DEWHA 2009). Overgrazing by cattle and other livestock, especially during drought or at times of the year when seed supply is limiting, has been a major contributor to the state-wide decline of the species (DEWHA 2009). Any activity that reduces the productivity of grass in remnant woodlands (such as inappropriate management of grazing animals) has the potential to impact Black-throated Finches. Livestock also degrade creeklines and other important water sources for the species. While the impacts of grazing are mostly deleterious, the provision of water for livestock through troughs and dams may allow Black-throated Finches to expand their breeding range.

Predation by feral animals such as cats is listed as an additional minor threat to the species (DEWHA 2009). Inappropriate management of domestic and feral animals as part of the SGCP could lead to increased impacts of these species on Black-throated Finches.

Road Mortality

The SGCP will result in increased vehicular traffic within the mine and between the mine and neighbouring regional centres. Because these roads do not pass through suitable habitat for Black-throated Finches (large tracts of remnant woodlands), increased road mortality due to the SGCP is unlikely.

The infrastructure corridor passes through potential habitat for the species. Service roads along this corridor will be closed to the public and are unlikely to have higher traffic than currently exists along private farm roads already present in the area.

Direct Mortality During Clearing

Due to the mobility of the species, direct mortality during clearing is not a major threat to the species. However, clearing of potential habitat during the breeding season (February to May: DEWHA 2006) has the potential to destroy nests and nestlings.

Changed Fire Regimes

Inappropriate fire regimes introduced as part of the SGCP could have the potential to alter the seasonal availability of grass seeds (Kutt and Woinarski 2007). This would result in the degradation of habitat for Black-throated Finches.

Weeds

The spread of exotic grasses is listed as an important threat to the species (DEWHA 2009). While some exotic pasture species are eaten by Black-throated Finches, others such as Buffel Grass are not. Any disruption to the natural grass communities on-site may cause gaps in the seed supply at certain times of the year. Inappropriate management of exotic pasture species as part of the SGCP has the potential to degrade habitat potentially used by Black-throated Finches.

20.3.10. Potential Impacts to Threatened Ecological Communities

20.3.10.1. Brigalow

Land Clearing

Brigalow (*Acacia harpophylla* dominant and co-dominant) communities will be impacted by the SGCP. The primary impact is through the clearing of approximately 14 ha of this TEC to accommodate the open cut mine and the infrastructure corridor. Avoidance of impacts to this TEC was a major consideration during planning stages of the SGCP, and 97 % (456.1 ha) of this TEC will be retained within the SGCP survey area outside the mine footprint.

Fragmentation and Edge Effects

Fragmentation and edge effects on remaining remnants are not expected to be significantly elevated due to the SGCP. Remnant patches of Brigalow being affected are already small and isolated. The mine footprint was positioned such that, if removal of Brigalow could not be avoided, small, isolated fragments were preferentially impacted over larger, connected ones with greater intrinsic ecological value. Consequently, the mine footprint avoids the largest tracts of Brigalow within the SGCP survey area (in the southern and western sections of the mine survey area).

The infrastructure corridor bisects several small fragments of remnant Brigalow. It is here that edge effects on remaining remnants may occur. These impacts may arise through dust deposition on leaves and/or increased weed invasion. The former is expected to be a minor impact, as it is restricted to the close vicinity of roads and earthworks, and declines exponentially away from the source (Zhu *et al*. 2010). While the proposed rail line will have an unsealed service road associated with it, this road will not be in public use. Its usage for rail line maintenance is not expected to be sufficiently frequent to cause biologically significant amounts of dust to settle on nearby vegetation.

Subsidence

No Brigalow will be impacted by cracking or subsidence resulting from longwall mining, as none of this TEC overlies proposed longwall panels, and none is located in nearby downstream locations that may be impacted by changed flow regime.

Artificial Lighting

No Brigalow is in close proximity to the mine pit or infrastructure that will require lighting. Ambient night-time light in the local area will be elevated as a result of the SGCP. Impacts to Brigalow of these increases are unknown.

Pest Animals

Grazing can strongly affect the growth and recruitment of native trees and shrubs in brigalow communities (DSEWPaC 2012d). All areas within the SGCP are under current pressure from cattle grazing. The SGCP will not elevate this grazing pressure. Among feral animals, feral pigs are considered to have the greatest impact on Brigalow communities (DSEWPaC 2012d). Inappropriate management of pig populations within the SGCP can degrade the condition of the Brigalow remnants present.

Changed Fire Regimes

Brigalow, and most tree and shrub species associated with this ecological community, are resilient to fire (DSEWPaC 2012d). However, high-intensity fires may kill root systems, and, historically, fire would have been rare in Brigalow communities (DSEWPaC 2012d). Frequent fires may reduce the amount of fallen timber (a feature of this community), and encourage grasses, which alters the suitability of the habitat to threatened fauna (see **Section 20.3.4**). Inappropriate fire management due to the SGCP is thus considered to have possible impacts on this threatened ecological community, even if these impacts are relatively minor.

Weeds

Roads and other linear infrastructure have the potential to facilitate weed invasion because they provide disturbed edge environments that weeds favour, and because vehicles spread weed seeds. Some weeds, such as Buffel Grass, have the potential to greatly reduce the diversity of the understorey (Butler and Fairfax 2003). They also have secondary impacts on Brigalow through altering the intensity and/or frequency of fires (DSEWPaC 2012d). Buffel Grass is already widespread across many Brigalow remnants to be impacted by the SGCP infrastructure corridor and the SGCP is not expected to exacerbate these infestations. However, the spread of other weed species currently rare or absent at the site (e.g. Parthenium) may be facilitated by the SGCP infrastructure corridor, especially during the construction phase, when earth disturbance and movement of machinery is greatest. Appropriate weed management practices can mitigate these elevated risks of weed establishment and spread.

20.3.11. Potential Impacts to Migratory Species

20.3.11.1. Rainbow Bee-eater

Habitat Loss

Rainbow Bee-eaters occur across mainland Australia and nearby islands, in almost all habitats except dense rainforest and treeless plains (DSEWPaC 2012i). The entire SGCP area provides suitable foraging habitat for the species, 4989.7 ha of which will be removed to accommodate the mine and associated infrastructure.

The species nests in burrows dug into banks, and sandy soils are generally preferred. One breeding colony was recorded within the SGCP area, although this is located outside the mine footprint and will not be impacted. Additional breeding sites may have gone unrecorded, and may be impacted by proposed activities.

Rainbow Bee-eaters readily breed in disturbed sites such as roadside cuttings, quarries, gravel pits, mines or mounds of gravel (DSEWPaC 2012i). It is expected that the SGCP will result in a net increase in the availability of such breeding sites.

Habitat Fragmentation

The species is highly mobile and readily flies over unfavourable habitat (DSEWPaC 2012i). All areas surrounding those impacted by the SGCP represent suitable foraging habitat for the species, and the SGCP will not compromise migration or dispersal of the species.

Subsidence

Rainbow Bee-eaters are not dependent on any of the vegetation communities potentially impacted by subsidence due to the SGCP.

Artificial Lighting

The impacts of artificial lighting on Rainbow Bee-eaters are unknown. Rainbow Bee-eaters regularly occur within towns, suburbs and homesteads (DSEWPaC 2012i), situations where artificial lighting is ubiquitous. There are cases of Rainbow Bee-eaters colliding with lighthouses during migration (DSEWPaC 2012i), implying that navigation may be affected by bright lights. However, the rarity of these events implies that impacts of lighting are likely to be negligible (DSEWPaC 2012i).

Noise and Air

Changes to noise and/or air quality as a result of the SGCP are not anticipated to have significant direct impacts on the Rainbow Bee-eater. While loud noise near breeding colonies may interfere with acoustic communication by the species, known breeding colonies of the species are located well away from such impacts.

Pest Animals

Nests in shallow burrows in the ground are highly vulnerable to predation by native and exotic predators, including foxes and dogs (DSEWPaC 2012i). The Cane Toad has been identified as an especially serious threat, as they frequently usurp burrows and eat eggs and nestlings (Boland 2004). Any activities of the SGCP that increase the densities of these pest species may compromise the local breeding success of Rainbow Bee-eaters.

Road Mortality

Collisions with vehicles are a known source of mortality for the species (DSEWPaC 2012i). This threat is greatest near breeding sites, where individuals are more often at or near ground level. No know breeding colonies are located at sites to contain new roads, or sites along roads that may experience increased traffic due to the SGCP. Nevertheless, new colonies may establish in roadside earth banks created as part of the SGCP, and these have the potential to be impacted by road mortality.

Direct Mortality During Clearing

Due to their mobility, adult Rainbow Bee-eaters will not suffer increased mortality due to direct impacts of clearing in the SGCP. Clearing carried out between the months of August and January has the potential to damage nests and nestlings (DSEWPaC 2012i).

Changed Fire Regimes

Fire regime is not considered important for the species (DSEWPaC 2012i).

Weeds

Weeds are not considered a threat to the species (DSEWPaC 2012i).

20.3.11.2. Eastern Great Egret

Habitat Loss

Eastern Great Egrets may utilise any water body transiently, including farms dams and creeks (DSEWPaC 2012l). Habitat for the species within the SGCP was limited in extent and marginal. The position of the infrastructure corridor was altered to avoid impacts to a vegetated wetland in which most observations of this species were made. Seasonally available habitat along Tallarenha Creek and Sapling Creek will be removed for the open mine pit. These do not constitute important habitat for the species, and do not support breeding by the species. Overall, habitat loss resulting from the SGCP is expected to be negligible for the Eastern Great Egret.

Habitat Fragmentation

Movement of this highly mobile species will not be impacted by the SGCP.

Subsidence

Modelling suggests that in a worst-case scenario, cracking may result in the temporary loss of water from Tallenrenha Creek overlying the longwall panels and immediately downstream from the SGCP (refer to **Section 20.3.2.5**). This could result in the temporary loss of habitat for Eastern Great Egrets. No individuals were observed to be utilising this creek at the time of surveys, and the habitat present is likely to currently support only one or few individuals transiently. Given the low significance of the impacted habitat to the species, overall impacts of longwall mining in the SGCP are predicted to be negligible.

Artificial Lighting

The impacts of artificial lighting on Eastern Great Egrets are unknown. It is not listed as an important threat to the species (DSEWPaC 2012l).

Noise and Air

Changes to noise and/or air quality as a result of the SGCP are not anticipated to have significant direct impacts on the Eastern Great Egret.

Pest Animals

The species primarily breeds in trees standing in water (DSEWPaC 2012l), and is thus largely protected from the impacts of feral predators. Invasion of exotic fish species can have indirect impacts on Eastern Great Egrets through reducing the populations of native fish and frogs used as prey (DSEWPaC 2012l).

Road Mortality

As the species is confined to aquatic habitats away from roads, collisions with vehicles constitutes a negligible threat to the species.

Direct Mortality During Clearing

This mobile species is unlikely to suffer any direct mortality during clearing works as part of the SGCP.

Changed Fire Regimes

Frequent burning of nest sites is a threat to the species (DSEWPaC 2012l). However, as no breeding colonies are present within the SGCP, and their aquatic feeding habitats are not impacted by fire, fire regime is not a threat to the species within the SGCP.

Weeds

Weeds are listed as a recognised threat to the species (DSEWPaC 2012l). Aquatic weeds that choke shallow waters used for foraging have the greatest impact. Para Grass (*Urochloa mutica*) is currently limited in extent within the SGCP area (see **Section 8.4.3.7**), and any activities that promote its spread could deleteriously impact the Eastern Great Egret.

