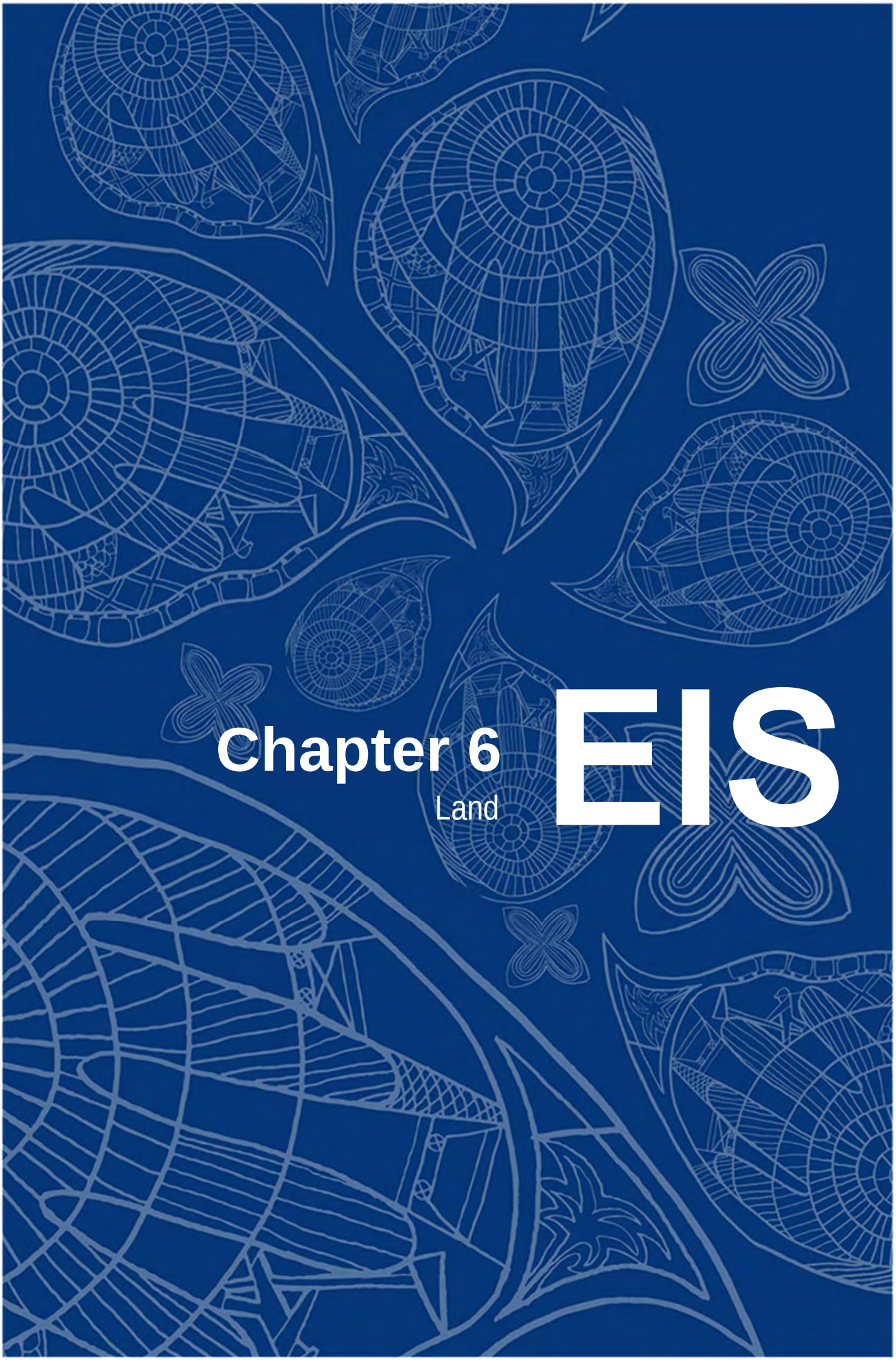
GLENCORE

ANNEXURE G: RCEP EIS Chapter 6 - Land



Chapter 6
Land

EIS

Table of Contents

6 Land

6.1 Introduction

This chapter provides an assessment of the potential impacts of the Rolleston Coal Expansion Project (the Project) on the land based environmental values of the Project Site. The assessment considers the likely nature and extent of potential impacts from the Project and identifies, where appropriate, safeguards to help mitigate, manage, or avoid adverse impacts over the life of the Project.

6.2 Scope of assessment

The purpose of the assessment is to describe and characterise the existing environmental values of the land area that have the potential to be affected by the Project. Where the assessment identifies a potential adverse impact on a land based attribute due to Project activities, mitigation is applied to reduce the potential impact.

The assessment has been scoped to address Section 4.2 of the Terms of Reference (ToR) for the Project. Several broad, land based topics are considered as part of this chapter. These include:

- Geology and geomorphology.
- Mineral resources and ore reserves.
- Land tenure and use.
- Existing infrastructure.
- Potential land degradation and likelihood of contaminated land.
- Land suitability and agriculture.
- Alterations to existing stock routes.
- Sensitive environmental areas.
- Landscape and visual amenity.

The assessment involved undertaking a range of desktop studies, stakeholder consultations, preliminary site investigations, and detailed technical studies, as described in Section 6.4 Methodology. Section 6.6 discussions potential impacts and Section 6.7 provides mitigation.

The Project is generally contained within MLA70415, MLA70416, MLA70458 and part of ML70307. This area is described as the Project Site. The area of direct impact is referred to as the Project Footprint. This footprint also includes a small area of 'off-lease' land that may be required for the re-alignment of Springwood Road. This area is not considered part of the Project Site as it is not required for the primary purpose of mining.

6.3 Legislation and policy

6.3.1 Queensland legislation

6.3.1.1 Environmental Protection Act 1994

The Project is to be assessed as a Non-Code Compliant Level 1 Mining Project subject to an Environmental Impact Statement (EIS) under the Queensland *Environmental Protection Act 1994* (EP Act). The Project is also a 'controlled action' under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The EIS process under the EP Act is accredited under the EPBC Act pursuant to the Bilateral Agreement between the Commonwealth and the State of Queensland.

The EP Act is the centrepiece of Queensland's environmental legislative system. The EP Act introduces fundamental definitions and provisions promoting the principles of ecologically sustainable development and environmental management. The EP Act describes and references a wide range of policies, processes, legislation and audit procedures applicable to mining activities (Chapter 5) and development in general. Regarding land management in particular, the application of the Act's 'general environmental duty' to minimise and prevent 'environmental harm' underwrites many of the objectives found in the ToR for this Project.

The chief executive of the former Department of Environment and Resource Management (DERM) issued the final ToR to be used in guiding the environmental impact assessment. The ToR lists the specific criteria which are to be addressed by Xstrata Coal Queensland in preparing the EIS to seek approval from the Queensland government for the Project's mining lease application (MLA) areas. The ToR lists both general environmental and assessment objectives alongside references to specific legislation, policies, guidelines, codes and standards.

References to other relevant planning instruments, policies, maps, guidelines, codes and registers are also considered in the assessment, where appropriate and applicable.

6.3.1.2 Land Protection (Pest and Stock Route Management) Act 2002

Queensland's stock route network is managed under the *Land Protection (Pest and Stock Route Management) Act 2002* (Land Protection Act). Stock routes generally occur over gazetted road reserves, both State-controlled and local government, with the network maintenance generally being the responsibility of the local government.

Stock routes are present within the Project area and may be impacted by Project activities. The EIS is therefore required to consider these stock routes and provide mitigation or management measures to avoid or minimise potential adverse impacts to an acceptable level.

6.3.1.3 Native Title (Queensland) Act 1993

The *Native Title (Queensland) Act 1993* came into effect after the High Court's recognition of native title in 1992. This Act primarily exists to give acknowledgement of the provisions contained in the Commonwealth native title legislation. The Commonwealth legislation recognises and protects native title, and promotes its coexistence with existing land management systems. Applications for claiming native title over State land, both leasehold and freehold, are conducted according to this Act and would apply to the Project Site.

6.3.1.4 Nature Conservation Act 1992

The *Nature Conservation Act 1992* (NC Act) provides for the creation and management of Queensland's protected areas. The Act is administered jointly by the Department of National Parks, Recreation, Sport and Racing and the Department of Environment and Heritage Protection (DEHP). The Project needs to consider the protected areas that are listed in Section 14 of the Act.

Protected areas are classified as:

- National Parks (scientific).
- National Parks.
- National Parks (Aboriginal land).
- National Parks (Torres Strait Islander land).
- National Parks (Cape York Peninsula Aboriginal land).
- National Parks (recovery).
- Conservation Parks.
- Resource Reserves.
- Nature Refuges.
- Coordinated Conservation Areas.

The NC Act also outlines processes for transferring land, such as state forest, into protected area estates. State forest is not a protected area under the NC Act, and is managed under the terms of the *Forestry Act 1959*.

6.3.1.5 Strategic Cropping Land Act 2011

The *Strategic Cropping Land Act 2011* (SCL Act) took effect in 2012 with the objectives of protecting land highly suitable for cropping, managing the impacts of development on that land and preserving the productive capacity of that land for future generations. The Act included provisions for identifying potential strategic cropping land (SCL), criteria for assessing and determining whether or not land is SCL, and established protection and management areas.

Areas mapped as potential SCL were identified within the Project Site. However, the Project fell under the transitional arrangements for SCL and was excluded under the permanent impact restriction (under section 288 of the SCL Act). Nonetheless, assessments were carried out in order to:

- Confirm the presence or otherwise of actual SCL within the Project Site.
- Comply with provisions of the SCL Act that require avoidance, mitigation and management.

The SCL Act was repealed on 13 June 2014, after the studies for the EIS had been completed, and partially replaced by the *Regional Planning Interests Act 2014* (Qld) (RPI Act).

6.3.1.6 Regional Planning Interests Act 2014

The RPI Act seeks to manage the impact of resource activities on areas of the State that contribute or are likely to contribute to Queensland's economic, social or environmental prosperity.

The RPI Act creates four areas of regional interest, primarily through the implementation of new generation regional plans, namely Priority Agricultural Area (PAAs), the Priority Living Area (PLA), the Strategic Cropping Area (SCA) and Strategic Environmental Areas (SEAs). Under the RPI Act proponents of resource projects proposed to impact on areas of regional interest need to apply for a Regional Interests Development Approval (**RIDA**), unless the activity is the subject of an exemption. Given the timing of the Act's commencement, the transitional provisions are also relevant for the Project.

The Project is mapped as falling within areas of PAA under the Central Queensland Regional Plan. Glencore will comply with its obligations under the RPI Act in this regard, which will form the subject of a separate assessment and approval process.

As noted above, the Project was excluded from the application of parts of the SCL Act under section 288 of the SCL Act, which fell within Chapter 9, Part 3, Division 3 of the SCL Act. Accordingly, while assessment work has been progressed to determine the status and appropriate avoidance and mitigation measures for any confirmed SCL, no applications under that Act had yet been made.

Section 99 of the RPI Act provides that activities related to mining lease or environmental authority applications which were exempt under Chapter 9, Part 3, Division 3 of the SCL Act are also exempt resource activities under the RPI Act for the purposes of the SCA.

Accordingly, Glencore is not required to seek a RIDA for the Project in respect of the SCA.

It is also noted for completeness that section 14(4) of the *Regional Planning Interests Regulation 2014* (Qld) provides that, where an activity is proposed to be carried out on land that is both used for a priority agricultural land use within a PAA and within the SCA, only the criteria for the PAA need to be met to the assessor's satisfaction. Accordingly, it is not anticipated that the exemption of the Project for the SCA will make any material difference to the RIDA application and assessment process.

6.3.1.7 Sustainable Planning Act 2009

The *Sustainable Planning Act 2009* (SP Act) is Queensland's principal planning legislation. Mining activities are 'exempt development' under Schedule 4 of the *Sustainable Planning Regulation 2009*, however many of the land use assessment guidelines listed in the ToR originate from instruments of the SP Act. The SP Act enables the jurisdiction of the local and regional planning authorities and schemes which overlay the Project Site. Planning schemes are required to be considered in this land use assessment; however the Project does not require approval by the scheme's administering local government for works undertaken on mining lease areas.

6.3.2 Local laws, planning instruments and strategic plans

The Project falls within the boundary of the Central Highlands Regional Council (CHRC). The CHRC was formed in 2008 following the amalgamation of Peak Downs Shire, Emerald Shire, Duaringa Shire and Bauhinia Shire. Of these former Shires, Bauhinia Shire was the local government authority for the Project.

6.3.2.1 Regional plan

The Central Queensland Regional Plan is given effect under the SP Act and the RPI Act and commenced on 18 October 2013.

The Central Queensland region includes the five local government areas of:

- Banana Shire Council.
- Central Highlands Regional Council.
- Gladstone Regional Council.
- Rockhampton Regional Council.
- Woorabinda Aboriginal Shire Council.

From 1 January 2014, the region will also include the Livingstone local government area.

The regional plan will:

- Protect the region's Priority Agricultural Land Uses from incompatible resource development by mapping Priority Agricultural Areas and identifying assessment criteria that will apply to resource activities undertaken on a Priority Agricultural Land Use within a Priority Agricultural Area.
- Protect the future of towns in the region by mapping Priority Living Areas and initiating legislative amendments that will allow local governments to determine whether or not resource activities can be located within a Priority Living Area.
- Identify infrastructure opportunities for the region.
- Provide regional direction in relation to other state interests.