20.3.11.3. Cotton Pygmy-goose

Habitat Loss

The SGCP will not remove any well-vegetated, aquatic habitat considered important for Cotton Pygmy-geese (Marchant and Higgins 1990). There were few vegetated wetlands within the entire survey area that may serve as marginal habitat for the species, and these were all located outside the mine footprint.

Habitat Fragmentation

The SGCP will not fragment habitat of the Cotton Pygmy-goose.

Subsidence

No habitat suitable for Cotton Pygmy-geese will be impacted by cracking and subsidence due to longwall mining.

Artificial Lighting

The impacts of artificial lighting on Cotton Pygmy-geese are unknown.

Noise and Air

Changes to noise and/or air quality as a result of the SGCP are not anticipated to have significant direct impacts on the Cotton Pygmy-goose.

Pest Animals

Pest animals are unlikely to be an important threat to this species, as Cotton Pygmy-geese spend most of their time on the water or in hollow trees standing in water (Beruldsen 1977).

Road Mortality

As the species is confined to aquatic habitats away from roads, collisions with vehicles constitutes a negligible threat to the species.

Direct Mortality During Clearing

This mobile species is unlikely to suffer any direct mortality during clearing works as part of the SGCP.

Changed Fire Regimes

Fire regimes have little to no impact on this aquatic species

Weeds

Aquatic weeds that outcompete native species constituting food for the Cotton Pygmy-goose can degrade habitat. Such weeds are currently scarce or absent in the SGCP area. Inappropriate management of the SGCP can lead to the introduction of such weeds to the site.

20.4. AVOIDANCE AND MITIGATION MEASURES TO REDUCE THE IMPACTS TO MNES

20.4.1. Avoidance

The justification for the proposed SGCP and an assessment of potential alternatives are provided in **Section 3—Project Rationale and Alternatives**.

The conservation of biodiversity has been a fundamental consideration in decision making for the SGCP. The existing nature conservation values have been identified, and the potential impacts described and quantified in **Section 8–Nature Conservation**.

As described in **Section 3—Project Rationale and Alternatives**, extensive modelling of mining options was undertaken to select the preferred methods and mine plans.

Environmental constraints were a key consideration taken into account during the modelling process.

In order to develop an alignment for the infrastructure corridor, the Proponent adopted an iterative planning process which considered the findings of baseline environmental studies as constraints on the design (e.g. terrestrial and aquatic ecology). Land clearing will be minimised or avoided, where practicable.

As described in **Section 3—Project Rationale and Alternatives**, the Proponent has committed to a stand-off from identified TECs (refer to **Figure 20-31** and **Figure 20-32**) within the open pit and underground mining areas to minimise direct surface disturbance.

Underground mining techniques result in reduced impacts on surface environmental and agricultural values due to the minimal surface disturbance. As described in **Section 4—Project Description**, an important objective of the multi-seam underground mine design was to maximise pillar stability through appropriate longwall panel and pillar widths and panel alignment.

The mitigation measures relevant to the residual potential impacts on MNES are described in **Section 20.4.2**.

20.4.2. Mitigation Measures

Proposed mitigation measures for reducing impacts on MNES are described in detail in **Section 21—Environmental Management Plan** and summarised below. To minimise adverse effects on threatened species, a Threatened Species Management Plan (TSMP) will be prepared and implemented prior to the commencement of construction. The TSMP will include specific mitigation and management measures to address predicted impacts on threatened species and communities. All threatened species and ecological communities will be monitored throughout the duration of operations. The TSMP will contain the proposed monitoring and reporting timeframes for management of each threatened species impacted by the SGCP, to facilitate auditing of environmental performance measures.

Impacts to MNES due to water resources are expected to be minimal. For details regarding the proposed surface water management and mitigation strategies, refer to **Section 9—Water Resources**, **Section 4** of **Appendix F—Surface Water** and **Sections 9** and **10** of **Appendix G—Groundwater**. All other mitigation measures are summarised below under the relevant MNES.

20.4.2.1. Ornamental Snake

Habitat Loss

Potential breeding habitat for the species will be largely avoided by the SGCP. Trees felled during the construction of the mine and infrastructure will be placed within potential habitat for Ornamental Snakes (Brigalow with gilgais) to provide shelter and improve the condition of the habitat present. Through the exclusion of cattle and rehabilitation of cleared areas fragmenting remaining habitat (see **Section 20.5**), the amount of favourable habitat available to Ornamental Snakes within the SGCP area will experience a net increase in area.

Habitat Fragmentation

The SGCP will not lead to fragmentation of habitat for Ornamental Snakes. Through the exclusion of cattle and rehabilitation of cleared areas fragmenting remaining habitat (see **Section 20.4.3** and **Section 20.5**), the connectivity of potential habitat for Ornamental Snakes within the SGCP area will experience a net increase.

Subsidence

No impacts to Ornamental Snakes from subsidence are anticipated. No specific mitigation measures are warranted.

Artificial Lighting

No impacts to Ornamental Snakes from artificial lighting are anticipated. No specific mitigation measures are warranted.

Noise and Air

No impacts to Ornamental Snakes from noise or reduced air quality are anticipated. No specific mitigation measures are warranted.

Pest Animals

A Weed and Pest Animal Management Plan (WPAMP) will be prepared and implemented over the life of the SGCP. The WPAMP will include a monitoring program and auditable performance measures, including reductions in Class 1 and 2 pest animals and noxious weeds.

The introduction and/or spread of pest fauna species will be mitigated by:

- implementing vertebrate pest control activities (particularly for pests such as feral pigs, dogs and cats) in consultation with local authorities and landholders and in accordance with relevant best practice and the LP Act

- putrescible waste will not be allowed to accumulate outside designated areas
- designated waste areas will be animal-proofed and the wastes regularly removed and/or buried
- where practicable, the SGCP will reduce new cane toad breeding opportunities by minimising the creation of additional small waterbodies suitable for cane toad breeding (e.g. ponding areas, roadside ditches or flood channels).

SGCP employees and contractors will be made aware of environmental obligations and compliance requirements through the site induction program.

Road Mortality

The only increase in road traffic within favourable Ornamental Snake habitat is along the infrastructure corridor. Mitigation measures to reduce impacts to Ornamental Snakes include:

- public access to these roads will be prohibited
- night-time traffic (coinciding with activity of the species) will be reserved only for emergency maintenance of rail-lines.

Direct Mortality During Clearing

SGCP employees and contractors will be made aware of environmental obligations and compliance requirements through the site induction program. They will be notified of the potential presence of Ornamental Snakes and instructed to temporarily cease clearing if any individuals are observed.

To minimise potential impacts, clearing will be:

- carried out using a phased approach, thereby allowing animals to move away from the clearing footprint
- undertaken with a qualified spotter-catcher on hand and in communication with the operators of the clearing machinery
- undertaken with a qualified spotter-catcher to relocate any observed fauna species of conservation significance immediately prior to clearing activities.

Strategies for dealing with sick or injured wildlife found during clearing will be detailed within the TSMP and will involve contacting identified local wildlife carers.

Changed Fire Regimes

The management of fire in potential habitat for Ornamental Snakes will take into account the need to preserve abundant fallen woody debris for shelter. Measures to reduce uncontrolled burns include:

- fire breaks around all coal stockpiles to avoid ignition of native vegetation from spontaneous combustion of coal
- prohibition of cigarette smoking away from the vicinity of mine buildings
- prohibition of the dumping of glass and other rubbish in areas of vegetation.

Weeds

The SGCP is not anticipated to increase the spread of aquatic weeds that threaten Ornamental Snakes. Nevertheless, reasonable measures will be taken to control known weed species in the SGCP area, with particular focus on areas near and within remnant vegetation. New weed infestations will be recorded and controlled where applicable under the *LP Act*.

A Weed and Pest Animal Management Plan (WPAMP) will be prepared and implemented over the life of the SGCP. The WPAMP will include a monitoring program and auditable performance measures, including reductions in Class 1 and 2 pest animals and noxious weeds.

The introduction and/or spread of weed species will be mitigated by:

- restricting light vehicle movement in areas outside of regular activity, particularly on irregularly used tracks
- restricting vehicle movement during and following rainfall, where practicable
- implementing strict wash-down procedures for all vehicles (including clearing and construction machinery) entering clearance zones, grazing areas or conservation areas
- controlling weeds according to guidelines under the relevant Weed Fact Sheet
- training and awareness of all staff.

20.4.2.2. Yakka Skink

Habitat Loss

While the SGCP is primarily located in non-remnant vegetation, largely unsuitable as habitat for the Yakka Skink, there will some loss of suitable habitat. The following measures will be in place to minimise these impacts:

- trees felled during the construction of the mine and infrastructure will be placed within potential habitat for Yakka Skinks to provide shelter and improve the condition of the habitat present

- through the exclusion of cattle and rehabilitation of cleared areas connecting remaining habitat (see **Section 20.4.3** and **Section 20.5**), favourable habitat available to Yakka Skinks within the SGCP area will be consolidated and its habitat values improved.

Habitat Fragmentation

The SGCP will avoid significant impacts to the connectivity of habitat for Yakka Skinks. Trees felled during the construction of the mine and infrastructure will be placed in piles within non-remnant vegetation connecting potential habitat for Yakka Skinks. This will facilitate dispersal of the species (Eddie 2012). These connecting areas of non-remnant vegetation will be managed (rehabilitated and cattle excluded) to improved their habitat value to Yakka Skinks (see **Section 20.4.3** and **Section 20.5**). Overall, the SGCP will result in a net increase in the connectivity of habitat for Yakka Skinks.

Subsidence

The impacts on Yakka Skinks of subsidence resulting from the SGCP are expected to be negligible. No specific mitigation measures are warranted.

Artificial Lighting

The impacts of artificial lighting on Yakka Skinks within the context of the SGCP are expected to be negligible. No species mitigation measures are warranted.

Noise and Air

The impacts of noise and reduced air quality on Yakka Skinks within the context of the SGCP are expected to be negligible. No species mitigation measures are warranted.

Pest Animals

A Weed and Pest Animal Management Plan (WPAMP) will be prepared and implemented over the life of the SGCP. The WPAMP will include a monitoring program and auditable performance measures, including reductions in Class 1 and 2 pest animals. Cattle will be excluded from potential habitat for Yakka Skinks to improve ground cover and increase habitat quality.

The introduction and/or spread of pest fauna species will be mitigated by:

- implementing vertebrate pest control activities (particularly for pests such as feral pigs, dogs and cats) in consultation with local authorities and landholders and in accordance with relevant best practice and the *LP Act*
- putrescible waste will not be allowed to accumulate outside designated areas
- designated waste areas will be animal-proofed and the wastes regularly removed and/or buried.

SGCP employees and contractors will be made aware of environmental obligations and compliance requirements through the site induction program.

Road Mortality

The SGCP is not expected to significantly elevate threats of road mortality to Yakka Skinks. No specific mitigated efforts are warranted.

Direct Mortality During Clearing

SGCP employees and contractors will be made aware of environmental obligations and compliance requirements through the site induction program. They will be notified of the potential presence of Yakka Skinks and instructed to temporarily cease clearing if any individuals are observed or signs of their presence are detected. Potential shelter sites (timber and rock piles, disused rabbit warrens) will be inspected by qualified persons for tracks, scats and sloughed skins prior to clearing.

To minimise potential impacts, clearing will be:

- carried out using a phased approach, thereby allowing animals to move away from the clearing footprint
- undertaken with a qualified spotter-catcher on hand and in communication with the operators of the clearing machinery
- undertaken with a qualified spotter-catcher to relocate any observed fauna species of conservation significance immediately prior to clearing activities.

Strategies for dealing with sick or injured wildlife found during clearing will be detailed within the TSMP and will involve contacting identified local wildlife carers.

Changed Fire Regimes

The management of fire in potential habitat for Yakka Skinks will take into account the need to preserve abundant fallen woody debris and ground layer vegetation for shelter. Mosaic burns will be implemented in order to retain these necessary habitat features, while reducing the potential for high-intensity, uncontrolled fires to sweep across large areas (Eddie 2012).

Other measures to reduce uncontrolled burns include:

- fire breaks around all coal stockpiles to avoid ignition of native vegetation from spontaneous combustion of coal
- prohibition of cigarette smoking away from the vicinity of mine buildings
- prohibition of the dumping of glass and other rubbish in areas of vegetation.

Weeds

Weeds are not considered an important threat to Yakka Skinks. No specific mitigation measures are warranted.

20.4.2.3. Dunmall's Snake

Habitat Loss

While the SGCP is primarily located in non-remnant vegetation, largely unsuitable as habitat for the Dunmall's Snake, there will some loss of potential habitat. The following measures will be in place to minimise these impacts:

- trees felled during the construction of the mine and infrastructure will be placed within potential habitat for Dunmall's Snake to provide shelter and improve the condition of the habitat present
- through the exclusion of cattle and rehabilitation of cleared areas connecting remaining habitat (see **Section 20.4.3** and **Section 20.5**), favourable habitat available to Dunmall's Snake within the SGCP area will be consolidated and its habitat values improved.

The SGCP may be outside the geographic range of this species. However, any efforts to increase and improve habitat for the Brigalow Scaly-foot on-site (see **Section 20.3.9.4**) will indirectly benefit this species, which is thought to utilise similar habitat.

Habitat Fragmentation

The SGCP will avoid significant impacts to the connectivity of habitat for Dunmall's Snake. Trees felled during the construction of the mine and infrastructure will be placed in piles within non-remnant vegetation connecting potential habitat for Dunmall's Snake. This will facilitate dispersal of the species (Hobson 2012). These connecting areas of non-remnant vegetation will be managed (rehabilitated and cattle excluded) to improve their habitat value to Dunmall's Snake (see **Section 20.4.3** and **Section 20.5**). Overall, the SGCP will result in a net increase in the connectivity of habitat for Dunmall Snakes.

Subsidence

The impacts on Dunmall's Snakes of subsidence resulting from the SGCP are expected to be negligible. No specific mitigation measures are warranted.

Artificial Lighting

The impacts on Dunmall's Snakes of artificial lighting resulting from the SGCP are expected to be negligible. No specific mitigation measures are warranted.

Noise and Air

The impacts on Dunmall's Snakes of noise and reduced air quality are expected to be negligible. No specific mitigation measures are warranted.

Pest Animals

A Weed and Pest Animal Management Plan (WPAMP) will be prepared and implemented over the life of the SGCP. The WPAMP will include a monitoring program and auditable performance measures, including reductions in Class 1 and 2 pest animals. Cattle will be excluded from potential habitat for Dunmall's Snakes to improve ground cover and increase habitat quality.

The introduction and/or spread of pest fauna species will be mitigated by:

- implementing vertebrate pest control activities (particularly for pests such as feral pigs, dogs and cats) in consultation with local authorities and landholders and in accordance with relevant best practice and the *LP Act*
- putrescible waste will not be allowed to accumulate outside designated areas
- designated waste areas will be animal-proofed and the wastes regularly removed and/or buried.

Road Mortality

Road-induced mortality is not expected to be significantly elevated by the SGCP. The only increase in road traffic within favourable Dunmall's Snake habitat is along the infrastructure corridor. Mitigation measures to reduce impacts to Dunmall's Snake include:

- public access to the infrastructure corridor will be prohibited
- night-time traffic within the infrastructure corridor (coinciding with activity of the species) will be reserved only for emergency maintenance of rail-lines.

Direct Mortality During Clearing

SGCP employees and contractors will be made aware of environmental obligations and compliance requirements through the site induction program. They will be notified of the potential presence of Dunmall's Snakes and instructed to temporarily cease clearing if any individuals are observed.

To minimise potential impacts, clearing will be:

- carried out using a phased approach, thereby allowing animals to move away from the clearing footprint
- undertaken with a qualified spotter-catcher on hand and in communication with the operators of the clearing machinery
- undertaken with a qualified spotter-catcher to relocate any observed fauna species of conservation significance immediately prior to clearing activities.

Strategies for dealing with sick or injured wildlife found during clearing will be detailed within the TSMP and will involve contacting identified local wildlife carers.

Changed Fire Regimes

The management of fire in potential habitat for Dunmall's Snakes will take into account the need to preserve abundant fallen woody debris and ground layer vegetation for shelter. Mosaic burns will be implemented in order to retain these necessary habitat features, while reducing the potential for high-intensity, uncontrolled fires to sweep across large areas.

Other measures to reduce uncontrolled burns include:

- fire breaks around all coal stockpiles to avoid ignition of native vegetation from spontaneous combustion of coal
- prohibition of cigarette smoking away from the vicinity of mine buildings
- prohibition of the dumping of glass and other rubbish in areas of vegetation.

Weeds

Reasonable measures will be taken to control known weed species in the SGCP area, with particular focus on areas near and within remnant vegetation. New weed infestations will be recorded and controlled where applicable under the *LP Act*.

A Weed and Pest Animal Management Plan (WPAMP) will be prepared and implemented over the life of the SGCP. The WPAMP will include a monitoring program and auditable performance measures, including reductions in Class 1 and 2 weeds.

The introduction and/or spread of weed species will be mitigated by:

- restricting light vehicle movement in areas outside of regular activity, particularly on irregularly used tracks
- restricting vehicle movement during and following rainfall, where practicable
- implementing strict wash-down procedures for all vehicles (including clearing and construction machinery) entering clearance zones, grazing areas or conservation areas
- controlling weeds according to guidelines under the relevant Weed Fact Sheet
- training and awareness of all staff.

20.4.2.4. Brigalow Scaly-foot

Habitat Loss

Mine placement aims to minimise habitat loss to the Brigalow Scaly-foot through the positioning of the mine footprint primarily in non-remnant vegetation. Nevertheless, there will be some loss of potential habitat. The following measures will be in place to minimise these impacts:

- trees felled during the construction of the mine and infrastructure will be placed within potential habitat for the Brigalow Scaly-foot to provide shelter and improve the condition of the habitat present
- through the exclusion of cattle and rehabilitation of cleared areas connecting remaining habitat (see **Section 20.4.3** and **Section 20.5**), favourable habitat available to the Brigalow Scaly-foot within the SGCP area will be consolidated and its habitat values improved.

Habitat Fragmentation

The SGCP will avoid significant impacts to the connectivity of habitat for Brigalow Scaly-foot. Trees felled during the construction of the mine and infrastructure will be placed in piles within non-remnant vegetation connecting potential habitat for the Brigalow Scaly-foot. This will facilitate dispersal of the species. These connecting areas of non-remnant vegetation will be managed (rehabilitated and cattle excluded) to improve their habitat value to the Brigalow Scaly-foot (see **Section 20.4.3** and **Section 20.5**). Overall, the SGCP will result in a net increase in the connectivity of habitat for the Brigalow Scaly-foot.

Subsidence

The impacts of subsidence on the Brigalow Scaly-foot are expected to be negligible. No specific mitigation measures are warranted.

Artificial Lighting

To reduce the impacts of artificial lighting on Brigalow Scaly-foots living closest to the mine pit and processing areas, all non-remnant vegetation located between the mine and current habitat will be rehabilitated to provide a buffer to filter out artificial light (see **Section 20.4.3** and **Section 20.5**).

Any lighting installed in the south-eastern corner of the mine pit (adjacent to potential habitat for Brigalow Scaly-foot) will be positioned such that it is angled away from the east or south. The placement of mine lighting will take into account minimising impacts to the Brigalow Scaly-foot.

Noise and Air

The impacts of noise and reduced air quality on the Brigalow Scaly-foot are expected to be negligible. No specific mitigation measures are warranted.

Pest Animals

A Weed and Pest Animal Management Plan (WPAMP) will be prepared and implemented over the life of the SGCP. The WPAMP will include a monitoring program and auditable performance measures, including reductions in Class 1 and 2 pest animals. Cattle will be excluded from potential habitat for the Brigalow Scaly-foot to improve ground cover and increase habitat quality.

The introduction and/or spread of pest fauna species will be mitigated by:

- implementing vertebrate pest control activities (particularly for pests such as feral pigs, dogs and cats) in consultation with local authorities and landholders and in accordance with relevant best practice and the *LP Act*
- putrescible waste will not be allowed to accumulate outside designated areas
- designated waste areas will be animal-proofed and the wastes regularly removed and/or buried.

Road Mortality

Road-induced mortality is not expected to be significantly elevated by the SGCP. The only increase in road traffic within favourable Brigalow Scaly-foot habitat is along the infrastructure corridor. Mitigation measures to reduce impacts to the Brigalow Scaly-foot include:

- public access to the infrastructure corridor will be prohibited
- night-time traffic within the infrastructure corridor (coinciding with activity of the species) will be reserved only for emergency maintenance of rail-lines.

Direct Mortality During Clearing

SGCP employees and contractors will be made aware of environmental obligations and compliance requirements through the site induction program. They will be notified of the presence of the Brigalow Scaly-foot and instructed to temporarily cease clearing if any individuals are observed.

To minimise potential impacts, clearing will be:

- carried out using a phased approach, thereby allowing animals to move away from the clearing footprint
- undertaken with a qualified spotter-catcher on hand and in communication with the operators of the clearing machinery
- undertaken with a qualified spotter-catcher to relocate any observed fauna species of conservation significance immediately prior to clearing activities.

Strategies for dealing with sick or injured wildlife found during clearing will be detailed within the TSMP and will involve contacting identified local wildlife carers.

Changed Fire Regimes

The management of fire in potential habitat for Brigalow Scaly-foot will take into account the need to preserve abundant fallen woody debris and ground layer vegetation for shelter. Mosaic burns will be implemented in order to retain these necessary habitat features, while reducing the potential for high-intensity, uncontrolled fires to sweep across large areas.

Other measures to reduce uncontrolled burns include:

- fire breaks around all coal stockpiles to avoid ignition of native vegetation from spontaneous combustion of coal
- prohibition of cigarette smoking away from the vicinity of mine buildings
- prohibition of the dumping of glass and other rubbish in areas of vegetation.

Weeds

Weeds are not considered an important threat to the Brigalow Scaly-foot. No specific mitigation measures are warranted.

20.4.2.5. Koala

Habitat Loss

The SGCP will remove potential habitat for Koalas. This loss of habitat will be offset by rehabilitating and revegetating fragmented habitat along Alpha Creek, in the far east of the SGCP area (see **Section 8.7.1.7**). Areas surrounding Alpha Creek contain the most important habitat for Koalas in the SGCP area, and by enlarging the amount of habitat within this core area, stability of the local Koala population will be enhanced.