6.3.2.2 Local planning scheme

The Project is located within the local government area of the CHRC. The designation given to the Project Site, under the applicable planning scheme covering the former Bauhinia Shire area, nominates the area both within and adjacent to the site as ‘Rural’ or ‘Open space’.

The Bauhinia Shire Planning Scheme details provisions for land use and zoning maps for (the former) Bauhinia Shire. The zones are broken down into precincts and areas, further defining different processes for assessment within the sub-areas. For the purpose of this assessment, precincts and areas will not be considered. There are three types of zones identified in the greater local government area:

- Rural – areas of the Shire predominantly used for agriculture and animal husbandry uses, and other rural uses (Part 4, Division 1).
- Open space – those areas of the Shire predominantly used for, or conserved for state forests, national parks, and timber reserves. (Part 4, Division 2).
- Town – applicable only to the townships of Springsure and Rolleston, the town zone allocates sub areas or ‘precincts’ to be managed with respect to the residential, commercial and industrial uses prevalent in the townships (Part 4, Division 3).

The mapping available online from Bauhinia Shire Council indicates that all of the Project Site is zoned for ‘rural’ use. The western edge of MLA70415 borders areas of ‘open space’ zoning. Rolleston’s ‘town’ zoning does not adjoin or immediately surround the Project Site and is located approximately 16 km to the east.

The Project is ‘exempt development’ (Section 1.2.11), not requiring approval under the Bauhinia Shire Council Planning Scheme.

Alongside the Planning Scheme’s land zoning is a separate set of spatial classifications called ‘overlays’. Overlays are imposed to enact development constraints for a different purpose to those made by zonings. The overlays can exist across zone boundaries, and are specific to four main groups, as described in the Bauhinia Shire Council Planning Scheme:

- Natural Features and Conservation Areas Overlays:
  - Catchment Overlay
  - Heritage Places Overlay.

- Economic Resources Overlays:
  - Agricultural Land Class Overlay
  - Mining Resource and Extractive Industry Overlay.
- Major Utilities Overlay.
- Natural Disaster Overlays:
  - Flood Hazard Overlay
  - Bushfire Overlay.

Notwithstanding the Project is exempt development, with the exception of the Heritage Places Overlay and the Major Utilities Overlay, all other overlays are relevant to the Project Site and are considered in this assessment.

6.3.3 Guidelines and standards

Supporting the EP Act and the *Environmental Protection Regulation 2008* is a wide range of policies, guidelines, codes and regulations published by the Queensland Government, the Australian Government, and institutions and associations involved with land management in Australia. The ToR for the Project require that the environmental impact assessment of land values is to be carried out with consideration of the following guiding documents, used for developing methodologies appropriate for addressing the ToR:

- *Land Suitability Assessment Techniques in the Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland* (DME, 1995).
- 6.1 Compilation of Land Resources Inventory (LRI) – Pre Mining Studies, of the *Land Suitability Assessment Techniques in the Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland* (DME, 1995).
- *Australasian Code for Reporting of Mineral Resources and Ore Reserves* (the JORC Code) (JORC, 2012).
- *Australian Guidelines for the Estimating and Reporting of Inventory Coal, Coal Resources and Coal Reserves* (CGC & QMC, 2003).
- CSIRO *Australian Soil and Land Survey Field Handbook* (National Committee on Soil and Terrain, 2009).
- CSIRO *Guidelines for Survey Soil and Land Resources* (McKenzie N, 2008).
- *State Planning Policy 2/02: Planning and Managing Development Involving Acid Sulfate Soils in Queensland*.
- Appendix 5 of the *Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland*. (EPA, 1998).
- *National Environment Protection (Assessment of Site Contamination) Measure* (NEPC, 1999) (as varied), (National Environment Protection Council (NEPC)).

The use of these guidelines has been noted in the relevant EIS chapters and supporting technical reports.

6.4 Methodology

The impact assessment was conducted by undertaking a range of desktop studies, stakeholder consultations, preliminary site investigations and detailed technical studies. The approach was designed to gather suitable information in order to assess the potential impacts arising from Project activities and propose mitigation measures as per the requirements of the ToR. The methodologies for each of the topography, geology, soils and contaminated land studies are explained in the following sections.

6.4.1 Topography

The topography of the Project Site and surrounds was derived relative to the Australian Height Datum (AHD) and drafted according to the Geocentric Datum of Australia (GDA) 94 datum. Imagery was obtained from aerial photography.

6.4.2 Tenures and infrastructure

Title searches for land tenures surrounding the Project Site were conducted. Mining and petroleum tenements were searched on the Department of Natural Resources and Mines (DNRM) Interactive Resource and Tenure Mapping (IRTM) tool. Information on infrastructure in the surrounding area was also obtained through the IRTM tool.

6.4.3 Native title

A desktop study of the current and historical native title claims was conducted for the Project Site and surrounding properties. The data for the study was obtained from online databases and mapping published by the Commonwealth's National Native Title Tribunal.

6.4.4 Land use and planning provisions

The assessment of the Project's impact upon existing and future land uses, as well as implications and inconsistencies with statutory planning instruments, was undertaken by reviewing:

- The provisions of the *Bauhinia Shire Planning Scheme*, which remains the applicable instrument of the CHRC during the transitionary phase of the area from the former Bauhinia Shire Council.
- The provisions of the *Bauhinia Stock Route Network Management Plan 2005 to 2009*, to determine the composition of the stock route network in the area.
- *State Planning Policy 1/92: Development and the Conservation of Agricultural Land* (SPP 1/92) and any supporting 'Land Suitability Assessment Techniques' provided in the *Technical Guidelines for the Environmental Management of Exploration and Mining Activities in Queensland* (DME, 1995).
- SCL Act and *State Planning Policy 1/12: Protection of Queensland's strategic cropping land* and supporting guidelines (DERM, 2012) (as relevant at the time).

Although the local planning instruments are not applicable to the Project's approvals process and, prior to the commencement of the RPI Act, neither was the Regional Plan, these were required to be referenced and considered in this EIS, along with any other planning instrument listed in the ToR.

6.4.5 Geology and geomorphology

The Project Site has been the subject of ongoing geological surveys for a number of decades. Initial pre-feasibility studies of the general area surrounding the Project Site were carried out for Brigalow Mines in 1982 and reviewed in 1983, establishing the baseline for understanding and describing the geology of the Project Site. Geological assessments were also conducted in 2002 for the development of the existing Rolleston Coal Mine, with operational geologists active on-site since the mine's establishment. The results of these baseline geological assessments have been used in this EIS in conjunction with surveys conducted to further establish the coal resources in the area for the Project's feasibility assessment stages.

Further geological investigations (Appendix F-1) were conducted to specifically address the following matters:

- Overburden/chip sampling.
- Drilling.
- Physical/chemical testing.
- Soil resources identification.

The outputs of the explorative geological surveys and reviews of previous studies formed the basis upon which mapping and stratigraphic imagery was generated for the Project Site and surrounding area. Regional studies published by Geoscience Australia were also considered and incorporated into the baseline assessment.

6.4.6 Mineral resources and ore reserves

The mineral resources and ore reserves were investigated and described according to guidelines set out in the ToR for the Project. The data was collected during geological studies of the Project Site, providing the information required to map the mineral resources and ore reserves.

The documents specified to guide the reporting and estimation of mineral resources and reserves included:

- *Australasian Code for Reporting of Mineral Resources and Ore Reserves* (the JORC Code) (JORC, 2012).
- *Australian Guidelines for the Estimating and Reporting of Inventory Coal, Coal Resources and Coal Reserves* (CGC & QMC, 2003).

Desktop searches were also conducted utilising the IRTM tool, in order to determine known mineral, coal, petroleum, natural gas and key resource areas (KRAs) within the Project area.

6.4.7 Soils and land suitability

The Project Site was studied as part of a soil survey conducted in 2011 by Palaris (Palaris, 2013) (Appendix D-1) to determine the soils types present in MLA70415, MLA70416 and MLA70458. The soil survey was conducted in accordance with the relevant sections of:

- *CSIRO Guidelines for Surveying Soil and Land Resources* (McKenzie, Grundy, Webster, & Ringrose-Voase, 2008).
- *Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland* (DME, 1995).
- *CSIRO Australian Soil Classification* (Isbell, 2002).
- *State Planning Policy 2/02: Planning and Managing Development Involving Acid Sulfate Soils.*

The soil survey was conducted to be compliant with Section 6.1 of *Compilation of Land Resources Inventory (LRI) – Pre Mining Studies of the Land Suitability Assessment Techniques*, contained within the DME Guidelines (1995). The soil survey was conducted under the standards established under the CSIRO Guidelines (McKenzie, Grundy, Webster, & Ringrose-Voase, 2008).

The DME Guidelines (1995) required a soil and land survey sufficient to compile a land resources inventory for the Project Site. These studies helped determine the erosion and rehabilitation conditions expected throughout the Project Site, as well as giving an indication of the quality of land being disturbed by Project activities. The specific tasks involved in compiling the land resources inventory as the first stage of the land suitability assessment process included:

- Reviewing available land resource information and geological and topographic mapping.
- Mapping of soils and terrain to a suitable scale.
- Sampling and characterisation of representative reference sites.
- Classifying soil in accordance with the Australian Soil Classification.
- Reporting of findings as a land resource inventory.

The outputs of the soil survey were interpreted to provide:

- Soil characterisation – Soils were described, mapped and illustrated with soil types classified according to the Australian Soil Classification.
- Good Quality Agricultural Land (GQAL) – Soil and mapping unit information was used to assess land suitability for rainfed cropping and grazing prior to using this information to identify GQAL.
- Strategic Cropping Land – Criteria for identifying SCL were applied to soil and soil mapping unit information to assess the potential impact on SCL as a result of the Project.
- Soil and rock properties – Physical and chemical properties were assessed to identify characteristics of the materials that will influence erosion potential, stormwater runoff quality, rehabilitation constraints and likely post-mining agricultural productivity.
- Acid sulfate soils – Soil morphology and chemical properties were used to investigate the presence of inland acid sulfate soils.
- Soil stability, quantity and quality – Soil data were used to address the geotechnical stability of the soil and the approximate quantity and quality of topsoil to be stockpiled due to mine operations.

Guidelines used in the preparation of this EIS are referenced where implemented throughout the chapter.

6.4.8 Contaminated land

Under the EP Act, contaminated land is defined as land which is impacted by a hazardous contaminant that may pose a potential risk to human health or the environment. Poor environmental management procedures, accidental spills, industrial activities and poor waste disposal procedures can all contribute to land contamination. To provide an understanding of the potential contamination status of the Project Site, the following methodology was undertaken:

- A desktop review of the current and historical land uses on properties within or adjacent to the Project Site.
- Identification of historical land uses undertaken on the properties within the Project area that are considered to have the potential to cause contamination.
- A review of available Queensland Government records to assess whether properties within the Project Site are recorded on the public access registers containing land use planning information, Environmental Management Register (EMR) or Contaminated Land Register (CLR).
- A desktop review of additional contamination sources with the potential to impact the Project Site, such as acid sulfate soil searches and unexploded ordinances search (UXO).
- A review of land potentially impacted by land contamination and the likelihood of impacts to the Project Site, based on proximity and contaminants of concern.

6.4.9 Erosion and sedimentation

The method for assessing erosion potential was split into two focus areas; water and wind erosion. A risk assessment has been conducted to determine the erosion potential of soils and landforms within the Project Site. In assessing erosion potential across the site, management measures are proposed to reduce the erosion and sedimentation and their subsequent impacts to environmental values within the Project Site.

The data used to determine the potential extent of water erosion included soil type and texture, slope, landform and cover descriptions for the different land units present across the Project Site. Water driven erosion was considered to be the greatest erosional risk to soils within the Project Site. Wind erosion, including its sources and impacts, has largely been considered as part of dust modelling in Chapter 11 Air Quality.

6.4.10 Environmentally Sensitive Areas

Maps obtained from the DEHP website have been used to identify the location of category A, B and C Environmentally Sensitive Areas (ESA) in the Project area. In addition, a desktop study was conducted to identify further sensitive areas in the vicinity of the Project Site. These sensitive areas were searched using the EPBC Protected Matters search tool, DEHP's WetlandInfo interactive mapping tool and the DNRM IRTM tool. The results from each search were subsequently summarised to identify any potential impacts.

6.4.11 Landscape character and visual amenity

The landscape and visual impact assessment (LVIA) has been informed by current guidelines, an appreciation of the types of impacts likely to be encountered, and the gathering of information currently available.

There are currently only limited national or state level guidelines for LVIA in Australia. Therefore, the approach to this LVIA has been developed with reference to accepted guidelines from other reputable sources, nationally and internationally, which include:

- The Landscape Institute and the Institute of Environmental Management and Assessment, UK (2002) *Guidelines for Landscape and Visual Impact Assessment, Second Edition* (2002).
- New Zealand Institute of Landscape Architects, NZ (2010) *Best Practice Note: Landscape Assessment and Sustainable Management 10.1*.
- New Zealand Institute of Landscape Architects, NZ (2010) *Best Practice Note: Visual Simulations BPG 10.2*.
- The Institution of Lighting Engineers (ILE), UK (2005) *Guidance Notes for Reduction of Obstructive Lighting*.
- *Australian Standard 4282 – Control of Obtrusive Effects of Outdoor Lighting* (1997).