Habitat Fragmentation

The SGCP will remove narrow corridors of potential Koala habitat along tributaries of Tallarenha Creek. So that the east-west movement of Koalas across the site is not severely impacted by the SGCP, the creek diversion between Sapling Creek and Dead Horse Creek will be revegetated with *Eucalyptus camaldulensis* and *Eucalyptus populnea* to allow it to serve as a movement corridor.

Subsidence

Small areas of riparian vegetation potentially used by Koalas could be impacted by subsidence and cracking due to longwall mining. This possible loss of habitat will be offset by the enlargement and improvement of habitat along Alpha Creek and Dead Horse Creek through proposed revegetation and rehabilitation.

A monitoring program will be established over the subsidence impact zone surrounding Tallarenha Creek to identify subsidence-induced changes to the creek profile and floodplain drainage patterns that could prevent flow draining downstream. If these impacts are identified through aerial and ground survey of the area, channels will be constructed to direct flows downstream. The highwall and low wall flood protection channels and levees will also be routinely monitored for effectiveness in safety conveying flood flows around the active mining area.

Geological investigations will be undertaken progressively over the life of the SGCP to inform subsidence prediction and the development of subsidence management measures where relevant. The first longwall panel will be monitored to provide validated parameters to use in subsequent influence function predictions (e.g. aerial monitoring, conventional cross-line surveys to obtain values for tilts and strains and subsurface monitoring to characterise the heights of the fractured zone).

Artificial Lighting

Impacts to Koalas of artificial lighting from the SGCP are expected to be negligible. No specific mitigation measures are warranted.

Noise and Air

Impacts to Koalas of noise and reduced air quality are expected to be negligible. No specific mitigation measures are warranted.

Pest Animals

A Weed and Pest Animal Management Plan (WPAMP) will be prepared and implemented over the life of the SGCP. The WPAMP will include a monitoring program and auditable performance measures, including reductions in Class 1 and 2 pest animals. Cattle will be excluded from potential habitat for the Koala to improve natural regeneration of food trees.

The introduction and/or spread of pest fauna species will be mitigated by:

- implementing vertebrate pest control activities (particularly for pests such as feral pigs, dogs and cats) in consultation with local authorities and landholders and in accordance with relevant best practice and the *LP Act*
- putrescible waste will not be allowed to accumulate outside designated areas
- designated waste areas will be animal-proofed and the wastes regularly removed and/or buried.

Road Mortality

No increase in road mortality is expected to occur within the SGCP area. Any increased rates of mortality along the Capricorn Highway (e.g., where it bisects Alpha Creek) will be closely monitored. Road kills are to be reported to the Environmental Manager. If mortality is observed, the following actions will be taken, in collaboration with the Queensland Department of Transport and Main Roads:

- speed limits will be reduced in Koala 'black spots' (sites of high Koala mortality)
- fences will be installed along roadsides in the vicinity of creeks to direct Koala movement under bridges instead of across roads
- lighting will be installed at Koala 'black spots' to make animals more visible to motorists.

Direct Mortality During Clearing

SGCP employees and contractors will be made aware of environmental obligations and compliance requirements through the site induction program. They will be notified of the presence of Koalas and instructed to temporarily cease clearing if any individuals are observed.

To minimise potential impacts, clearing will be:

- carried out using a phased approach, thereby allowing animals to move away from the clearing footprint
- undertaken with a qualified spotter-catcher on hand and in communication with the operators of the clearing machinery

- undertaken with a qualified spotter-catcher to relocate any observed fauna species of conservation significance immediately prior to clearing activities.

Strategies for dealing with sick or injured wildlife found during clearing will be detailed within the TSMP and will involve contacting identified local wildlife carers.

Changed Fire Regimes

The management of fire in potential habitat for Koalas will take into account the need to prevent high-intensity fires from reaching the canopy. Mosaic burns will be implemented to reduce the potential for high-intensity, uncontrolled fires to sweep across large areas.

Other measures to reduce uncontrolled burns include:

- fire breaks around all coal stockpiles to avoid ignition of native vegetation from spontaneous combustion of coal
- prohibition of cigarette smoking away from the vicinity of mine buildings
- prohibition of the dumping of glass and other rubbish in areas of vegetation.

Weeds

Weeds are not considered an important threat to Koala populations in the SGCP area. No specific mitigation measures are warranted.

20.4.2.6. Squatter Pigeon

Habitat Loss

Mine placement aimed to minimise potential habitat loss to the Squatter Pigeon through the positioning of the mine footprint primarily in non-remnant vegetation. Nevertheless, there will be some loss of potential habitat. Through the exclusion of cattle and rehabilitation of cleared areas connecting remaining habitat (see **Section 20.4.3** and **Section 20.5**), favourable habitat available to the Squatter Pigeon within the SGCP area will be consolidated and its habitat values improved.

Habitat Fragmentation

Habitat fragmentation is not an important impact of the SGCP on Squatter Pigeons. No specific mitigation measures are warranted.

Subsidence

Subsidence is not an important impact of the SGCP on Squatter Pigeons. No specific mitigation measures are warranted.

Artificial Lighting

The impacts of artificial lighting on Squatter Pigeons are probably negligible. No specific mitigation measures are warranted.

Noise and Air

Noise and reduced air quality are expected to have minimal impacts on Squatter Pigeons. No specific mitigation measures are warranted.

Pest Animals

A Weed and Pest Animal Management Plan (WPAMP) will be prepared and implemented over the life of the SGCP. The WPAMP will include a monitoring program and auditable performance measures, including reductions in Class 1 and 2 pest animals. Overgrazing is considered one of most important factors in the decline of the Squatter Pigeon (Reis 2012). Cattle will be excluded from potential habitat for Squatter Pigeons to increase the amount of understorey and grass seeds available.

The introduction and/or spread of pest fauna species will be mitigated by:

- implementing vertebrate pest control activities (particularly for pests such as feral pigs, dogs and cats) in consultation with local authorities and landholders and in accordance with relevant best practice and the *LP Act*
- putrescible waste will not be allowed to accumulate outside designated areas
- designated waste areas will be animal-proofed and the wastes regularly removed and/or buried.

Road Mortality

The following measures are to be in place to mitigate impacts of vehicular traffic on Squatter Pigeons:

- Speed limits of 40 km/h will be placed on all roads within the mining lease and infrastructure corridor
- SGCP employees and contractors will be made aware of environmental obligations and compliance requirements through the site induction program. They will be notified of the need to report all incidences of collisions with wildlife
- Speed limits will be revised, pending road mortality rates recorded
- Roads within the infrastructure corridor will be closed to the public.

Direct Mortality During Clearing

The SGCP is not expected to result in any direct mortality to Squatter Pigeons. No specific mitigation measures are warranted.

Changed Fire Regimes

The management of fire in potential habitat for Squatter Pigeons will take into account the need to preserve a year-round supply of grass seed and open areas for foraging. Mosaic burns will be implemented in order to retain these necessary habitat features, while reducing the potential for high-intensity, uncontrolled fires to sweep across large areas.

Other measures to reduce uncontrolled burns include:

- fire breaks around all coal stockpiles to avoid ignition of native vegetation from spontaneous combustion of coal
- prohibition of cigarette smoking away from the vicinity of mine buildings
- prohibition of the dumping of glass and other rubbish in areas of vegetation.

Weeds

Reasonable measures will be taken to control known weed species in the SGCP area, with particular focus on areas near and within remnant vegetation. New weed infestations will be recorded and controlled where applicable under the *LP Act*.

A Weed and Pest Animal Management Plan (WPAMP) will be prepared and implemented over the life of the SGCP. The WPAMP will include a monitoring program and auditable performance measures, including reductions in Class 1 and 2 weeds, and prevention of the spread of Buffel Grass into areas of favourable Squatter Pigeon habitat.

The introduction and/or spread of weed species will be mitigated by:

- restricting light vehicle movement in areas outside of regular activity, particularly on irregularly used tracks
- restricting vehicle movement during and following rainfall, where practicable
- implementing strict wash-down procedures for all vehicles (including clearing and construction machinery) entering clearance zones, grazing areas or conservation areas
- controlling weeds according to guidelines under the relevant Weed Fact Sheet
- training and awareness of all staff.

20.4.2.7. Black-throated Finch

Habitat Loss

Loss of habitat for Black-throated Finches within the mining lease is negligible and no specific mitigation for this is warranted. To offset the loss of potential breeding sites within the infrastructure corridor, an extensive tract of currently fragmented habitat will be connected and restored in the vicinity of Alpha Creek (see **Section 20.4.3** and **Section 20.5**). In this area, the requirement of the species for nearby water is satisfied by Alpha Creek, Sapling Creek and Dead Horse Creek. However, the Black-throated Finch's requirements for a year-round supply of native grass seeds and remnant woodlands are currently jeopardised by the fragmentation of habitat in this area and grazing by cattle. Cattle will be excluded from this area, to ensure a supply of grass-seeds is maintained year-round. Non-remnant vegetation will be revegetated and rehabilitated to improve the amount of favourable habitat present and its connectivity. These actions will ensure that ecological requirements of the Black-throated Finch will be met along Alpha Creek, and such habitat will connect with large tracts of remnant vegetation to the south. These actions will result in a net benefit to the Black-throated Finch within the SGCP area.

Habitat Fragmentation

The SGCP will not introduce any new barriers to the movement of Black-throated Finches. The restoration of non-remnant vegetation in the east of the SGCP area (along Alpha Creek) will connect currently fragmented habitat, and result in a net reduction in habitat fragmentation for Black-throated Finches within the SGCP area.

Subsidence

Loss of pooled water from the headwaters of tributaries of Tallarenha Creek due to cracking from longwall mining is unlikely but possible. In the event that this occurs, artificial water supplies (dams) may be constructed in nearby areas to provide alternate sources of water for Black-throated Finches, should they occur in this area. The impact monitoring and response protocols will be specified in the TSMP.

Artificial Lighting

Minimal impacts on Black-throated Finches from artificial lighting are anticipated. No specific mitigation measures are warranted.

Noise and Air

Minimal impacts on Black-throated Finches from noise or reduced air quality are anticipated. No specific mitigation measures are warranted.

Pest Animals

Grazing by cattle is one of the major threats to the Black-throated Finch, both across its entire range and within the Galilee Basin (Grice 2012). The SGCP will exclude cattle from all areas of habitat for Black-throated Finches. This habitat will be one of few areas within the region that will not be subject to grazing pressure. This will vastly improve the quality of habitat present on-site.

To mitigate impacts of feral predators on Black-throated Finches, a Weed and Pest Animal Management Plan (WPAMP) will be prepared and implemented over the life of the SGCP. The WPAMP will include a monitoring program and auditable performance measures, including reductions in Class 1 and 2 pest animals.

The introduction and/or spread of pest fauna species will be mitigated by:

- implementing vertebrate pest control activities (particularly for pests such as feral pigs, dogs and cats) in consultation with local authorities and landholders and in accordance with relevant best practice and the *LP Act*
- putrescible waste will not be allowed to accumulate outside designated areas
- designated waste areas will be animal-proofed and the wastes regularly removed and/or buried.

Road Mortality

The service road along the infrastructure corridor passes through potential habitat for Black-throated Finches. To avoid road-induced mortality to any Black-throated Finches that colonise this area, the road will be closed to public access, and used infrequently.

Direct Mortality During Clearing

Where practicable, clearing of potential habitat for Black-throated Finches (i.e., remnant vegetation within the infrastructure corridor) will take place outside the breeding season (breeding occurs from February to May). Prior to any clearing of potential habitat within the breeding season, a suitably qualified ecologist will check for nests.

Changed Fire Regimes

The management of fire in potential habitat for Black-throated Finches will take into account the need to preserve nesting sites (dense shrubbery and hollow trees) and a year-round supply of grass seed. Mosaic burns will be implemented in order to retain these necessary habitat features, while reducing the potential for high-intensity, uncontrolled fires to sweep across large areas.

Other measures to reduce uncontrolled burns include:

- fire breaks around all coal stockpiles to avoid ignition of native vegetation from spontaneous combustion of coal
- prohibition of cigarette smoking away from the vicinity of mine buildings
- prohibition of the dumping of glass and other rubbish in areas of vegetation.

Weeds

Reasonable measures will be taken to control known weed species in the SGCP area, with particular focus on areas near and within remnant vegetation. New weed infestations will be recorded and controlled where applicable under the *LP Act*.

A Weed and Pest Animal Management Plan (WPAMP) will be prepared and implemented over the life of the SGCP. The WPAMP will include a monitoring program and auditable performance measures, including reductions in Class 1 and 2 weeds, and prevention of the spread of Buffel Grass into areas of favourable Black-throated Finch habitat.

The introduction and/or spread of weed species will be mitigated by:

- restricting light vehicle movement in areas outside of regular activity, particularly on irregularly used tracks
- restricting vehicle movement during and following rainfall, where practicable
- implementing strict wash-down procedures for all vehicles (including clearing and construction machinery) entering clearance zones, grazing areas or conservation areas
- controlling weeds according to guidelines under the relevant Weed Fact Sheet
- training and awareness of all staff

20.4.2.8. Brigalow

Land Clearing

Trees will be felled into the construction zone to avoid impacting on neighbouring vegetation. Vegetation clearing and construction will be limited to dry weather conditions where practicable to minimise erosion, runoff and soil disturbance.

The removal of ~14 ha of Brigalow (currently in small, isolated fragments) will be offset by the protection and restoration of the remaining 456 ha to improve its overall condition. Condition will be improved through:

- the exclusion of cattle
- allowing the regrowth of surrounding non-remnant vegetation to provide a buffer, improve connectivity and ultimately expand the amount of remnant vegetation occurring on-site
- appropriate fire management
- the management of weeds.

These are detailed further in the following sections.

Fragmentation and Edge Effects

To counter edge effects (e.g., dust, weed invasion) on Brigalow fragments within the infrastructure corridor:

- maintenance roads will be closed to the public and used infrequently
- weeds will be actively managed, and the spread of pasture grasses into Brigalow communities will be monitored and controlled

- livestock will be excluded from remaining remnants.

Subsidence

The SGCP will not cause any impacts to Brigalow through subsidence. No specific mitigation measures are warranted.

Artificial Lighting

The impacts of artificial lighting within the SGCP on Brigalow are probably negligible. No specific mitigation measures are warranted.

Pest Animals

Cattle will be excluded from remaining Brigalow communities, vastly improving the condition of remnants. Programmes for the control of Feral Pigs will be implemented as part of the WPAMP, in consultation with local authorities and landholders and in accordance with relevant best practice and the *LP Act*.

Changed Fire Regimes

Brigalow communities rarely experience fires naturally (DSEWPaC 2012d). Management of fire within the SGCP will aim to reduce the likelihood of uncontrolled fires spreading into Brigalow communities. Measures to reduce uncontrolled burns include:

- fire breaks around all coal stockpiles to avoid ignition of native vegetation from spontaneous combustion of coal
- prohibition of cigarette smoking away from the vicinity of mine buildings
- prohibition of the dumping of glass and other rubbish in areas of vegetation
- regular prescribed burning of adjacent eucalypt communities to reduce fuel load in close proximity to brigalow remnants, and thereby reduce the risk of high-intensity uncontrolled burns.

Weeds

Reasonable measures will be taken to control known weed species in the SGCP area, with particular focus on areas near and within Brigalow ecological communities. New weed infestations will be recorded and controlled where applicable under the *LP Act*. In addition, the spread of pasture grasses, such as Buffel Grass, within Brigalow communities will be monitored and controlled, to preserve the ecological function of remaining remnants.

A Weed and Pest Animal Management Plan (WPAMP) will be prepared and implemented over the life of the SGCP. The WPAMP will include a monitoring program and auditable performance measures, including reductions in Class 1 and 2 weeds, and Buffel Grass in Brigalow ecological communities.

The introduction and/or spread of weed species will be mitigated by:

- restricting light vehicle movement in areas outside of regular activity, particularly on irregularly used tracks
- restricting vehicle movement during and following rainfall, where practicable
- implementing strict wash-down procedures for all vehicles (including clearing and construction machinery) entering clearance zones, grazing areas or conservation areas
- controlling weeds according to guidelines under the relevant Weed Fact Sheet
- training and awareness of all staff.

20.4.2.9. Rainbow Bee-eater

Habitat Loss

The SGCP will result in a net decrease in foraging habitat, but a net increase in breeding habitat, for Rainbow Bee-eaters.

Habitat for foraging will be improved outside the mine footprint through the restoration and revegetation of cleared areas and the exclusion of cattle (see **Section 20.4.3** and **Section 20.5**).

Habitat Fragmentation

The SGCP will not impact the movement of Rainbow Bee-eaters. No mitigation measures for habitat fragmentation are warranted.

Subsidence

Rainbow Bee-eaters will not be significantly impacted by potential subsidence resulting from the SGCP. No specific mitigation measures are required.

Artificial Lighting

The impact of artificial lighting on Rainbow Bee-eaters is likely to be negligible. Any mortality associated with collisions with flood-lights will be recorded and monitored.

Noise and Air

The impacts of noise and reduced air quality on Rainbow Bee-eaters are expected to be minimal. No specific mitigation measures are warranted.

Pest Animals

A Weed and Pest Animal Management Plan (WPAMP) will be prepared and implemented over the life of the SGCP. The WPAMP will include a monitoring program and auditable performance measures, including reductions in Class 1 and 2 pest animals.

The introduction and/or spread of pest fauna species will be mitigated by:

- implementing vertebrate pest control activities (particularly for pests such as feral pigs, dogs and cats) in consultation with local authorities and landholders and in accordance with relevant best practice and the LP Act
- putrescible waste will not be allowed to accumulate outside designated areas
- designated waste areas will be animal-proofed and the wastes regularly removed and/or buried
- where practicable, the SGCP will reduce new cane toad breeding opportunities by minimising the creation of additional small waterbodies suitable for cane toad breeding (e.g. ponding areas, roadside ditches or flood channels).

SGCP employees and contractors will be made aware of environmental obligations and compliance requirements through the site induction program

Road Mortality

In the event that breeding colonies establish in roadside cuttings where they are at risk of collisions with vehicles, speed limits will be appropriately lowered in the vicinity of such colonies.

Direct Mortality During Clearing

Immediately prior to any clearing or earthworks to be carried out between the months of August and January, the site will be inspected for potential nest burrows by a qualified person. No sites with active nests will be disturbed until the conclusion of breeding.

Changed Fire Regimes

Fire regime is not considered an important threat to Rainbow Bee-eaters. No specific mitigation measures are warranted.

Weeds

Weeds are not considered an important threat to Rainbow Bee-eaters. No specific mitigation measures are warranted.

20.4.2.10. Eastern Great Egret

Habitat Loss

The amount of habitat for Eastern Great Egrets that will be lost due to the SGCP is negligible. No specific mitigation measures are warranted.

Habitat Fragmentation

Habitat for Eastern Great Egrets will not be fragmented by the SGCP. No specific mitigation measures are warranted.

Subsidence

The impact of subsidence on habitat for Eastern Great Egrets is expected to be negligible. No specific mitigation measures are warranted.

Artificial Lighting

No specific mitigation measures are warranted.

Noise and Air

No specific mitigation measures are warranted.

Pest Animals

The following measures will be in place to prevent the spread of Tilapia and other exotic fish within the SGCP area and its surrounds:

- the location and spread of Tilapia will be monitored as part of the WPAMP
- all SGCP staff and contractors will be educated about the presence of Tilapia on-site during site inductions, and be forbidden to move fish between water-bodies.

Road Mortality

Road mortality is not an important threat to Eastern Great Egrets. No specific mitigation measures are required.

Direct Mortality During Clearing

No direct mortality of Eastern Great Egrets is expected to occur during clearing. No specific mitigation measures are required.

Changed Fire Regimes

Fire regimes within the SGCP area are unlikely to impact Eastern Great Egrets. No specific mitigation measures are warranted.

Weeds

Reasonable measures will be taken to control known weed species in the SGCP area, including aquatic weeds such as Paragrass. New weed infestations will be recorded and controlled where applicable under the *LP Act*.

A Weed and Pest Animal Management Plan (WPAMP) will be prepared and implemented over the life of the SGCP. The WPAMP will include a monitoring program and auditable performance measures, including reductions in Class 1 and 2 weeds, and prevention of the spread of aquatic weeds into potential habitat for Eastern Great Egrets.

The introduction and/or spread of weed species will be mitigated by:

- restricting light vehicle movement in areas outside of regular activity, particularly on irregularly used tracks

- restricting vehicle movement during and following rainfall, where practicable
- implementing strict wash-down procedures for all vehicles (including clearing and construction machinery) entering clearance zones, grazing areas or conservation areas
- controlling weeds according to guidelines under the relevant Weed Fact Sheet
- training and awareness of all staff.

20.4.2.11. Cotton Pygmy-goose

Habitat Loss

The SGCP will not reduce the amount of habitat available to Cotton Pygmy-geese. No specific mitigation measures are warranted.

Habitat Fragmentation

The SGCP will not fragment habitat available to Cotton Pygmy-geese. No specific mitigation measures are warranted.

Subsidence

There will be no impacts of subsidence on Cotton Pygmy-goose habitat within the SGCP. No specific mitigation measures are warranted.

Artificial Lighting

There will be no impacts of artificial lighting on Cotton Pygmy-geese within the SGCP. No specific mitigation measures are warranted.

Noise and Air

There will be no impacts of noise or reduced air quality on Cotton Pygmy-geese within the SGCP. No specific mitigation measures are warranted.

Pest Animals

Pest animals are not an important threat to Cotton Pygmy-geese. No specific mitigation measures are warranted.

Road Mortality

Direct mortality of Cotton Pygmy-geese through collisions with vehicles will not be elevated by the SGCP. No specific mitigation measures are warranted.

Direct Mortality During Clearing

The SGCP will not cause direct mortality of Cotton Pygmy-geese during clearing. No specific mitigation measures are warranted.

Changed Fire Regimes

Fire regimes will not impact Cotton Pygmy-geese. No specific mitigation measures are warranted.

Weeds

Reasonable measures will be taken to control known weed species in the SGCP area, including aquatic weeds such as Para Grass. New weed infestations will be recorded and controlled where applicable under the *LP Act*.

A Weed and Pest Animal Management Plan (WPAMP) will be prepared and implemented over the life of the SGCP. The WPAMP will include a monitoring program and auditable performance measures, including reductions in Class 1 and 2 weeds, and prevention of the spread of aquatic weeds into areas of favourable Cotton Pygmy-goose habitat.