For the purposes of this assessment, these are considered the most relevant and appropriate guidelines for LVIA, and are collectively referred to as the 'EIA guidelines' in this chapter.

The LVIA methodology is applicable to the assessment of likely impacts:

- During the construction and operation of the Project.
- Following the decommissioning of the Project.
- During both day and night time.

6.5 Description of environmental values

6.5.1 Topography

The Project Site is dominated by low undulating hilly country formed over weakly dissected volcanic rocks. It rises on average to 50 m above the alluvial terraces and gently undulating low broad rises fringing Bootes and Meteor Creeks. Forming a backdrop to the southwest of the Project Site is the Black Alley Range, part of Carnarvon National Park, which includes the Consuelo Tableland. The Consuelo Tableland is located approximately 60 km from the Project Site at 1,232 m AHD.

Three topographic units have been recognised as:

Undulating to low hilly terrain:

- The hilly terrain is generally flat topped and forms a gently undulating peneplain covered by red, red-brown and brown clay soils which grade into dark grey soils downslope or in depressed areas.

Prominent low steep-flow scarps:

- A distinct change of slope occurs at the edge of the hilly terrain. Prominent low steep scarps exist between hard and soft formations where resistant volcanic flows have been truncated or eroded. The most prominent feature of this type is a ridge which parallels Meteor Creek to the south of the Project Site.

Flat low lying alluvial plains:

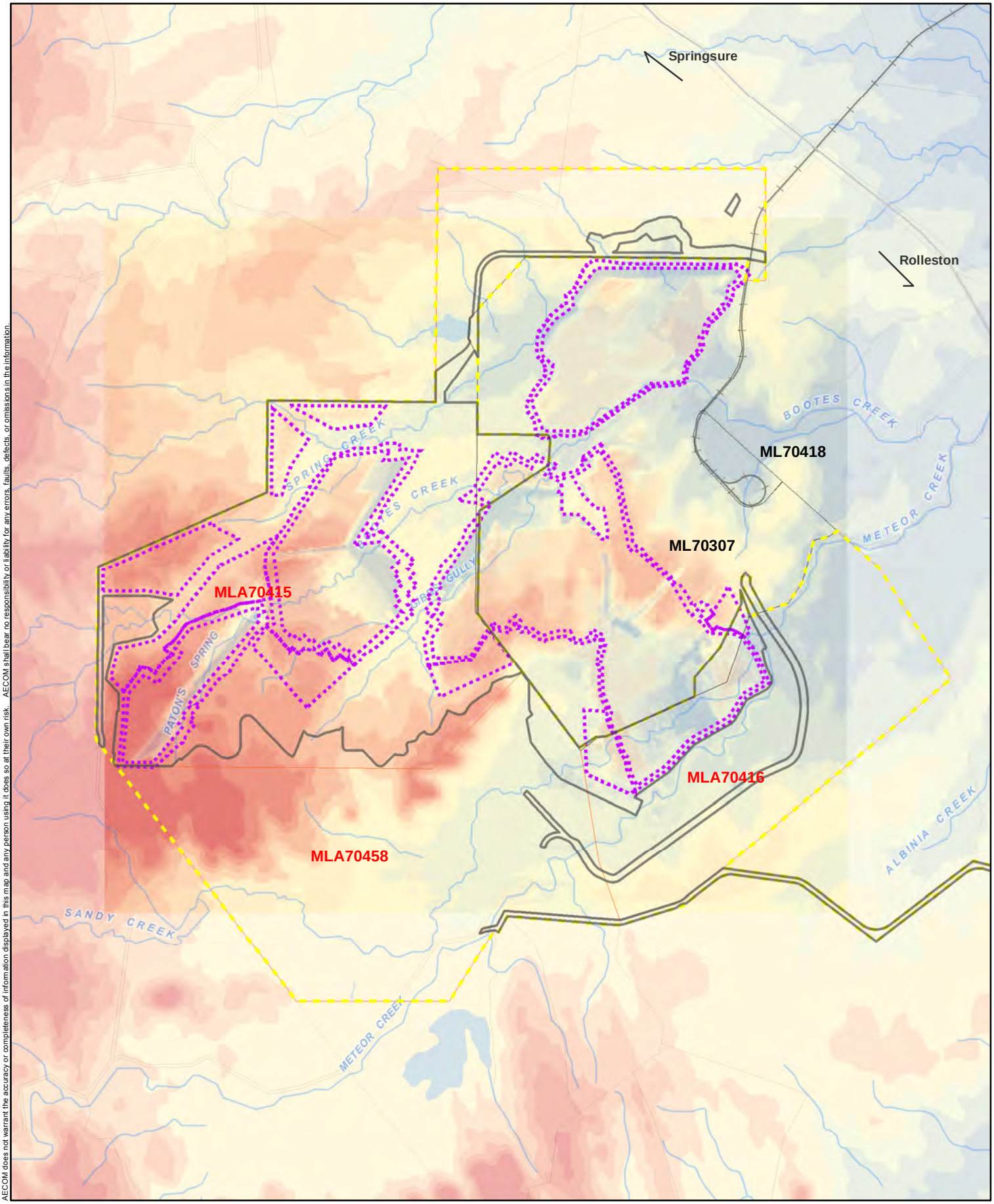
- The scarp areas give way to gently sloping, undulating and locally benched slopes, or grade into broadly undulating, mildly dissected, foot slope interfluves. These landforms merge into colluvial, very gently sloping terraces of the Cainozoic alluvial province. Drainage flats and low terraces have formed adjacent to Bootes and Meteor Creeks, which in some places have incised up to 15 m into the Meteor Creek floodplain. Flow in Bootes and Meteor Creeks is intermittent and strongly seasonal. The low-lying land, into which Bootes Creek drains, becomes swampy in the wet season and is located entirely in the Carnarvon National Park.

The landscape elevations are detailed in Figure 6.1. Further information on surface drainage patterns is provided in Chapter 9 Surface Water, with the surface drainage indicated within the Project's catchment areas.

6.5.2 Land use

The Project is located within a 'rural' zoning area of the CHRC planning scheme. The nearest townships, Rolleston and Springsure, are respectively 16 km and 58 km east and northwest of the Project Site along the Dawson Highway. The townships provide accommodation for locally-based mine workers and contractors, as well as other industries that support employment in the region and at which people may have been employed in prior to mining. The majority of mine workers and contractors for the Project would be accommodated in the existing accommodation facility located about 1 km north of the existing mining lease, on the western side of the mine access road leading from the Dawson Highway. The location of sensitive receptors within and surrounding the Project Site is shown in Figure 6.2.

The land uses immediately surrounding or adjacent to the Project Site are generally agricultural, or relate to the existing operation at the Rolleston Coal Mine. Agricultural land uses are largely pastoral, with areas suitable for cropping also to the south of the Project Site. Easements and tenures supporting the existing Rolleston Coal Mine, such as those held for road, rail, power and accommodation related infrastructure, form the major land uses immediately adjacent to the Project Site, with the exception of agricultural and rural residential land use. Land use surrounding the Project Site is illustrated on Figure 6.2.



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xstrata coal

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DATUM GDA 1994, PROJECTION MGA ZONE 55

Legend

- Roads
- Railways
- Watercourses
- Project Site
- Project Footprint
- Existing Mining Lease
- Proposed Mining Lease
- Dump Area
- Pit Area

Elevation (m AHD)

200
210
220
230
240
250
260
270
280
290
300
310

Data sources:
DEM, Pits, Dumps - Xstrata Coal
Railways - Queensland Rail Network, 2012
Roads - © MapInfo Australia Pty Ltd (2012) Based on [Roads - all – State Digital Road Network (SDRN)] provided with the permission of MapInfo Australia Pty Ltd (2012).
Mining leases - State Government DME, QLD 2013

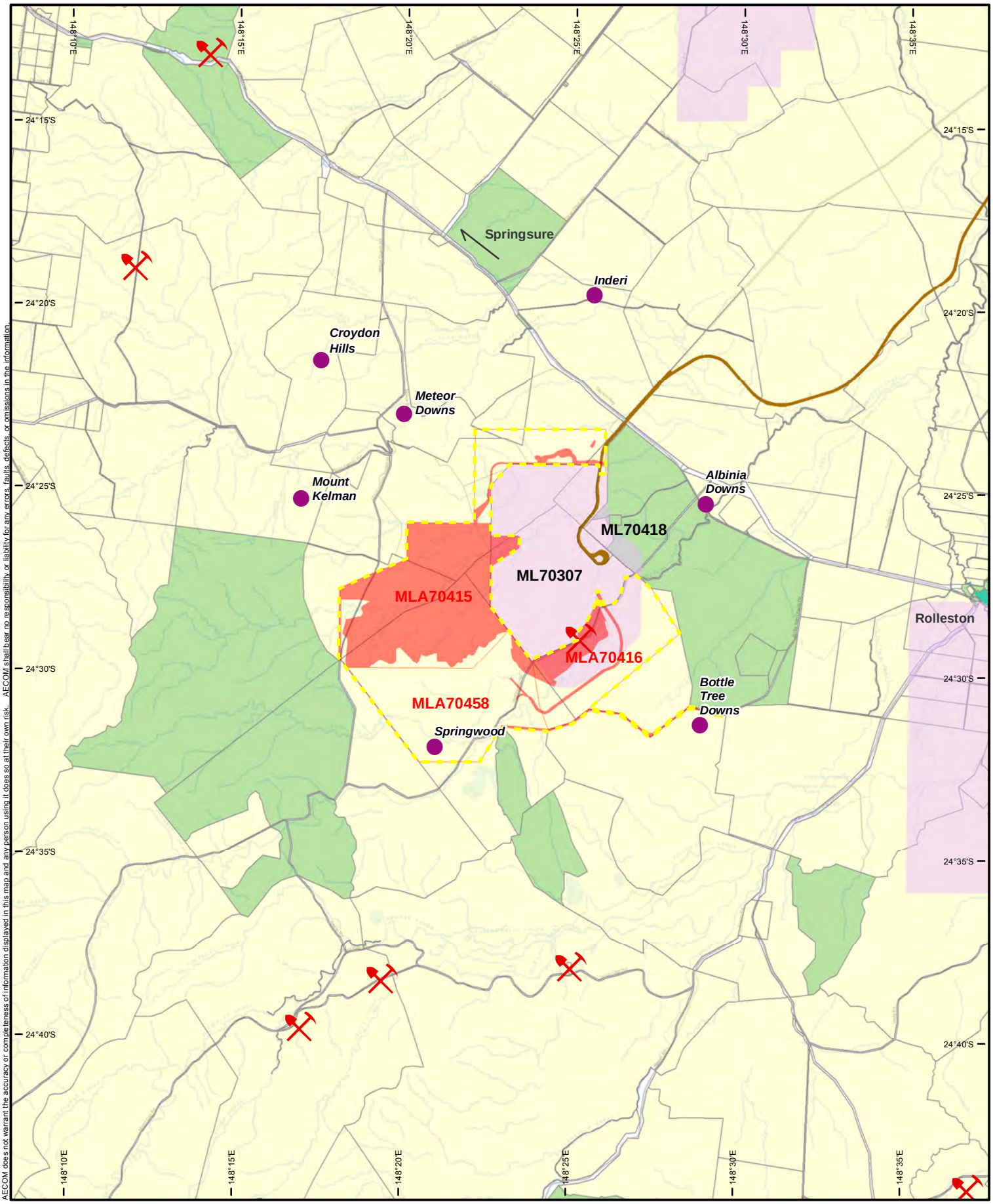
ROLLESTON COAL EXPANSION PROJECT

Landscape Elevation

PROJECT ID	60267739
CREATED BY	VV
LAST MODIFIED	VV - 23 Oct 2014

Figure 6.1

Filename: P:\Projects\60267739\4. Tech Work Area\4.7 GIS\EIS\4.9_GIS\02_MXDs\2_EIS_Chapters\06_Land\FIG_601.mxd



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xstrata coal

N

0 2.5 5 Km

1:250,000 (when printed at A4)

DATUM GDA 1994, PROJECTION MGA ZONE 55

Legend

- Sensitive Receptors
- Extractive Industries
- Roads
- Railways
- Watercourses
- Project Site
- Project Footprint
- Existing Mining Lease
- Proposed Mining Lease

Land use / Zoning

- Township
- Railway
- Mining Tenements
- Open Space
- Rural

Data sources:
Waterways - StreetPro (c)2013 Pitney Bowes Business Insight, PSMA
Railways - Queensland Rail Network, 2012
Roads - © MapInfo Australia Pty Ltd (2004) Based on [Roads - all – State Digital Road Network (SDRN)] provided with the permission of MapInfo Australia Pty Ltd (2004)
Land Use and Zoning Data - State Government (2011)

ROLLESTON COAL EXPANSION PROJECT

Land Use

PROJECT ID	60267739
CREATED BY	VV
LAST MODIFIED	AS - 21 Jan 2014

Figure 6.2

Filename: J:\Interoffice\60103583\4. Tech Work Area\4.7 GIS\EIS\4.9_GIS\02_MXDs\2_EIS_Chapters\06_Land\20130913\FIG_602.mxd

6.5.3 Tenure

6.5.3.1 Mineral and petroleum tenure

The existing Rolleston Coal Mine operates within the boundary of ML70307, held by Xstrata Coal Queensland (now Glencore Coal Queensland Pty Ltd but for the purposes of consistency in this EIS is also referred to as Xstrata Coal Queensland). The Project includes the application for three additional mining leases, MLA70415, MLA70416 and MLA70458, for which Xstrata Coal Queensland is the applicant. Xstrata Coal Queensland also holds ML70418 over the rail loop and load-out area, on the western boundary of ML70307, however no development on that lease is likely to be carried out as part of the Project. These tenures are shown in Figure 6.3 with a summary of the tenures in Table 6-1.