The introduction and/or spread of weed species will be mitigated by:

- restricting light vehicle movement in areas outside of regular activity, particularly on irregularly used tracks
- restricting vehicle movement during and following rainfall, where practicable
- implementing strict wash-down procedures for all vehicles (including clearing and construction machinery) entering clearance zones, grazing areas or conservation areas
- controlling weeds according to guidelines under the relevant Weed Fact Sheet
- training and awareness of all staff.

20.4.3. Revegetation and Rehabilitation

Following the future completion of mining activities, all land disturbed as a consequence of activities will be revegetated and rehabilitated using locally native flora, in accordance with a rehabilitation management plan (see **Section 5.6** for further details). Decommissioned land will be managed until such time as it satisfies pre-determined targets regarding species assemblages and vegetation structure. Habitat for MNES will be incorporated into these targets. Rehabilitation aims to create self-sustaining ecosystems similar to surrounding ecosystems. The final land use will be a combination of grazing and native bushland. Rehabilitation of disturbed areas will be undertaken throughout the life of the SGCP, as areas of operation change. Revegetation and rehabilitation of mined land will result in minimal long-term impacts of the SGCP to MNES, despite the existence of the short-term impacts outlined in **Sections 20.3.9, 20.3.10** and **20.3.11**.

In addition to the rehabilitation of mined land, all non-remnant vegetation contained within land managed by the SGCP (including the infrastructure corridor and most lots surrounding the mine: see **Figure 8-14**) will be rehabilitated to improve their ecological value. Further details are provided in **Section 8.7.1.7** and **Section 20.5.** This will connect currently fragmented habitat, and provide an important biodiversity corridor linking the SGCP with large tracts of remnant vegetation to the south. Livestock will be excluded from these areas. Vegetation will be monitored and managed for the life of the SGCP, in accordance with a fire management plan, threatened species management plan, weed and pest animal management plan, and rehabilitation management plan. These actions will greatly improve the quantity and quality of habitat for MNES within the local region, and produce a net environmental gain. These protected areas will also provide an important refuge for MNES and other flora and fauna, to enable their future colonisation of mined land following its rehabilitation.

20.5. PROPOSED OFFSETS FOR RESIDUAL IMPACTS

The Australian Government defines environmental offsets as 'actions taken outside of a development site that compensate for the impacts of that development – including direct, indirect or consequential impacts' (DEWR, 2007).

Environmental impacts provide an opportunity to achieve long-term conservation outcomes whilst providing flexibility for Proponents seeking to undertake development which will have environmental impacts (DEWR, 2007).

For mining activities in Queensland, offsets are required when there is residual environmental impact following minimisation and avoidance measures by the Proponent. Biodiversity offset principles are contained within the *Queensland Biodiversity Offsets Policy 2011, Policy for Vegetation Management Offsets 2011 and the Queensland Government Environmental Offsets Policy 2008* (DERM, 2011b).

Avoidance and mitigation of impacts on the threatened species and TECs are described in **Section 20.4** and will be detailed in the TSMP. However, there are likely to be residual impacts from the SGCP. These include impacts on, and removal of, habitat for threatened species, and clearing of threatened ecological communities.

Due to residual impacts on threatened species, their habitats and threatened ecological communities posed by the SGCP, a Biodiversity Offsets Strategy will be developed and implemented. Offset options will be presented in the Biodiversity Offsets Strategy and will outline measures to ensure that these offsets are managed to maintain and enhance biodiversity values.

The *Draft Policy Statement: Use of environmental offsets under the Environmental Protection and Biodiversity Conservation Act 1999* (DEWR, 2007) identifies eight principles for the use of environmental offsets under the *EPBC Act*.

The SGCP Biodiversity Offsets Strategy will be developed in consideration of these principles:

1. Environmental offsets should be targeted to the matter protected by the *EPBC Act* that is being impacted.

2. A flexible approach should be taken to the design and use of environmental offsets to achieve long-term and certain conservation outcomes which are cost effective for Proponents.
3. Environmental offsets should deliver a real conservation outcome.
4. Environmental offsets should be developed as a package of actions which may include both direct and indirect offsets.
5. Environmental offsets should, as a minimum, be commensurate with the magnitude of the impacts of the development and ideally deliver outcomes that are 'like for like'.
6. Environmental offsets should be located within the same general area as the development activity.
7. Environmental offsets should be delivered in a timely manner and be long lasting.
8. Environmental offsets should be enforceable, monitored and audited.

Areas that are suitable for offsets (DERM, 2011b) will require identification by a suitably qualified ecologist using ecological equivalence methodologies (DERM 2011c). Biodiversity offsets will be provided in accordance with the *Queensland Biodiversity Offsets Policy 2011*, and determined in consultation with DEHP. The determination of ecological equivalence will involve the assessment of BioCondition in all major vegetation units to be impacted by the proposed activities. This will be completed in accordance with the *Queensland BioCondition Assessment Manual 2011*. Furthermore, additional fauna trapping will clarify the habitat value of certain parts of impacted and potential offsets areas.

Biodiversity offsets will be finalised within 12 months of issue of an Environmental Authority for the SGCP. The Proponent is presently involved in consultative discussions with DEHP to finalise requirements for biodiversity offsets in cooperation with DEHP and other mining Proponents within the Galilee Basin. The current offsets plan is summarised below.

SGCP has acquired several properties on which the mining activities are planned. Mining activities will occupy a central portion of these properties. The mine has been carefully positioned to avoid impacting MNES, with the open-cut mine area lying predominantly within non-remnant vegetation. A total of 4960 ha of (mostly) non-remnant vegetation will be removed, most of which is marginal habitat for the Brigalow Scaly-foot, Squatter Pigeon and Ornamental Snake. Small areas of habitat for the Koala, Black-throated Finch and the Brigalow ecological community will also be impacted.

To compensate for these losses, and to provide a net environmental benefit of the SGCP, areas outside the mine footprint are proposed to be protected and restored to high-quality remnant vegetation. Areas outside the mine footprint already contain a higher proportion of remnant vegetation than those being impacted by the mine. These areas thus potentially exceed requirements for ecological equivalence. This will be quantified by a suitably qualified ecologist using ecological equivalence methodologies (DERM, 2011c).

Remnant vegetation outside the mine footprint is currently fragmented and under pressure from grazing. The SGCP offers an excellent opportunity to increase the amount of remnant vegetation in the Alpha region. The SGCP proposes to restore up to 16,000 hectares of mostly non-remnant vegetation back to high quality remnant vegetation (**Figure 8-14**). This offset area would be kept free of cattle, and managed for weeds and pest animals according the *Land Protection (Stock route and Pest Management) Act* and the provisions of the *Biodiversity Offsets Policy 2011*. This will greatly increase the biodiversity values of the existing ecosystem. It will also establish a substantial biodiversity corridor, linking currently fragmented remnant vegetation with extensive tracts of remnant vegetation in the Carnarvon Ranges, to the south of the SGCP area (**Figure 8-14**).

Restored vegetation will provide important habitat for the Brigalow Scaly-foot, Koala, Black-throated Finch, Squatter Pigeon, Ornamental Snake, Yakka Skink, Dunmall's Snake, Rainbow Bee-eater and other MNES that possibly, but are less likely to, utilise the site.

20.6. MONITORING AND REPORTING

Detailed monitoring programs will be contained in the following management plans to be prepared prior to the commencement of construction:

- Weed and Pest Animal Management Plan
- Migratory Species Management Plan
- Threatened Species Management Plan
- Waterways Management Plan
- Fire Management Plan.

Environmental monitoring will comply with the requirements of the Environmental Authority.

As described in **Section 5—Rehabilitation and Decommissioning**, rehabilitation performance criteria will be submitted to the DEHP for review and comment in a Rehabilitation Management Plan.

The Rehabilitation Management Plan will, at a minimum:

- develop design objectives for rehabilitation of disturbed areas and post mining land uses across the mine
- specify soil and waste rock characteristics for use in rehabilitation
- detail rehabilitation methods applied to different areas of the SGCP
- identify rehabilitation performance criteria for different rehabilitation areas
- explain planned native vegetation rehabilitation areas and corridors
- identify rehabilitation sites to be used to develop rehabilitation success criteria
- develop a contingency plan for rehabilitation maintenance or redesign
- describe end of mine landform design plan and post mining land uses across the mine
- propose ERE management and offset protection.

In addition to rehabilitated areas, reference sites will be monitored to allow a comparison of the development and success of the rehabilitation against a control. Reference sites indicate the condition of surrounding un-mined areas that the rehabilitated disturbance area will aim to replicate. Monitoring will be conducted periodically by independent, suitably skilled and qualified persons at locations which will be representative of the range of conditions on the rehabilitating areas. Annual reviews will be conducted of monitoring data to assess trends and monitoring program effectiveness.

The Proponent will provide the results of environmental monitoring to regulatory agencies and the public. The Proponent will comply with all reporting requirements of the Environmental Authority and other State and Commonwealth legislation.

As described in **Section 8—Nature Conservation**, a second round of stygofauna sampling is proposed to be conducted during the 2012 post-wet season. Based on this sampling, either:

- no stygofauna will be recorded, in which case stygofauna should not be considered a relevant environment factor and no further sampling will be recommended, or
- stygofauna are recorded and depending on the conservation significance and ecological requirements of the animals collected, the objective will be to maintain the abundance, diversity, geographic distribution and productivity of stygofauna at species and ecosystem levels through avoidance or management of threatening processes.

ANNEXURE A ASSESSMENTS OF SIGNIFICANT IMPACT CRITERIA

Annexure A – Assessments of Significant Impact Criteria

Species	*EPBC Act* Status	Significant Impact Criteria: An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:								
		Lead to decrease in population[1]	**Reduce the area of occupancy[2]**	**Fragment existing population[3]**	**Adversely affect critical habitat[4]**	**Disrupt breeding cycle[5]**	**Decrease habitat[6]**	**Result in invasive species[7]**	**Introduce disease[8]**	**Interfere with recovery[9]**
Dasyurus hallucatus (Northern Quoll)	Endangered	Northern Quolls have not been recorded within the SGCP area and are not likely to occur due to the absence of rocky habitats. The SGCP will not lead to a decrease in the population of Northern Quolls.	The SGCP will not remove habitat for Northern Quolls.	The SGCP will not fragment existing populations of Northern Quolls.	There is no critical habitat for Northern Quolls within the SGCP area.	The SGCP will not disrupt the breeding cycles of Northern Quolls because they are absent from the mining area.	The SGCP will not remove habitat for Northern Quolls.	The SGCP will not result in increases in invasive animal numbers. A pest animal management plan will be implemented nevertheless.	There are presently no diseases that threaten Northern Quolls.	No habitat required for the recovery of Northern Quolls in within the SGCP area.
Neochmia ruficauda ruficauda (Star Finch (southern))	Endangered	Star Finches have not been recorded within the SGCP area and are not likely to occur due to the absence of suitable habitat. The SGCP will not lead to a decrease in the population of Star Finches.	The SGCP will not remove habitat for Star Finches.	The SGCP will not fragment existing populations of Star Finches.	There is no critical habitat for Star Finches within the SGCP area.	The SGCP will not disrupt the breeding cycles of Star Finches because they are absent from the mining area.	The SGCP will not remove habitat for Star Finches.	The SGCP will not result in increases in invasive animal numbers. A pest animal management plan will be implemented nevertheless.	There are presently no diseases that threaten Star Finches.	No habitat required for the recovery of Star Finches in within the SGCP area.
Poephila cincta cincta (Black-throated Finch (southern))	Endangered	Black-throated Finches have not been recorded within the SGCP area and are not likely to utilise habitats impacted by the mine. Black-throated Finches are known from land north of the SGCP area and may potentially move into the SGCP area during favourable conditions when populations increase.	The SGCP will not remove a substantial amount of habitat for Black-throated Finches, if the species should occur on site.	The SGCP will not fragment existing populations of Black-throated Finches.	There is no critical habitat identified for Black-throated Finches within the SGCP area.	The SGCP will not disrupt the breeding cycles of Black-throated Finches because they are absent from the mining area.	Small amounts of potential habitat may be removed to accommodate the infrastructure corridor.	The SGCP will not result in increases in invasive animal numbers. A pest animal management plan will be implemented nevertheless.	There are presently no diseases that threaten Black-throated Finches.	No habitat required for the recovery of Black-throated Finches is within the SGCP area.