Table 6-1 Mining tenure of the Project

Tenure	Size (hectares)	Status	Date granted/lodged	Effective until
ML70307	4,864	Granted	29-May-2003	31-May-2033
MDL227	1,294	Granted (renewal lodged)	27-Nov-2000	30-Nov-2015
MLA70415	6,271	Application (COA[1] issued)	02-Oct-2009	N/A
MLA70416	2,624	Application (COA[1] issued)	02-Oct-2009	N/A
MLA70458	3,589	Application (COA[1] issued)	22-Aug-2012	N/A
ML70418	163	Granted	31-May-2013	01-June-2043

1 Certificate of Application (COA)

The Project's mining tenure overlaps a number of exploration permits for coal (EPC) held by Xstrata Coal Queensland (now Glencore Coal Queensland Pty Ltd), which are the prerequisite tenures for the MLAs. These EPCs are listed in Table 6-2.

Table 6-2 Prerequisite EPCs for the Project

Tenure	Overlapping tenure	Principal holder	Date lodged	Date granted	Effective until
EPC 885	MLA70458	Glencore Coal Queensland Pty Ltd	26-Feb-2004	31-Aug-2006	30-Aug-2016
EPC 737	MLA70415, MLA70458	Glencore Coal Queensland Pty Ltd	12-Mar-2001	23-May-2001	Application for Renewal lodged
EPC 1463	ML70458	Glencore Coal Queensland Pty Ltd	02-Jul-2008	15-Apr-2010	14-Apr-2015
EPC 595	ML70307, MLA70415, MLA70416, MLA70458	Glencore Coal Queensland Pty Ltd	29-Sep-1995	15-Jan-1996	14-Jan-2017
EPC 1771	ML70307 ML70418	Glencore Coal Queensland Pty Ltd	10-Jun-2009	15-Jan-2010	Application for Renewal lodged
EPC 538	ML70307, MLA70415, MLA70416	Glencore Coal Queensland Pty Ltd	26-Mar-1993	30-Nov-1993	30-Nov-2016

The Project Site overlaps exploration permit for petroleum (EPP) 756 held by OME Resources Australia Pty Ltd. No other petroleum, geothermal gas or mining tenures, KRAs or extractive industry permits overlap the Project Site. Table 6-3 provides information about this tenure, and a MLA that adjoins the Project Site.

Table 6-3 Overlapping and adjoining tenure

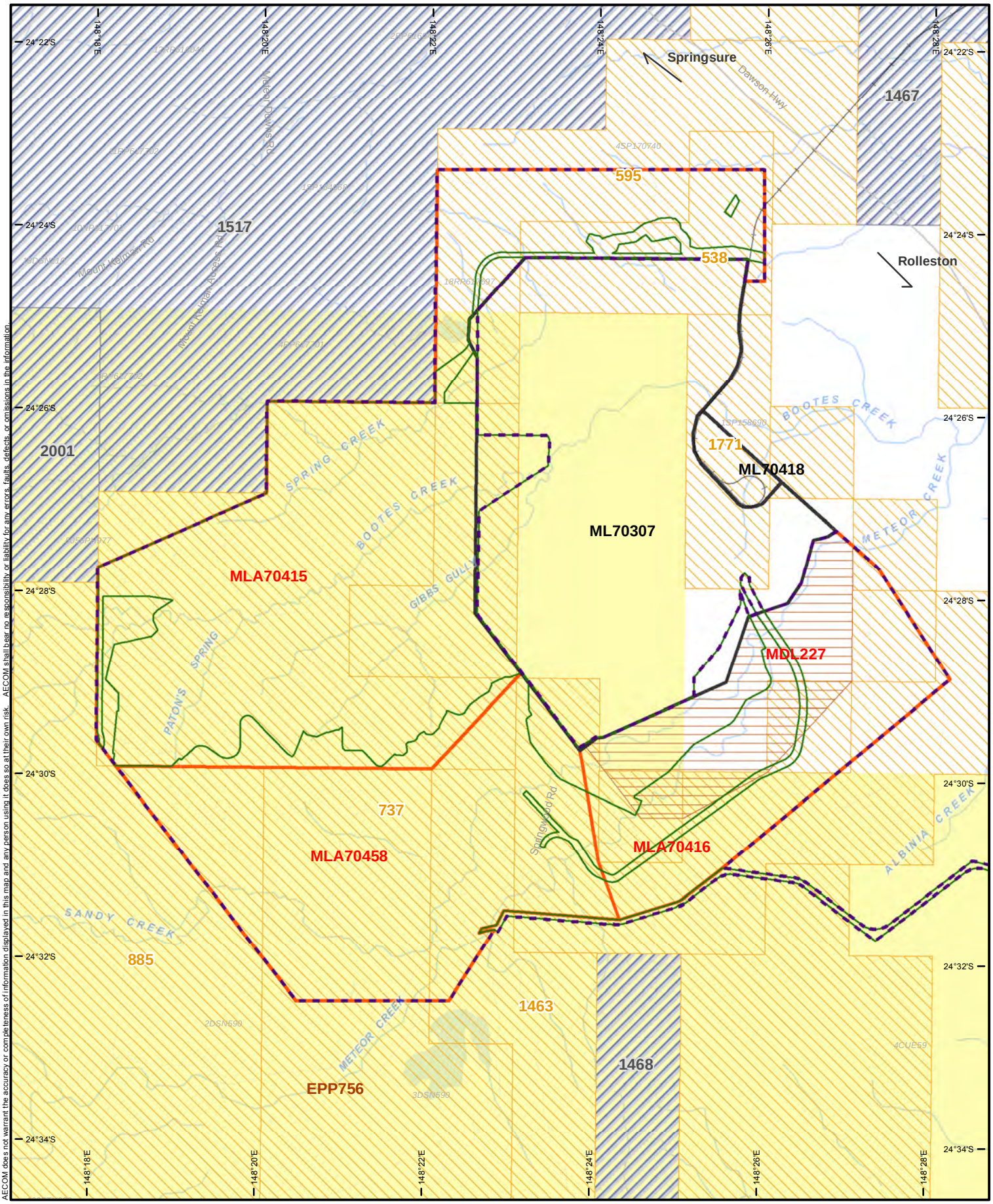
Tenure	Overlapping / adjoining tenure	Principal holder	Status	Date lodged
EPP 756	ML70307, MLA70415, MLA70416, MLA70458, MDL227	OME Resources Australia Pty Ltd	Application	19-Sep-2002
MLA 70452	MLA70415 (adjoins)	Endocoal Limited*	Application	29-Apr-2011

*Endocoal Limited are registered as the principal holder, but are now known as U&D Mining Industry.

The Project Site's overlapping and adjoining tenures are shown in Figure 6.3 and Table 6-3. Adjacent land tenures are listed in Table 6-4, and shown in Figure 6.4. These properties were identified through title searches undertaken during the community consultation program for the Project (refer Chapter 1 Introduction for more information).

Table 6-4 Background tenures underlying and adjacent to the Project Site

Lot and Plan	Owner	Property name	Mine area overlay/boundary
3SP170740	Ergon Energy	-	MLA70415
158NPW881	State of Queensland	Albinia National Park	MLA70415
1SP174071	Glencore Coal Queensland	-	MLA70415
2SP174071	Queensland Rail	-	ML70307, MLA70415
1SP158690	State of Queensland	Reserve for Strategic Land Management	ML70418
2SP164061	Queensland Rail and Abigroup	-	ML70307
1SP164061	State of Queensland	'Meteor Park'	MLA70416, ML70307, ML70458, ML70418, MLA70415
4CUE59	Patterson	'Bottle Tree Downs'	MLA70416, MLA70458
3DSN590	Glencore Coal Queensland	Formerly part of 'Springwood'	MLA70415, MLA70416, MLA70458, ML70307
2DSN590	Tyson	'Springwood'	MLA70415, ML70458
211FTY1812	State of Queensland	Mount Pleasant State Forest	MLA70458
160FTY909	State of Queensland	Mount Pleasant State Forest	MLA70415
5055PH977	State of Queensland	'Mount Kelman Holding'	MLA70415
4RP617701	Glencore Coal Queensland	'Meteor Downs'	MLA70415
1SP164068	Glencore Coal Queensland	'Meteor Downs'	MLA70415
4SP170740	Glencore Coal Queensland	'Meteor Downs'	MLA70415



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xstrata coal

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DATUM GDA 1994, PROJECTION MGA ZONE 55

Legend

- Major Roads
- Minor Roads
- Railways
- Watercourses
- Project Site
- Project Footprint
- Existing Mining Lease
- Proposed Mining Lease
- EPC Xstrata Coal (885, 737, 1463, 595, 1771, 538)
- EPC Other (1468, 1057, 1467, 1517, 2001)
- EPP 756
- MDL 227

Data sources:
Waterways - StreetPro (c)2013 Pitney Bowes Business Insight, PSMA
Railways - Queensland Rail Network, 2012
Roads - © MapInfo Australia Pty Ltd (2004)
Based on [Roads - all – State Digital Road Network (SDRN)] provided with the permission of MapInfo Australia Pty Ltd (2004).
Mining leases - State Government DME, 2013

ROLLESTON COAL EXPANSION PROJECT

Mining Tenures Overlapping and Adjoining Tenures

PROJECT ID	60267739
CREATED BY	VV
LAST MODIFIED	VV - 21 Jan 2014

Figure 6.3

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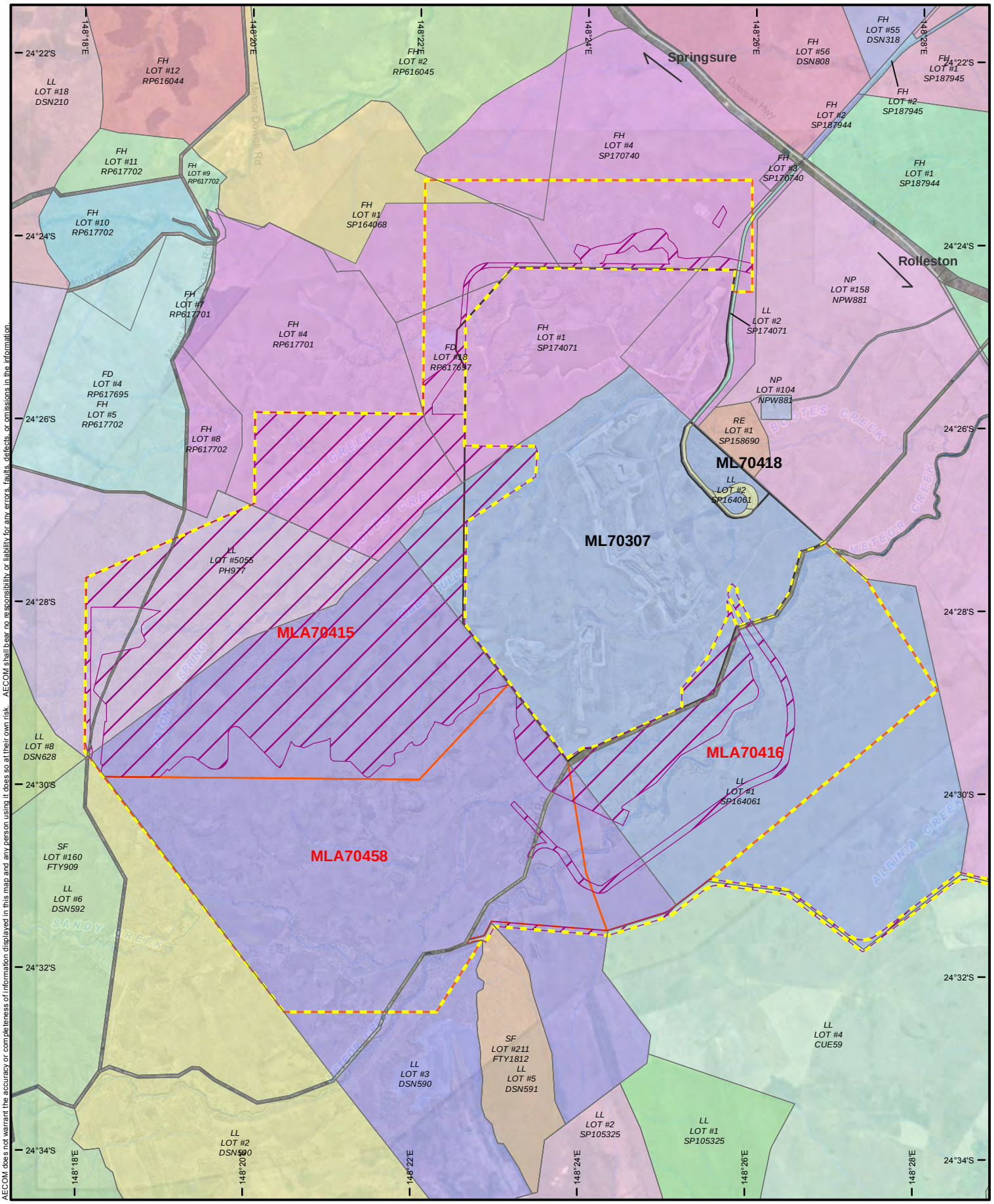

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xstrata coal

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DATUM GDA 1994, PROJECTION MGA ZONE 55

Legend

- Roads
- Railways
- Watercourses
- Project Site
- Project Footprint
- Existing Mining Lease
- Proposed Mining Lease

Data sources:
Waterways - StreetPro (c)2013 Pitney Bowes Business Insight, PSMA
Railways - Queensland Rail Network, 2012
Roads - © MapInfo Australia Pty Ltd (2004)
Based on [Roads - all – State Digital Road Network (SDRN)] provided with the permission of MapInfo Australia Pty Ltd (2004)
DCDB Cadastral Boundaries - State Government DNRM (2012)
Mining Leases - State Government DME, QLD 2013

Land Tenures

1014NPW881	1SP158690	2SP164061	5055PH977	
10RP617702	1SP164061	2SP174071	55DSN318	
11RP617702	1SP164068	2SP187944	56DSN808	
12RP616044	1SP174071	2SP187945	5DSN591	
158NPW881	1SP187944	3DSN590	5RP617702	
160FTY909	1SP187945	3SP170740	6DSN592	
18DSN210	211FTY1812	4CUE59	7RP617701	
18RP617697	2DSN590	4RP617695	8DSN628	
1SP105325	2RP616045	4RP617701	8RP617702	
	2SP105325	4SP170740	9RP617702	

ROLLESTON COAL EXPANSION PROJECT

Land Tenure

PROJECT ID	60267739
CREATED BY	VV
LAST MODIFIED	AS - 21 Jan 2014

Figure 6.4

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6.5.4 Cultural heritage

Part 7 of the *Aboriginal Cultural Heritage Act 2003* (ACH Act) requires the development of a Cultural Heritage Management Plan (CHMP) where an existing agreement does not exist. A CHMP for that part of the Project within ML70307 has been developed and agreed with the relevant Traditional Owners. This plan (and agreement) is referred to as the *Cultural Heritage Management Plan – Rolleston Mine 2003*. This plan was developed in 2003 and accords with the *Cultural Record (Landscapes Queensland and Queensland Estate) Act 1987*. This Act has now been repealed and superseded by the ACH Act, however existing agreements remain in effect.

The *Cultural Heritage Management Plan – Rolleston Mine 2003* was amended with the agreement of the parties to that plan in 2011.

An additional CHMP is required for that part of the Project not within ML70307. Searches of the National Native Title Tribunal database were used to identify the following relevant Aboriginal parties (for the purposes of Part 4 of the ACH Act):

- QC06/5 - QUD23/06 Karingbal #2
- QC08/5 - QUD216/08 Bidjara People.

In December 2011, Xstrata Coal Queensland issued written notices to each of the relevant people inviting them to take part in development of the additional CHMP. The Bidjara People (QC08/5 and QUD216/08) responded within the timeframe required in the notice and were endorsed as an Aboriginal Party. Xstrata Coal Queensland agreed the *Rolleston Expansion Cultural Heritage Management Plan 2013* with the Bidjara People. This plan was approved by DATSIMA on 3 April 2013. This second plan provides for surveys to be conducted by the Karingbal #2 and the Bidjara People of areas on MLA70415, MLA70416, ML70418 and MLA70458 (not including ML70307) where activities would take place and provides measures to protect identified cultural heritage.

6.5.5 Geology

The regional and local geology of the Project Site has been described as part of this EIS. The geological description is taken from an assessment conducted by Environmental Earth Sciences (2012), as attached in Appendix F-1. The appendix contains further information in terms of overburden and waste rock characterisation. Appendix H-1 illustrates the regional geology and indicative cross sections of the Project Site.

6.5.5.1 Regional geology

The Project Site lies on the western edge of the Bowen Basin in a tectonic region known as the Denison Trough, in which thick sequences of Permian and Triassic sediments are located. Deformation of the sediments is regarded as being contemporaneous, but accentuated by further movement during a mild orogeny in the late Triassic. Sedimentation continued throughout the Mesozoic, while uplift in the early Tertiary was followed by erosion and the extrusion of basalt flood volcanics. Deposition of alluvium occurred during recent geological times.

The regional stratigraphy of the area consists of the dominantly marine Lower to Upper Permian Back Creek Group (comprising in ascending order; the Cattle Creek Formation, Aldebaran Sandstone, Freitag Formation, Ingelara Formation and Catherine Sandstone, Peawaddy Formation and Black Alley Shale). This is overlain conformably by the dominantly terrestrial Upper Permian Blackwater Group (comprising in ascending order; the Burngrove Formation and the coal bearing Rangal Coal Measures which is equivalent to the Bandanna Formation in this part of the Denison trough). The Permian strata were conformably overlain by Triassic strata, however in much of the Rolleston area the Triassic sediments have been removed and a large unconformity exists between the Permian and Tertiary strata. The Tertiary consists primarily of sequences of basalt flows with some sedimentary strata developed between the basalts.

Regional geology is illustrated in Figure 6.5.

Figure 6.5 Geology of the Project Site and surrounding area (after Springsure 1:250,000 Geol Sheet)

6.5.5.2 Local geology

Tectonic deformation along the western edge of the Denison Trough has been minimal and the geological structure is relatively simple. It is regarded as being partly contemporaneous, but accentuated by mid-Triassic compressional tectonics forming a series of structural features. The Project Site lies between two of these major structural features which generally strike north-south. The eastern structure, the Albinia Fault is a fault downthrown 500 m to the east, striking sub parallel to the eastern boundary of the northern part of MLA70415. The western structure is a large fault which defines the edge of the Springsure Anticline and lies to the west of the Project Site. Between these two structures gentle folding of the strata into a series of broadly north-south trending synclines and anticlines has occurred. The axial trends of the folds vary from north-northeast to north-northwest.

The main structural features controlling the occurrence of the coal measures in the Project Site are two double plunging anticlines – the Consuelo and Inderi anticlines; and two complementary synclines – the Meteor Park and Meteor Downs synclines. A third syncline – the Rewan Syncline – has been recognised from exploration to be the main structure in the south-western part of MLA70415.

Economically important coal seams occur along the western limb of the Inderi Anticline in the north of MLA70415 where dips are of the order of 2º to the west, though coal is interpreted to exist on the steeper eastern limb. The Consuelo Anticline in the south of MLA70415 is a steeper and tighter structure, which limits the south western extent of coal seams. Dips on the eastern limb of the Consuelo Anticline are of the order of 3.5º, but steepen to 7.5º towards the south. The location of the Albinia Fault in the north of the Project area has been broadly defined by drilling. This major fault significantly limits the potential for economic resources to exist in the north east of the Project Site. Current Rolleston Coal Mine operations have identified smaller scale fault structures. Faults appear to be thrust structures as indicated by the amount of seam thickening observed in drill core, occasionally full seam repetition has been encountered.

6.5.5.3 Stratigraphy

The stratigraphy within the Project Site consists of Quaternary alluvium unconformably overlying Tertiary basalts which have in-filled the palaeochannels and unconformably overlie the Permo-Triassic strata which contain the economic coal seams.

Quaternary

Typically, the Quaternary sequences consist of unconsolidated clay, silt, sand and/or gravel located primarily along the floodplains of the drainage channels (i.e. Meteor Creek and Bootes Creek). Quaternary sequences in the Project Site have not been fully evaluated due to poor field records particularly in the historical drill hole database. Modelled thicknesses range from 0 to 31 m with an average of 4 m.

Tertiary

Uplift in the early Tertiary was followed by significant erosion incising the Permo-Triassic palaeosurface forming drainage canyons and valleys which were initially lined with sands and clays. Basic volcanic lava flowed eastward from fissures in the Springsure area to cover the Mesozoic sediments, which overlie the Permian strata, of the Rolleston area. These volcanics have been grouped generically under the name ‘basalt’. However, they comprise a number of vesicular, amygdaloidal and crystalline basaltic to andesitic flows ‘interbedded’ with ash bands and interflow sediments. These interflow sediments are made up of sandy clays several metres thick, which mark breaks in volcanic activity. In the Rolleston area at least four flood basalt flows have been interpreted overlying these initial sediments and infilling the valleys. The erosion resistant basalt causes a reversal of relief with the weaker older Permo-Triassic strata eroded away to leave resistant basalt caps forming topographic highs up to 30 m above the surrounding areas. The basalt topography separates the alluvial areas. Modelled thicknesses range from 0 to 90 m and average 26 m.

Triassic

Non-marine red brown mudstones and greenish fine grained sandstones typical of the Rewan Group conformably overlie the coal measures of the Blackwater Group and are not preserved over the existing mine site, but have been recognised in drill holes to the east and southeast of ML70307 and in the northern and southern extensions of MLA70415 and adjacent tenements.

Permian

The Upper Permian Blackwater Group contains the economic coal seams and consists of mostly non-marine sequences, which have been deposited conformably on the older dominantly marine Lower to Upper Permian Back Creek Group. Rock types generally recognised within the Blackwater Group sequence include sandstone, carbonaceous siltstone, mudstone, shale and coal. These sequences blanket the Rolleston area, but are not preserved on the tops of the Inderi and Consuelo Anticlines.

The coals are contained in the upper part of the Blackwater Group and have been interpreted to be the Bandanna Formation which is equivalent to the Rangal Coal Measures in this part of the Denison Trough. Coal seams have gentle dips and are characterised by consistent thickness, quality and lithotype. The Bandanna Formation conformably overlies the Black Alley Shale (the uppermost sequence in the Back Creek Group) which is interpreted to represent a pro-delta marine sequence. Because of its distinctive lithology of hard black shale, siltstone and interbedded clays, it can be readily used as a marker bed for correlation purposes. This unit occurs consistently about 30 m below the D Seam.

Conformably underlying the Black Alley Shale is the Peawaddy Formation which consists of lithic sandstones and coquinite siltstones near the top, overlying dominantly thinly interbedded to laminated siltstones and carbonaceous mudstones.

Underlying these sequences are the dominantly sandstone, siltstone and conglomeratic sequences of the Catherine Sandstone, Ingelara Formation, Freitag Formation, Aldebaran Sandstone and the Cattle Creek Formation from the Back Creek Group which subcrop beneath the anticlines, particularly the Consuelo Anticline.

The stratigraphy of the Rolleston area and the local geology is depicted in Table 6-5.

Table 6-5 Stratigraphy of the Rolleston area

Age	Unit	Lithology
Quaternary	-	Unconsolidated silt, clay, sand, gravel.
Tertiary	-	Generally unconsolidated sands and gravels and crystalline basalt, andesites and vesicular basalt.
Lower Triassic	Rewan Group	Fine grained sandstones and non-marine mudstones.
Upper Permian	Blackwater Group – Bandanna Formation	X1 and X2 seams
Upper Permian	Blackwater Group – Bandanna Formation	Sandstone, carbonaceous siltstone, mudstone, shale.
Upper Permian	Blackwater Group – Bandanna Formation	A seam
Upper Permian	Blackwater Group – Bandanna Formation	Sandstone, carbonaceous siltstone, mudstone, shale.
Upper Permian	Blackwater Group – Bandanna Formation	B seam
Upper Permian	Blackwater Group – Bandanna Formation	Sandstone, carbonaceous siltstone, mudstone, shale.
Upper Permian	Blackwater Group – Bandanna Formation	C seam
Upper Permian	Blackwater Group – Bandanna Formation	Sandstone, carbonaceous siltstone, mudstone, shale.
Upper Permian	Blackwater Group – Bandanna Formation	D seam
Upper Permian	Blackwater Group – Bandanna Formation	Sandstone, carbonaceous siltstone, mudstone, shale.
Lower-Upper Permian	Back Creek Group – Black Alley Shale	Hard black shale, siltstone and interbedded clays.
Lower-Upper Permian	Back Creek Group – Peawaddy Formation	Lithic quartzose sandstone and carbonaceous siltstone.

6.5.5.4 Geomorphology

Much of the Permian-Triassic geology in the area is overlain by Quaternary alluvium or Tertiary ‘flood’ basalts. The alluvium primarily occurs in the northern and southern parts of the area along the creek floodplains of Meteor (Sandy) and Bootes Creeks. The thickest of the Quaternary alluvium sequences is found within the Meteor/Sandy Creek floodplain where up to 20 m of alluvium has been deposited.

The Tertiary basalts unconformably overlie the sedimentary sequences and ‘cap’ the topographic rises in the area that separates the zones of alluvial deposition. The weathering of these volcanics contributes to the dispersive nature of the clay sediments observed due to the sodic nature of some constituent mineralogies.

Catchment headwaters for Bootes Creeks occur east of a plunging anticlinal fold, and derive sediment from the following units, identified using the Geoscience Australia’s ‘Stratigraphic Names Database’ and Geoscience Australia’s ‘Generalised Stratigraphic Column’ for the Denison Trough, Bowen Basin:

- Middle Triassic Moolayember formation, micaceous, lithic sandstone, micaceous siltstone.
- Early to Middle Triassic Clematis group, medium to coarse grained quartzose to sub-labile, micaceous sandstone, siltstone, mudstone and granule to pebble conglomerate.