1. lead to a long-term decrease in the size of a population

Annexure A – Assessments of Significant Impact Criteria

2. reduce the area of occupancy of the species
3. fragment an existing population into two or more populations
4. adversely affect habitat critical to the survival of a species
5. disrupt the breeding cycle of a population
6. modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
7. result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat
8. introduce disease that may cause the species to decline, or
9. interfere with the recovery of the species

Annexure A – Assessments of Significant Impact Criteria

Species	*EPBC Act* Status	Significant Impact Criteria: An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:							
		Reduce ecological community [1]	**Fragment ecological community**[2]	**Adversely affect critical habitat**[3]	**modify or destroy abiotic factors**[4]	**Change species composition**[5]	**Assist invasive species**[6a]	**Mobilisation of chemicals**[6b]	**Interfere with recovery**[7]
Brigalow (*Acacia harpophylla* dominant and co-dominant) (Brigalow TEC)	Endangered	The SGCP will reduce the area of Brigalow TEC by clearing <14 ha.	The SGCP will not substantially increase fragmentation of Brigalow TEC.	Brigalow TEC is to be cleared for the SGCP, but the areas to be cleared are small isolated fragments and are not critical to the survival of the TEC.	Abiotic factors resulting from the SGCP will have negligible impacts on Brigalow TEC. Brigalow does not overlay the underground mining area, and buffer zones will be established around existing areas of Brigalow surrounding the mining impact area.	Brigalow TEC will be managed in accordance with a threatened species management plan, a fire management plan, and weed and pest animal plan. Monitoring of Brigalow TEC will be conducted within the areas adjacent to the mining area.	A weed and pest animal plan will be implemented for the site which will mitigate the impacts of invasive species on Brigalow TEC.	Environmental management procedures within the SGCP mine area will mitigate the mobilisation of any potential pollutants into areas of Brigalow TEC. Monitoring of Brigalow TEC in potential areas of impact will facilitate early remedial action in the unlikely event that there are impacts on the TEC.	The SGCP will not interfere with the recovery of Brigalow TEC. A small area will be cleared and these impacts will be offset under the SGCP Biodiversity Offsets Strategy.
Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin	Endangered	The TEC Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin does not occur within the SGCP area. The SGCP will therefore not impact on this TEC.							
Weeping Myall Woodlands	Endangered	The TEC Weeping Myall Woodlands does not occur within the SGCP area. The SGCP will therefore not impact on this TEC.							
Acacia deuteroneura (Two-nerved Wattle)	Vulnerable	*Acacia deuteroneura* is not known to occur within the SGPC area. The SGCP will therefore not impact on this species.							
Acacia ramiflora (Branch-flowered Wattle)	Vulnerable	*Acacia ramiflora* is not known to occur within the SGPC area. The SGCP will therefore not impact on this species.							
Cadellia pentastylis (Ooline)	Vulnerable	*Cadellia pentastylis* is not known to occur within the SGPC area. The SGCP will therefore not impact on this species.							
Commersonia argentea (Silver Kurrajong)	Vulnerable	Commersonia argentea is not known to occur within the SGPC area. The SGCP will therefore not impact on this species.							

Annexure A – Assessments of Significant Impact Criteria

Species	*EPBC Act* Status	Significant Impact Criteria: An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:							
		Reduce ecological community [1]	**Fragment ecological community**[2]	**Adversely affect critical habitat**[3]	**modify or destroy abiotic factors**[4]	**Change species composition**[5]	**Assist invasive species**[6a]	**Mobilisation of chemicals**[6b]	**Interfere with recovery**[7]
Dichanthium queenslandicum (King Blue grass)	Vulnerable	*Dichanthium queenslandicum* is not known to occur within the SGPC area. The SGCP will therefore not impact on this species.							
Marsdenia brevifolia (Short-leaved Milk-vine)	Vulnerable	*Marsdenia brevifolia* is not known to occur within the SGPC area. The SGCP will therefore not impact on this species.							

1. reduce the extent of an ecological community
2. fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines
3. adversely affect habitat critical to the survival of an ecological community
4. modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns
5. cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting
6. cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

   a. assisting invasive species, that are harmful to the listed ecological community, to become established, or

   b. causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or

7. interfere with the recovery of an ecological community

Annexure A – Assessments of Significant Impact Criteria

Species	*EPBC Act* Status	Significant Impact Criteria: An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:								
		Lead to decrease in population[1]	**Reduce the area of occupancy[2]**	**Fragment existing population[3]**	**Adversely affect critical habitat[4]**	**Disrupt breeding cycle[5]**	**Decrease habitat[6]**	**Result in invasive species[7]**	**Introduce disease[8]**	**Interfere with recovery[9]**
Nyctophilus corbeni (South-eastern Long-eared Bat)	Vulnerable	There are no records of the South-eastern Long-eared Bat within the SGCP area. The nearest records are from west of Taroom, approximately 320 km away. An important population of this species is highly unlikely to be affected by the SGCP.	Because the SGCP is not likely to contain South-eastern Long-eared Bats, an important population of this species is highly unlikely to be affected by the SGCP.	The SGCP will not fragment a population of South-eastern Long-eared Bats.	There is no critical habitat for South-eastern Long-eared Bats impacted by the SGCP.	Because the SGCP is not likely to contain South-eastern Long-eared Bats, an important population of this species is highly unlikely to be affected by the SGCP.	Because the SGCP is not likely to contain South-eastern Long-eared Bats, impacts on habitat or habitat quality for the species highly unlikely as a result of the SGCP.	Although the South-eastern Long-eared Bat is not known to occur within the SGCP area, a pest animal management plan for the SGCP will mitigate impacts from invasive species within the SGCP area.	No diseases that may affect South-eastern Long-eared Bats will result from the SGCP.	The SGCP will not interfere with the recovery of South-eastern Long-eared Bats because the species is not known to occur within the region.
Delma torquata (Collared Delma)	Vulnerable	The SGCP area lies outside of the known distribution of *Delma torquata*. The nearest record of *Delma torquata* is approximately 250 km east of the SGCP area at Blackdown Tableland National Park. No important populations of the species are likely to occur within the Alpha region.	No important populations of *Delma torquata* are within the SGCP area as the species is not known to occur in the Alpha region.			The SGCP will not disrupt the breeding cycle of *Delma torquata* as the species is not known to occur in the Alpha region.	The SGCP will not remove habitat for *Delma torquata* as the species is not known to occur in the Alpha region.	A Pest Animal Management Plan will be implemented for the SGCP are to mitigate impacts from invasive species.	No disease is known to affect *Delma torquata* which may cause its decline.	The SGCP will not interfere with the recovery of *Delma torquata* as the species is not known to occur in the region.

Annexure A – Assessments of Significant Impact Criteria

Species	*EPBC Act* Status	Significant Impact Criteria: An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:								
		Lead to decrease in population[1]	**Reduce the area of occupancy**[2]	**Fragment existing population**[3]	**Adversely affect critical habitat**[4]	**Disrupt breeding cycle**[5]	**Decrease habitat**[6]	**Result in invasive species**[7]	**Introduce disease**[8]	**Interfere with recovery**[9]
Denisonia maculata (Ornamental Snake)	Vulnerable	The SGCP area is within the known distribution of the Ornamental Snake. While it was not detected during surveys, Ornamental Snakes are difficult to detect and may occur in the SGCP area. Should Ornamental Snakes occur in the SGCP area, the population is not likely to be important, as the habitats present are not those most frequently used by Ornamental Snakes (i.e. cracking clay soils with Brigalow).	If an important population of Ornamental Snakes occurs within the Alpha region, it is not within the SGCP mine footprint, due to the suboptimal habitat for the species in this area.	Fragmentation of an important population will not result from the SGCP.	There is no critical habitat for the Ornamental Snake within the SGCP area.	Disruption of a breeding cycle of an important population of Ornamental Snakes will not occur as a result of the SGCP.	High-quality habitat (Brigalow) will be mostly avoided by the SGCP. Habitat quality will be improved through the exclusion of livestock and restoration of land outside the mine footprint.	A Pest Animal Management Plan will be implemented for the SGCP are to mitigate impacts from invasive species. Impacts on Ornamental Snakes due to invasive animals within the SGCP are unlikely.	There is no disease known to affect Ornamental Snakes likely to interfere with its recovery.	The impacts of the SGCP on Ornamental Snakes are unlikely to interfere with its recovery, as impacts to high quality habitat are avoided.

Annexure A – Assessments of Significant Impact Criteria

Species	*EPBC Act* Status	Significant Impact Criteria: An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:								
		Lead to decrease in population[1]	**Reduce the area of occupancy[2]**	**Fragment existing population[3]**	**Adversely affect critical habitat[4]**	**Disrupt breeding cycle[5]**	**Decrease habitat[6]**	**Result in invasive species[7]**	**Introduce disease[8]**	**Interfere with recovery[9]**
Egernia rugosa (Yakka Skink)	Vulnerable	The Queensland Brigalow Belt Reptile Recovery Plan (Richardson, 2008) does not identify any population of Yakka Skinks considered to be an important population. Because of the suboptimal habitat for Yakka Skinks within areas impacted by the SGCP, and the extent of similar habitat within the wider area, it is considered unlikely that the SGCP would lead to the decline of a potential local population, whether or not such a population would be considered an important population.	A lack of records of the Yakka Skink within the SGCP area, and its absence from fauna survey results, suggests that there is no important population of the species within the SGCP area.	A lack of records of the Yakka Skink within the SGCP area, and its absence from fauna survey results, suggests that there is no important population of the species within the SGCP area.	No habitat critical to the survival of Yakka Skinks is present within the SGCP area.	Because of the suboptimal habitat for Yakka Skinks within the SGCP footprint, provided preclearing surveys are undertaken to target the species, the SGCP will not impact on breeding of the species.	No habitat critical to the survival of Yakka Skinks is present within the SGCP area. The SGCP is not likely to impact on Yakka Skink habitat to the extent that the species declines.	A Pest Animal Management Plan will be implemented for the SGCP are to mitigate impacts from invasive species. Impacts on Yakka Skinks due to invasive animals within the SGCP are unlikely.	There is no disease known to affect Yakka Skinks likely to interfere with its recovery.	The SGCP will not interfere with the recovery of Yakka Skinks due to the likely absence of the species from the Project footprint and the suboptimal habitat within the area impacted by the SGCP.

Annexure A – Assessments of Significant Impact Criteria

Species	*EPBC Act* Status	Significant Impact Criteria: An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:								
		Lead to decrease in population[1]	**Reduce the area of occupancy[2]**	**Fragment existing population[3]**	**Adversely affect critical habitat[4]**	**Disrupt breeding cycle[5]**	**Decrease habitat[6]**	**Result in invasive species[7]**	**Introduce disease[8]**	**Interfere with recovery[9]**
Furina dunmalli (Dunmall's Snake)	Vulnerable	The SGCP area is within the known distribution of Dunmall's Snake. While not detected during surveys, Dunmall's Snakes are difficult to detect and may occur in the SGCP area due to the presence of suitable habitat. If Dunmall's Snakes occur in the area, the population is unlikely to decrease due to the SGCP, as impacts to remnant habitat are largely avoided.	If Dunmall's Snakes occur in the SGCP area, the population is not likely to be important, because of the absence of local records for the species, indicating low densities of the species, if it is present.	If Dunmall's Snakes occur in the SGCP area, the population is not likely to be important, because of the absence of local records for the species, indicating low densities of the species, if it is present.	There is no critical habitat for Dunmall's Snake within the SGCP area.	It is unlikely that the SGCP will disrupt the breeding cycle of an important population of Dunmall's Snake.	Most vegetation to be cleared is non-remnant, and not high-quality habitat for Dunmall's Snakes.	A Pest Animal Management Plan will be implemented for the SGCP are to mitigate impacts from invasive species. Impacts on Dunmall's Snakes due to invasive animals within the SGCP are unlikely.	There is no disease known to affect Dunmall's Snakes likely to interfere with its recovery.	The SGCP will not interfere with the recovery of Dunmall's Snake as there are no local records of the species in the Alpha region.

Annexure A – Assessments of Significant Impact Criteria

Species	*EPBC Act* Status	Significant Impact Criteria: An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:								
		Lead to decrease in population[1]	**Reduce the area of occupancy[2]**	**Fragment existing population[3]**	**Adversely affect critical habitat[4]**	**Disrupt breeding cycle[5]**	**Decrease habitat[6]**	**Result in invasive species[7]**	**Introduce disease[8]**	**Interfere with recovery[9]**
Paradelma orientalis (Brigalow Scaly-foot)	Vulnerable	The SGCP contains a population of Brigalow Scaly-foots that is outside of the known distribution of the species, and extends the species' distribution. This population is therefore important as it is near the limit of the species' range. The SGCP is likely to reduce the size of the local population of Brigalow Scaly-foots in the short-term, due to clearing of <5000 ha of (mostly suboptimal) habitat.	The area of occupancy for Brigalow Scaly-foots will be reduced by <5000 ha by the SGCP.	The existing population of Brigalow Scaly-foots will not be fragmented as there is contiguous habitat surrounding the SGCP area.	The SGCP does not constitute critical habitat for Brigalow Scaly-foots.	The breeding cycle of Brigalow Scaly-foots will be disrupted during clearing operations and individuals will be extirpated from the area cleared for the open-cut mine and associated infrastructure.	The SGCP will remove habitat for the Brigalow Scaly-foot, but this habitat is not critical for the persistence of the species. High-quality habitat will remain outside of the impact footprint of the SGCP. However there may be regional declines in the species due to cumulative impacts from numerous Projects in the Galilee Basin.	Implementation of a Pest Animal Management Plan will mitigate impacts by invasive animals on the Brigalow Scaly-foot within the SGCP area.	No diseases are known to impact on the Brigalow Scaly-foot.	Offsets will be implemented to provide an interconnected area of high-quality habitat for the species, such that recovery of the species is not impaired by the SGCP.
Rheodytes leukops (Fitzroy River Turtle)	Vulnerable	The Fitzroy River Turtle does not inhabit the SGCP area. The watercourses within the SGCP are ephemeral and unsuited to this species.								

Annexure A – Assessments of Significant Impact Criteria

Species	*EPBC Act* Status	Significant Impact Criteria: An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:								
		Lead to decrease in population[1]	**Reduce the area of occupancy[2]**	**Fragment existing population[3]**	**Adversely affect critical habitat[4]**	**Disrupt breeding cycle[5]**	**Decrease habitat[6]**	**Result in invasive species[7]**	**Introduce disease[8]**	**Interfere with recovery[9]**
Geophaps scripta scripta (Squatter Pigeon)	Vulnerable	Squatter Pigeons are widely distributed in Queensland and were not detected during surveys of the SGCP. The SGCP will not impact on an important population of the species, should it occur on site.			The SGCP area does not constitute critical habitat.	Squatter Pigeons are widely distributed in Queensland and were not detected during surveys of the SGCP. The SGCP will not impact on an important population of the species, should it occur on site.		A Pest Animal Management Plan will be implemented and will mitigate impacts from invasive animals on Squatter Pigeons, should they occur on site.	The will be no disease risk to Squatter Pigeons from the SGCP.	The SGCP will not interfere with the recovery of the species.
Rostratula australis (Australian Painted Snipe)	Vulnerable, Migratory	Painted Snipe may use the SGCP in a transitory capacity, although the SGCP area does not contain high-quality habitat for the species and does not sustain an important population.			The area is not critical for the survival of Painted Snipe.	Painted Snipe are unlikely to breed within the SGCP area.	The SGCP area does not contain high-quality habitat for the species.	A Pest Animal Management Plan will be implemented and will mitigate impacts from invasive animals on Painted Snipe, should they occur on site.	The SGCP does not present a risk of disease to Painted Snipe, should they occur on site.	The SGCP will not interfere with the recovery of Painted Snipe.

1. lead to a long-term decrease in the size of a population
2. reduce the area of occupancy of the species
3. fragment an existing population into two or more populations
4. adversely affect habitat critical to the survival of a species
5. disrupt the breeding cycle of a population
6. modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
7. result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat
8. introduce disease that may cause the species to decline, or
9. interfere with the recovery of the species

Annexure A – Assessments of Significant Impact Criteria

Species	*EPBC Act* Status	Significant Impact Criteria: An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:		
		Modify habitat[1]	**Result in invasive species[2]**	**Disrupt lifecycle[3]**
Haliaeetus leucogaster (White-bellied Sea Eagle)	Migratory	White-bellied Sea Eagles are unlikely to use the SGCP area due to its distance from permanent water bodies. The SGCP will not substantially modify habitat used by White-bellied Sea Eagles.	A Pest Animal Management Plan will be implemented for the SGCP, which will mitigate impacts of invasive animals on White-bellied Sea Eagles, should they occur on site.	White-bellied Sea Eagles are unlikely to use the SGCP area due to its distance from permanent water bodies. The SGCP will not disrupt the breeding, feeding, migratory or resting behaviour of White-bellied Sea Eagles.
Hirundapus caudacutus (White-throated Needletail)	Migratory	White-throated Needletails are an aerial species that is highly mobile and can utilise airspace over disturbed landscapes. The SGCP area constitutes marginal habitat for the species. The SGCP is unlikely to modify habitat for White-throated Needletails.	Due to their aerial nature, White-throated Needletails are not impacted by invasive species.	The lifecycle of White-throated Needletails will not be disrupted by the SGCP area.
Merops ornatus (Rainbow Bee-eater)	Migratory	The SGCP does not constitute important habitat for Rainbow Bee-eaters. Rainbow Bee-eaters are common, highly mobile and seasonally migratory, and able to utilise a range of habitat types. It is likely that some habitat for Rainbow Bee-eaters will be removed, but the amount of potential breeding sites will have a net increase due to the SGCP.	A Pest Animal Management Plan will be implemented for the SGCP, which will mitigate impacts of invasive animals on Rainbow Bee-eaters.	The SGCP area is not likely to contain an ecologically significant proportion of the regional Rainbow Bee-eater population. Rainbow Bee-eaters are common, highly mobile and seasonally migratory, and able to utilise a range of habitat types, therefore abundant habitat is available outside of the SGCP area.
Ardea alba modesta (Eastern Great Egret)	Migratory	Eastern Great Egrets are common within the Alpha region. They are widely distributed and highly mobile, using a broad range of water bodies. The SGCP area does not contain important habitat for the species.	A Pest Animal Management Plan will be implemented for the SGCP, which will mitigate impacts of invasive animals on Eastern Great Egrets.	The SGCP area is not likely to contain an ecologically significant proportion of the regional Eastern Great Egret population. Breeding is unlikely on site, and their movements are unlikely to be substantially impacted by the SGCP.
Ardea ibis (Cattle Egret)	Migratory	Cattle Egrets are uncommon within the Alpha region, and are usually found further east. The SGCP area does not constitute important habitat for the species.	A Pest Animal Management Plan will be implemented for the SGCP, which will mitigate impacts of invasive animals on native animals, including Cattle Egrets.	The SGCP area does not contain an ecologically significant proportion of the Cattle Egret population. Cattle Egrets are common to the east of the SGCP area, highly mobile and seasonally migratory, and able to utilise a range of habitat types. The SGCP will not disrupt their lifecycle.
Nettapus coromandelianus albipennis (Cotton Pygmy-goose)	Migratory	The SGCP area does not contain important habitat for the Cotton Pygmy-goose, and they are unlikely to use the area except in a transitory capacity.	A Pest Animal Management Plan will be implemented for the SGCP, which will mitigate impacts of invasive animals on Cotton Pygmy-geese, should they occur on site.	The SGCP area does not contain quality habitat for the cotton pygmy-goose, and they are unlikely to use the area except in a transitory capacity. The SGCP will not disrupt the lifecycle of Cotton Pygmy-geese.
Gallinago hardwickii (Latham's Snipe)	Migratory	Latham's Snipe utilise watercourses and inundated areas and are likely only to occur in the SGCP area during very wet periods. As such the SGCP does not constitute important habitat for the species.	A Pest Animal Management Plan will be implemented for the SGCP, which will mitigate impacts of invasive animals on Latham's Snipe, should they occur on site.	High quality habitat for Latham's Snipe is not present within the SGCP area and as such the SGCP is not likely to impact on a significant proportion of the species.

Annexure A – Assessments of Significant Impact Criteria

Species	*EPBC Act* Status	Significant Impact Criteria: An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:		
		Modify habitat[1]	**Result in invasive species[2]**	**Disrupt lifecycle[3]**
Rostratula australis (Australian Painted Snipe)	Migratory	Painted Snipe utilise watercourses and inundated areas and are likely only to occur in the SGCP area during very wet periods. As such the SGCP does not constitute important habitat for the species.	A Pest Animal Management Plan will be implemented for the SGCP, which will mitigate impacts of invasive animals on Painted Snipe, should they occur on site.	High quality habitat for Painted Snipe is not present within the SGCP area and as such the SGCP is not likely to impact on a significant proportion of the species.
Apus pacificus (Fork-tailed Swift)	Migratory	The Fork-tailed Swift is an aerial species that is highly mobile. It is likely to utilise the SGCP area infrequently, as the species flies over large areas and is not sedentary. They are able to utilise airspace over a wide range of disturbed habitats, and the SGCP is unlikely to modify habitat for Fork-tailed Swifts.	Due to their aerial nature, Fork-tailed Swifts are not impacted by invasive species.	The movements and lifecycle of Fork-tailed Swifts will not be disrupted by the SGCP.
Anseranas semipalmata (Magpie Goose)	Migratory	Habitat for magpie geese is not available within the SGCP area.		

1. substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species
2. result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or
3. seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.