- Early Triassic Rewan group, lithic sandstone, pebbly lithic sandstone, mudstone and minor volcanolithic pebble conglomerate (at base).
- Permian Rangal coal measures calcareous sandstone, calcareous shale, mudstone, coal and concretionary limestone (within Bandanna Formation).
- Late Permian Black Alley Shale, shale, siltstone, tuff, bentonite and labile sandstone.
- Late Permian Peawaddy formation, carbonaceous mudstone and siltstone, lithic sub-labile sandstone and coquinitic siltstone.
- Late Permian Catherine sandstone, quartzose to sub-labile sandstone, siltstone and mudstone.
- Permian Ingelara formation, conglomeratic sandy siltstone, mudstone and sandstone.
- Permian Freitag formation, sub-labile sandstone, pebbly sandstone, siltstone and mudstone.
- Permian Aldebaran sandstone, comprising pebbly quartz sandstone, conglomerate, minor shale, siltstone and coal.

The folded nature of the area has led to the development of scarps (minor with colluvium at the base) and floodplains (alluvium) within the Meteor and Sandy Creek catchments. A similar situation is also noted within the Bootes Creek catchments although to a lesser degree.

6.5.5.5 Geophysical and chemical properties

The physical and chemical properties of surface materials, sub-surface materials and geological structures have an influence on, or can be influenced by, the Project's construction and operational activities. Both an overburden rock characterisation study (refer Chapter 8 Waste) and a soils survey have been carried out in order to assess these influential chemical and physical properties.

The results of these studies particularly pertain to the following considerations in this EIS:

- Rehabilitation programs (refer Chapter 4 Decommissioning and Rehabilitation) – the suitability of overburden and topsoil in developing a successful strategy for rehabilitation.
- Stormwater run-off quality (refer Chapter 9 Surface Water) – the effect of exposing or altering surface and sub-surface materials, leaching or run-off into downstream catchments.
- Erosion and sedimentation – the potential for certain soils and land units to erode, passing sediment in overland flow either trapped on-site or flowing into the downstream catchments.
- Agricultural productivity – the capability of land before mining, predominately in terms of GQAL and SCL, and the subsequent design of continual rehabilitation and post mining land use targets.
- Occupational Health and Safety (refer Chapter 18 Health and Safety) – the potential for hazardous land materials to be exposed, creating health and safety risks to mine workers, contractors and the general public.

6.5.5.6 Geotechnical stability

The Project Site comprised thick alluvial materials, particularly in the Meteor Creek floodplain, and basalt flows surrounding these areas. The basalt ranges from fresh, high-strength flows through to very closely jointed, low-strength, weathered materials. The contact zones between the basalt flows and the base of weathering in the coal measures contain varying thicknesses of tertiary sediments.

Some minor instability can be expected with possible associated water flows into the pit during mining. The unconsolidated quaternary alluvium consists of combinations of clays, sands and silt. The proposed mining method and mine layout include measures that are to be designed to minimise geotechnical or drainage issues associated with this material.

6.5.5.7 Palaeontologic significance

In Queensland, a number of significant paleontological sites have been identified, and are protected by a range of measures including World Heritage status, national parks and reserves, as well as state reserves, and listings on heritage registers such as the now-superseded Register of the National Estate. A desktop survey of cultural heritage listings showed there were no sites identified in the vicinity of the Project.

6.5.5.8 Coal seam gas

In preparation for making a fugitive gas estimation under the Australian Coal Association Research Program (ACARP) Guidelines, Xstrata Coal Queensland conducted a gas exploration drilling program across the Project Site in 2012. A total of 15 boreholes were drilled to investigate all potential gas bearing strata.

The primary target for these boreholes was the D-Seam as this is the basal coal seam in this sequence. All samples were subjected to gas content and composition tests and proximate analyses.

Results show that the Project Site is in a single gas domain. This means that all boreholes exhibit similar gas trends with depth. Further, the whole remaining pit area is in the 'Low Gas Zone' as defined by Section 3.25 of the National Greenhouse and Energy Reporting (Measurement) Determination 2012.

It is not considered likely that coal seam gas (CSG) exists in commercially relevant quantities within the strata that would be disturbed by the Project. Drilling and exploration programs completed across the Project Site have not encountered any notable intersections of CSG within the coal seams present.

No granted petroleum tenures exist over the Project Site. The Queensland *Mineral Resources Act 1989* requires a proponent to optimise the use of incidental CSG where it is commercially and technically feasible to do so. However, gas data indicates negligible quantities, which would produce insufficient gas to be of commercial value.

6.5.6 Mineral resources and ore reserves

The Project's mineral resources and ore reserves have been estimated and recorded in accordance with the relevant measurement standards (the JORC Code) (2012), and the *Australian Guidelines for the Estimating and Reporting of Inventory Coal, Coal Resources and Coal Reserves*. The mineral resources and ore reserves reported according to the JORC Code have been summarised according to their location and tonnage in Table 6-6.

Table 6-6 Summary of Project's Mineral Resources (December 2012)

Pit/Area	Measured (million tonnes)	Indicated (million tonnes)	Measured + Indicated (million tonnes)
Within ML70307	**157.5**	**52.7**	**210.2**
A seam	5.2	3.9	9.1
B seam	36.6	14.2	50.8
C seam	0.0	2.9	2.9
D seam	115.7	31.7	147.4
Project Site (MLA70415, ML70416)	**25.0**	**170.8**	**195.8**
A seam	1.9	6.9	8.8
B seam	9.6	56.7	66.3
C seam	0.0	0.5	0.5
D seam	13.5	106.7	120.2
Total reserves	**182.5**	**223.5**	**406.0**

The coal seams are gently dipping, and are characterised by consistent thickness, quality and lithotype. The coals are contained in sediments of the Permian Blackwater Group and are loosely regarded as equivalent to the Rangal Coal Measures or, more strictly, the Bandanna Formation in this part of the Denison Trough. Table 6-5 describes the main stratigraphic units observed within the Project Site.

Within the Project Site, average seam dips are 2º to 3º and increase to 5º in localised areas, making them ideally suited to open-cut mining. Coal seam thicknesses are generally consistent with minimal variation, especially in the D Seam. Coal seam thicknesses range from 0.5 m to 5 m with the wider D seam (5 m thick) constituting around 65% of the coal resource.

Coal at the Project Site has been described as low rank, high volatile bituminous C (ASTM classification). Key quality features are:

- Low ash, precluding the need for washing.
- Moderate sulphur levels.
- High moisture and moderate energy levels.

Coal quality parameters appear to be relatively consistent throughout each seam. This is related to the general lack of seam splitting and the consistency of seam lithotype profiles across the deposit profile.

6.5.6.1 Coal seam stratigraphy

Eight coal seams were originally identified across the Project Site and named, in top-down stratigraphic order – X1, X2, U, A1, A2, B, C, D. Subsequent re-evaluation has revised the coal stratigraphy into six seams. These seams occur in the upper part of the Blackwater Group sequence. The resources considered and reported for the Project are contained in the A (A1 and A2), B, C and D seams. The plies or 'seams' which are not included in the in situ resources are very dirty, extensively intruded and/or poorly developed and are not considered as a resource.

In descending stratigraphic order the seams proposed to be mined at the Project Site are:

A Seam

The A Seam occurs only in its un-split form within ML70307. The main area of the A Seam is centred north of the Springwood Road region and extends into the central portion of ML70307 where it maintains a thickness of approximately 3.5 m. The A Seam is present in MLA70416 but degrades to a carbonaceous unit in MLA70415.

B Seam

The B Seam is present over MLA70415 and MLA70416 and reaches a maximum thickness of around 3.3 m and an average thickness of 2.5 m. It has a generally dull lithotype profile which provides a method of distinguishing it from the D Seam. The quality of the B Seam is poorer with a higher ash content and lower calorific value.

C Seam

The C Seam is present in MLA70416, but rarely exceeds more than 0.5 m thick. The C Seam occurs approximately 3 m below the B Seam.

D Seam

The D Seam is the most important individual seam in the deposit, making up a majority of the total resource (Measured + Indicated) of the surveyed Project Site. Seam thickness is consistent across the deposit with an average thickness of approximately 4.4 m ranging from about 0.7 to 6.1 m. The lithotype profile comprises a generally dull top section (some 0.5 – 1.0 m); a dull to bright middle section (around 2.5 – 3.0 m); and a generally bright lower section (generally 1.5 – 2.0 m). A thin coaly, carbonaceous, stony ply is usually present at the immediate base of the seam. This ply is not consistently present in all drill holes and in some cases may have been recorded as floor material rather than included in the seam. It can be up to 0.2 m thick, but is generally less than 0.1 m thick. Inorganic bands are uncommon resulting in a remarkably 'clean' coal.

Figures 3.4 to 3.10 in Chapter 3 Description of the Project indicate the location of the mineral resources and ore reserves in the Project Site.

6.5.6.2 Reserve parameters – modifying factors and assumptions

The reported resources and reserves are subject to modifying factors and assumptions made in arriving at the estimates. Coal losses and waste dilution have been applied to each of the mineable coal seams to allow for the mining process. The roof losses applied are based on the type of mining equipment (dragline versus excavator) that is expected to expose the seam. Further coal losses due to overburden/inter-burden blasting have also been included.

Floor loss and dilution is specified as a thickness and an allowance has also been made for expected coal losses and dilution adjacent to the high wall and of the low wall strip edge. Figure 6.6 summarises these assumptions.

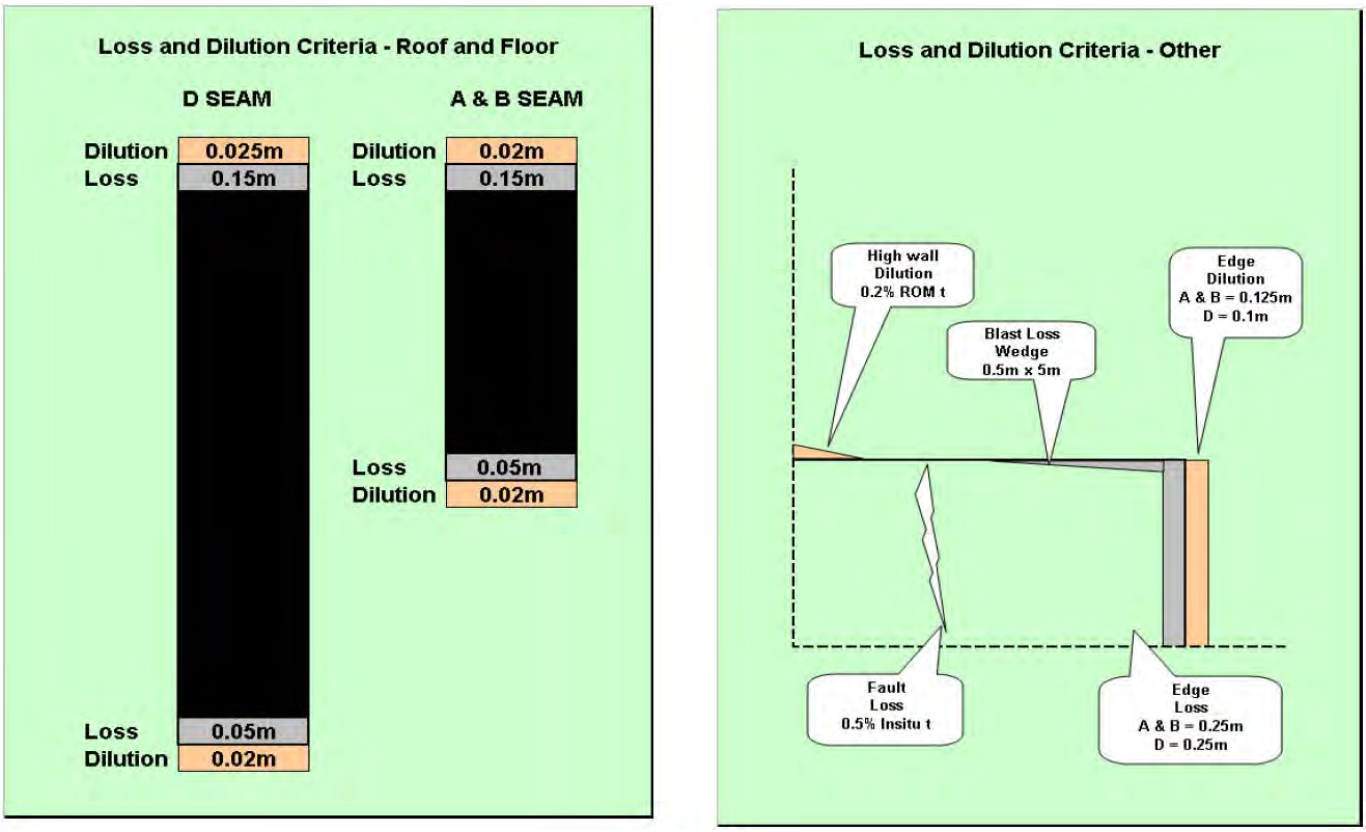


Figure 6.6: Coal loss and dilution criteria from the Project's Initial Development Plan (Xstrata Coal Queensland)

Coal losses and waste dilution have been applied to all mineable coal seam interfaces as per Figure 6.6. Appropriate qualities were assigned to the loss and dilution volumes in the generation run of mine (ROM) tonnages. ROM coal is calculated and reported at a 17.5% moisture level.

6.5.7 Soils

A soil survey of the Project Site was completed by Palaris in 2013 and is included as Appendix D-1. The surveys include details on the physio-chemical nature of the soil units identified in the Project Site, as well as the landform units.

Soil survey field work was conducted in June / July 2011 (MLA70415, MLA70416) and in October 2011 (MLA70458). Over 500 sites were investigated within the bounds of the Project Site. Twelve different soil types have been identified in the Project Site. Identified soils can generally be grouped into three main soil associations based on parent materials and formation processes.

6.5.7.1 Soil groups

The first group includes soils derived from alluvial deposition occurring adjacent to Meteor and Sandy Creeks in the south of the Project Site. Areas of lighter textured soils occur along the recent levees, grading into texture contrast soils within the transition zone to the deep cracking clays of the flat alluvial plains. The heavy clay soils are potentially suited to both long-term dry-land and, subject to adequate water supply, irrigated cropping.

The second group comprises soils derived from largely colluvial processes within the basaltic landscape. The weathering of the basaltic parent material has resulted in *in situ* formation of dark, cracking, self-mulching clay soils on undulating plains. Depth and rockiness are variable depending on slope and landscape position, with the deeper soils found on the open downs of the gently undulating plains. Although this particular group of soils is generally quite fertile, there are substantial areas not suited to farming due to shallow soil depth and low resultant moisture holding capacity. A little over half of the area of these soils within the Project Site is suitable for rain fed cropping with the remainder better suited to grazing. The third group comprises soils formed from colluvial, and colluvial / alluvial deposits, and some sedentary soils on mixed calcareous sediments, occurring within the Brigalow scrub soils on the gently undulating plains. These soils are found mainly in the south of the Project Site.

Their suitability for agriculture is often limited by unfavourable drainage, together with some areas of excessive surface rockiness and therefore best suited to pastoral activities.

6.5.7.2 Project Site soils

The 12 soils have been correlated with the *Field Manual: Understanding and Managing Soils in the Central Highlands* (Bourne and Tuck, 1993) wherever possible as well as relevant land resource surveys of the area. Several of the soil types in the Project Site are potentially arable, ranging from cracking clays (A1, A2, B2, B3 and C1) to non-cracking clays (A3, A5 and C2). These soils have also been classified against the GQAL mapping for CHRC GQAL mapping (formerly Bauhinia Shire Planning Scheme) and assessed against the SCL guidelines in place under the SCL Act following completion of the field survey investigations. These criteria have effectively been retained under the RPI Act Guideline 08/14: *How to demonstrate that land in the strategic cropping area does not meet the criteria for strategic cropping land*. The soils are given in terms of their type, concept, Australian Soil Classification in Table 6-7.

Table 6-7 Project Site soils

Soil type (AMU – Bourne and Tuck 1993)	Concept	Soils (Australian Soil Classification)	Concept (Bourne and Tuck (1993), adapted from Table 5.2 in Resource Information volume)
Soils derived from alluvium			
A1 (Adelong)	Broad alluvial plains of deep grey to black cracking clays on flood plains associated with Meteor Creek.	Grey Vertosols - Cracking and self-mulching medium to heavy clays which are well structured and moderately drained.	Dark to grey surface over dark to grey subsoil becoming lighter and slightly mottled at depth Uniform medium to heavy clay; >1.5 m Self-mulching and deeply cracking with alkaline reaction trend.
A2 (Moramana)	Deep black sandy clay along recent and/or active drainage lines within the basaltic landscape.	Black Vertosols - Deep black cracking clays with coarse granular self-mulch. Deep clay subsoils have sandier and coarser structured subsoil than the surrounding *in-situ* basalt soil.	Brown to red surface over brown, dark or red subsoil Medium clay over medium heavy clay subsoil, >1.5 m Strongly self-mulching surface over alkaline strongly structured subsoil, often forms a gilgai complex.
A3 (Glen Idol)	Gently undulating alluvial frontage country of moderately deep clays which are quite hard and coarse structured (clay soils within areas of variable alluvial materials).	Brown Dermosols - Non cracking firm surface which may be sandy overlying dark coloured sandy clays which are very hard and coarse structured.	Red to reddish brown surface over red to reddish brown subsoil Clay loam to sandy clay loam over medium to medium heavy clay; generally >0.9 m Generally hard setting surface and no bleach; moderate prismatic structured subsoil; alkaline subsoils; carbonate often present; texture contrast soils.
A4 (Isaac)	Active channels and levees associated with Meteor Creek. Variable soils which are usually sandy and stratified.	Brown Chromosols and Dermosols - Alluvial stratified thin texture contrast soils, deep sandy loams and clay loams.	Brownish black to brownish grey surface over yellowish brown to brownish grey subsoil Loamy fine sand to sandy clay loam surface over sandy clay subsoil; >1.5 m Neutral reaction trend; few inclusions or coarse fragments; often textural stratification.

Soil type (AMU – Bourne and Tuck 1993)	Concept	Soils (Australian Soil Classification)	Concept (Bourne and Tuck (1993), adapted from Table 5.2 in Resource Information volume)
A5 (No similar AMU)	Slightly elevated levees along the Meteor Creek floodplain.	Brown Chromosols and Dermosols – A thin silty clay loam overlies hard, coarse structured dark clay which overlies brown sandy clays below 90 cm.	No similar AMU
Mainly colluvial soils on basaltic undulating plains			
B1 (Jimbaroo)	Crests and upper slopes of rises, in the basaltic landscape.	Black Vertosols - Mainly cracking and self-mulching shallow (<50 cm) black clay soils which are well structured and drained.	Dark to reddish brown surface over dark to reddish brown subsoil Light medium clay surface over medium to heavy clay subsoil; <0.45 m to bedrock; Neutral to alkaline self-mulching to hard setting surface; often stony throughout.
B2 (Orion)	Moderately deep (mainly 60- 90 cm) clay soils on basalt or calcareous sediments on undulating plains.	Black Vertosols - Cracking and strong self-mulching black earths which are well structured and drained.	Grey-brown to dark throughout Uniform medium to heavy clay; 0.45 m to 1.2 m to bedrock Surface stone may be present Coarse, moderately self-mulching surface; neutral to alkaline; and strongly structured subsoils.
B3 (Orion)	Open downs of gently undulating plains with deep (>90 cm) cracking clay soils.	Black Vertosols - Soil as for B2 except for greater profile depth.	Grey-brown to dark throughout Uniform medium to heavy clay; 0.45 m to 1,2 m to bedrock Surface stone may be present Coarse, moderately self-mulching surface; neutral to alkaline; and strongly structured subsoils.
B4 (Highlands)	Steep and rocky uplands dominated by shallow (<30 cm) clay soils on hard basalt.	Brown Rudosols - Soils are dark medium clays.	Reddish brown to yellowish brown over rock Variable; generally shallow, rocky sandy clay loam to loamy sand; >0.1 m to bedrock Neutral reaction trend; massive structure.
B5 (Highlands)	Lighter textured clay than for B4. Shallow (<60 cm) and often rocky.	Brown Rudosols - Firm sandy surface over clay loam to light sandy clay reddish brown soils.	Reddish brown to yellowish brown over rock Variable; generally shallow, rocky sandy clay loam to loamy sand; >0.1 m to bedrock Neutral reaction trend; massive structure.

Soil type (AMU – Bourne and Tuck 1993)	Concept	Soils (Australian Soil Classification)	Concept (Bourne and Tuck (1993), adapted from Table 5.2 in Resource Information volume)
Colluvial and sedentary soils on mixed calcareous sediments			
C1 (Rolleston/ Springton)	Brigalow scrub soils along gently undulating plains to the south. Includes areas of normal gilgai.	Brown Vertosols and Dermosols - Cracking and non-cracking grey / brown medium heavy clays with moderately coarse subsoil structure below about 40 cm.	**Rolleston** Grey to dark surface over grey to yellow-brown subsoil; red or yellow mottles at depth Uniform medium to heavy clay; >0.9 m Slight (< 0.4 m vertical interval) linear or normal gilgai may occur; self- mulching surface; soil reaction trend varies from acid to alkaline. **Springton** Red to reddish brown surface over reddish brown to dark reddish brown subsoils often slightly mottled Uniform light to medium heavy Clay; >0.6 m to bedrock Neutral self-mulching to hard setting surface with alkaline reaction trend; often coarse structured subsoils.
C2 (No similar AMU)	Deeper (60-120+ cm) uniform brown clay.	Brown Dermosols - Firm non-cracking light to medium clay surface. Subsoils are not mottled but form moderately hard and coarse structure with impeded drainage.	No similar AMU

6.5.7.3 Soil physical and chemical properties

The physical and chemical properties of the soils within the Project Site are presented in Appendix D-1. These properties, along with the land suitability and soil class, have been assessed to indicate the range of inherent soil type functions and limitations. Knowledge of specific properties, such as those outlined in Table 6-8 would help in determining mitigation strategies for the various processes and activities associated with the use of the land for mining purposes.

Table 6-8 Physical and chemical properties of soil affecting environmental outcomes

Indicator / activity	Main parameters
Erosion potential	Exchangeable Sodium Percentage (ESP)
Storm water run-off	ESP, pH, Electrical Conductivity (EC), Cation Exchange Capacity (CEC), Emerson class (on waste rock) and/or Dispersion Index (on soils)
Rehabilitation	ESP, pH, EC
Agricultural productivity	ESP, pH, EC, CEC, Emerson class

6.5.7.4 Topsoil and cover media

Topsoil associated with the Rolleston Coal Mine has been previously assessed and described as part of historic impact assessments.

This work was undertaken during 2002 and 2009 and collectively covered ML70307. Soil and its re-use within the existing site has been guided by this work and the *Biodiversity and Land Management Plan*, *Cover Material Management Guideline* and *Rehabilitation Management Plan*. These documents identify the soil types present on ML70307 as well options for its recovery and re-use within the current mine, for example progressive rehabilitation.

Indicative topsoil recovery depths have been estimated over the Project Site using soil surveys carried out by Palaris in 2012 and Gilbert and Sutherland in 2009. The preliminary depth and type of topsoils able to be recovered within the Project Footprint is detailed in Table 6-9.

Table 6-9 Indicative topsoil recovery over Project Site (derived from Palaris, 2013)

Soil types	Australian Soil Classification	Recommended stripping depth (cm)	Potential depth (cm)
A1	Grey Vertosols (cracking)	30	50 (check salt)
A2	Black Vertosols	30	50 (check salt)
A4	Brown Chromosols and Dermosols	30	40
A5	Brown Chromosols and Dermosols	30	70
B1	Black Vertosols	30	40 (potentially all to basalt)
B2	Black Vertosols	30	40 (potentially all to basalt)
B4	Brown Rudosols	30	-
B4v	Brown Rudosols	30	40
C	Brown Vertosols and Dermosols	30	40 (no deeper – coarse)
C2	Brown Dermosols	30	40

6.5.8 Land assessment

Cropping and grazing land suitability assessments were conducted for the Project Site and used as the basis for identifying GQAL classes. Also, the criteria for identifying SCL in Queensland were applied to the data collected during the soil survey to delineate likely SCL. The SCL criteria have largely been retained under the RPI Act.

6.5.8.1 Strategic cropping land

The existing Rolleston Coal Mine and areas of the Project Site lie within the SCL Western Cropping Zone.

SCL trigger mapping downloaded on 10 July 2013 and checked against trigger mapping published 20 June 2014 identifies potential SCL in MLA70416 and MLA70458 but none in MLA70415 (see Figure 6.7). Data available from field investigations have been evaluated against eight zonal criteria (Slope, Rockiness, Gilgai microrelief, Soil depth, Soil wetness, Soil pH, Salinity, and Soil water storage) to determine whether land shown as SCL in the trigger mapping meets the SCL criteria (as continued under RPI Act Guideline 08/14).The results of the assessments of whether the soils meet SCL criteria are shown in Table 6-10 and Table 6-11 for MLA70416 and MLA70485 respectively.

Table 6-10 Assessed status of soils mapped within areas shown as SCL in trigger mapping within MLA70416

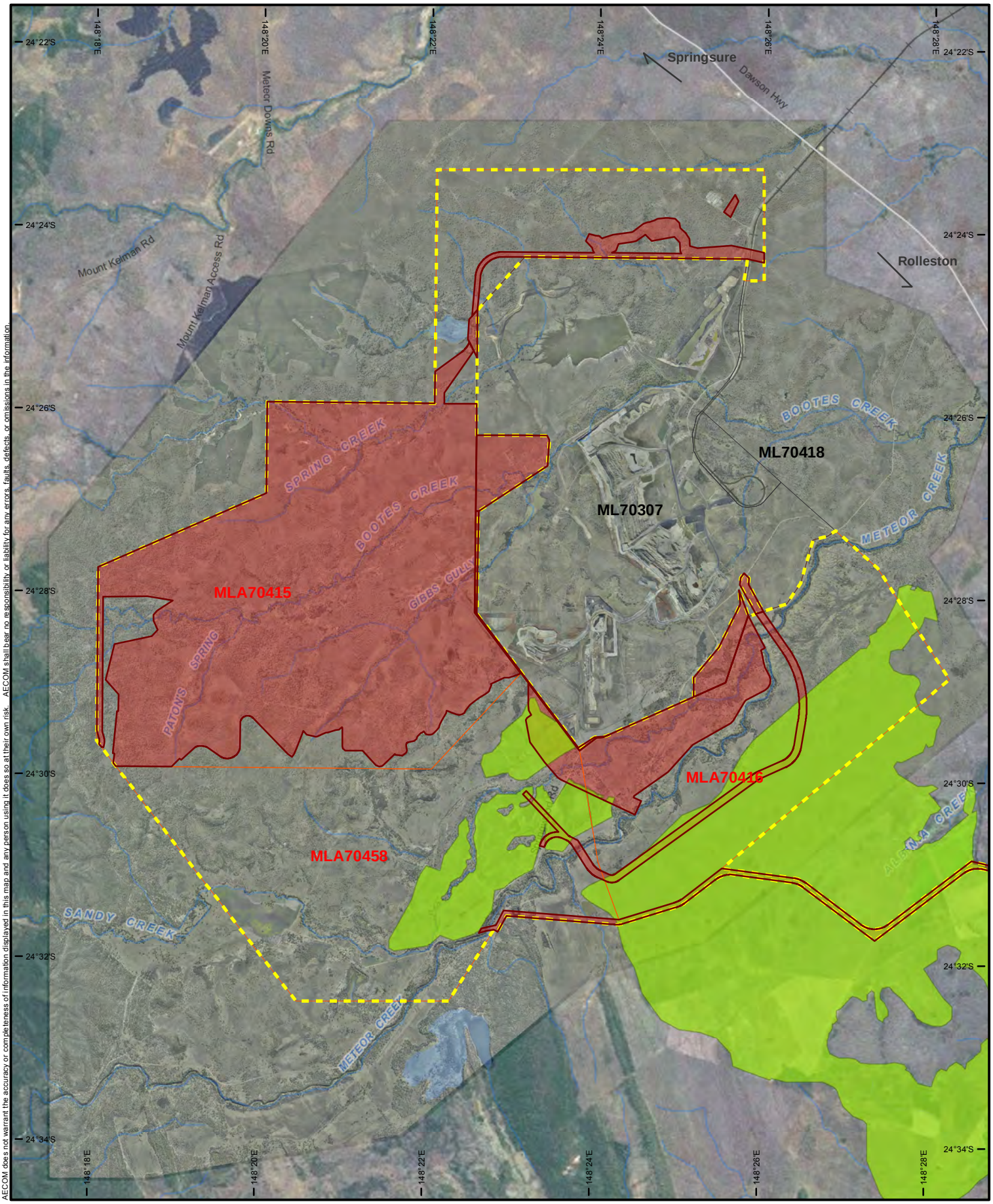
Soil	Brief soil description	Assessed SCL status
A1	Black and Grey Vertosols formed on alluvium	SCL
A4	Active channels and levees associated with creeks and drainage lines. Variable soils which are usually sandy and stratified	Not SCL – active stream flow areas
A5	Grey and Brown Sodosols, Chromosols and Dermosols usually with thin A horizons	SCL

Soil	Brief soil description	Assessed SCL status
B5	Shallow (<60 cm) Brown Rudosols	Not SCL – soil depth
C1	Black and Grey Vertosols and Dermosols greater than 600 mm deep	SCL

Table 6-11 Assessed status of soils mapped within areas shown as SCL in trigger mapping within MLA70458

Soil	Brief soil description	Assessed SCL status
A1	Black and Grey Vertosols formed on alluvium	SCL
A4	Active channels and levees associated with creeks and drainage lines. Variable soils which are usually sandy and stratified	Not SCL – active stream flow areas
A5	Grey and Brown Sodosols, Chromosols and Dermosols usually with thin A horizons	SCL
B1	Shallow Black Vertosols, usually <50 cm to weathered basalt	Not SCL – Slope and shallow soils
B3	Black Vertosols usually >900 mm to weathered basalt	SCL
C1	Black and Grey Vertosols and Dermosols greater than 600 mm deep	SCL

Further information on the representative soil survey site descriptions and SCL assessment for the various soil types is provided in Appendix D-1.



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DATUM GDA 1994, PROJECTION MGA ZONE 55

Legend

- Roads
- Railways
- Watercourses
- Project Site
- Project Footprint
- Existing Mining Lease
- Proposed Mining Lease
- SCL Trigger Map

Data sources:
Waterways - StreetPro (c)2013 Pitney Bowes Business Insight, PSMA
Railways - Queensland Rail Network, 2012
Roads - © MapInfo Australia Pty Ltd (2004)
Based on [Roads - all – State Digital Road Network (SDRN)] provided with the permission of MapInfo Australia Pty Ltd (2004)
Trigger Map for Strategic Cropping Land - Data created by Palaris for Xstrata Coal
Mining Leases - State Government DME, QLD 2013
Imagery - Aerial December 2011 - Xstrata Coal, Landsat7 Mosaic

ROLLESTON COAL EXPANSION PROJECT

Government SCL Trigger Mapping

PROJECT ID	60267739
CREATED BY	VV
LAST MODIFIED	AS - 21 Jan 2014

Figure 6.7

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6.5.8.2 Good quality agricultural land

Identification and protection of GQAL through local government planning schemes was specified in legislation and supported through SPP 1/92. SPP 1/92 has now been repealed, with the objective of protecting agricultural land from alienation now dealt with under the RPI Act. Nevertheless, the relationship between land suitability classes and GQAL classes is set out in Table 6-12 with GQAL mapping used by CHRC provided in Figure 6.8. Land suitability assessments for the Project Site soils and the resultant GQAL classification are given in Table 6-13.

Table 6-12 Comparison of land suitability and GQAL categories

Land suitability (DPI, 1990)		GQAL (DPI & DHLGP, 1993)	
Class	**Description**	**Class**	**Description**
1	Suitable with negligible limitations	A	Land that is suitable for current and potential crops with limitations to production which range from none to moderate levels.
2	Suitable with minor limitations		
3	Suitable with moderate limitations		
4	Marginal – not suitable	B	Land that is marginal for current and potential crops due to severe limitations; suitable for pastures. Engineering and/or agronomic improvements may be required before the land is considered suitable for cropping.
5	Not suitable	C	Land that is suitable only for improved or native pastures due to limitations which preclude continuous cultivation for crop production; but some areas may tolerate a short period of ground disturbance for pasture establishment.
		D	Land not suitable for agricultural uses due to extreme limitations. This may be undisturbed land with significant habitat, conservation and/or catchment values or land that may be unsuitable because of very steep slopes, shallow soils, rock outcrop or poor drainage. Bauhinia SC planning scheme subdivides and maps this as C2 and C3 depending on the ability to introduce improved pasture species without ground disturbance.

Table 6-13 GQAL and land suitability assessments for the Project Site

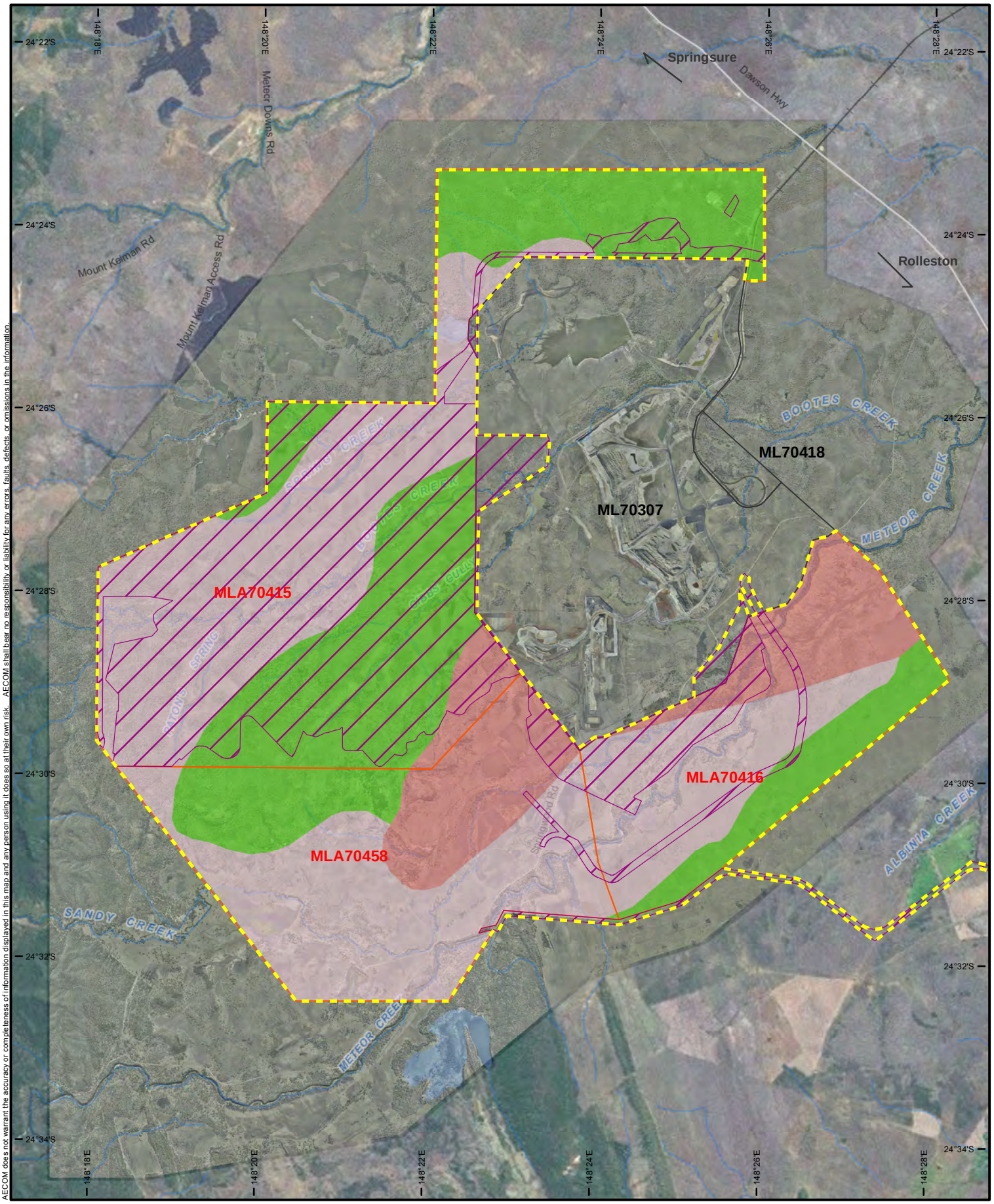
Soil type	Area (ha)	AMU (Bourne and Tuck, 1993)	GQAL	Land Suitability			
				Dryland cropping		Grazing	
				Class	Limitations	Class	Limitations
A1	2043	Adelong	A	Class 2	c2, f2, m2	Class 1	-
A2	536	Moramana	D	Class 5	c2, f5, m3	Class 4	c2, f5, m3
A3	288	Glen Idol	A	Class 3	n3, m3, k2	Class 2	n2, m2
A4	265	Isaac	D	Class 5	c2, f5, m3	Class 4	f4
A5	1042	No similar AMU	B	Class 4	n4, m4, w4, k4	Class 4	n4, m4, s3
B1	959	Jimbaroo	B	Class 4	n4, m4, k3	Class 3	n4, m4, k3
B2	2105	Orion	A	Class 3	e2, n2, k2, r2, d3, m3	Class 2	n2, d2, m2

Soil type	Area (ha)	AMU (Bourne and Tuck, 1993)	GQAL	Land Suitability			
				Dryland cropping		Grazing	
				Class	Limitations	Class	Limitations
B3	1176	Orion	A	Class 2	e2, n2, k2, r2, d2, m2	Class 1	-
B4	1408	Highlands	C	Class 5	m5, d5, k3	Class 4	m4, d4
B5	201	Highlands	C	Class 5	m5, d5, k3	Class 4	m4, d4
C1	1751	Rolleston/Springton	A	Class 3	k3	Class 2	w2
C2	541	No similar AMU	A	Class 3	c2, n3, m3, w3, k3	Class 3	n3, m3
Swamp	52	Not described	D	Class 5	f5	Class 5	f5

The Project Site has been classed as follows:

- ***Land Class A*** - includes soil types A1, A3, B3, B2, C1 and C2 64% or approximately 7,904 ha.
- ***Land Class B*** – includes soil types A5 and B1 – approximately 16%.
- ***Land Class C*** – includes soil types B4 and B5 – approximately 13%.
- ***Land Class D*** – includes soil types A2 and A4 (and a swamp area to the south of MLA70458) – approximately 7%. Soil types A2 and A4 are primarily active drainage lines and, therefore, not able to be cropped or effectively grazed.

These land classifications are shown in Figure 6.9.



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DATUM GDA 1994, PROJECTION MGA ZONE 55

Legend

- Roads
- Railways
- Watercourses
- Project Site
- Project Footprint
- Existing Mining Lease
- Proposed Mining Lease

Government Overlay

- A
- C1
- C2

Data sources:
Waterways - StreetPro (c)2013 Pitney Bowes Business Insight, PSMA
Railways - Queensland Rail Network, 2012
Roads - © MapInfo Australia Pty Ltd (2004)
Based on [Roads - all – State Digital Road Network (SDRN)] provided with the permission of MapInfo Australia Pty Ltd (2004)
GQAL Dataset - State Government DNRM (2010)
Mining Leases - State Government DME, QLD (2013)
Imagery - Aerial December 2011 - Xstrata Coal, Landsat7 Mosaic

ROLLESTON COAL EXPANSION PROJECT

GQAL Classification from CHRC Mapping

PROJECT ID	60267739
CREATED BY	VV
LAST MODIFIED	AS - 21 Jan 2014

Figure 6.8

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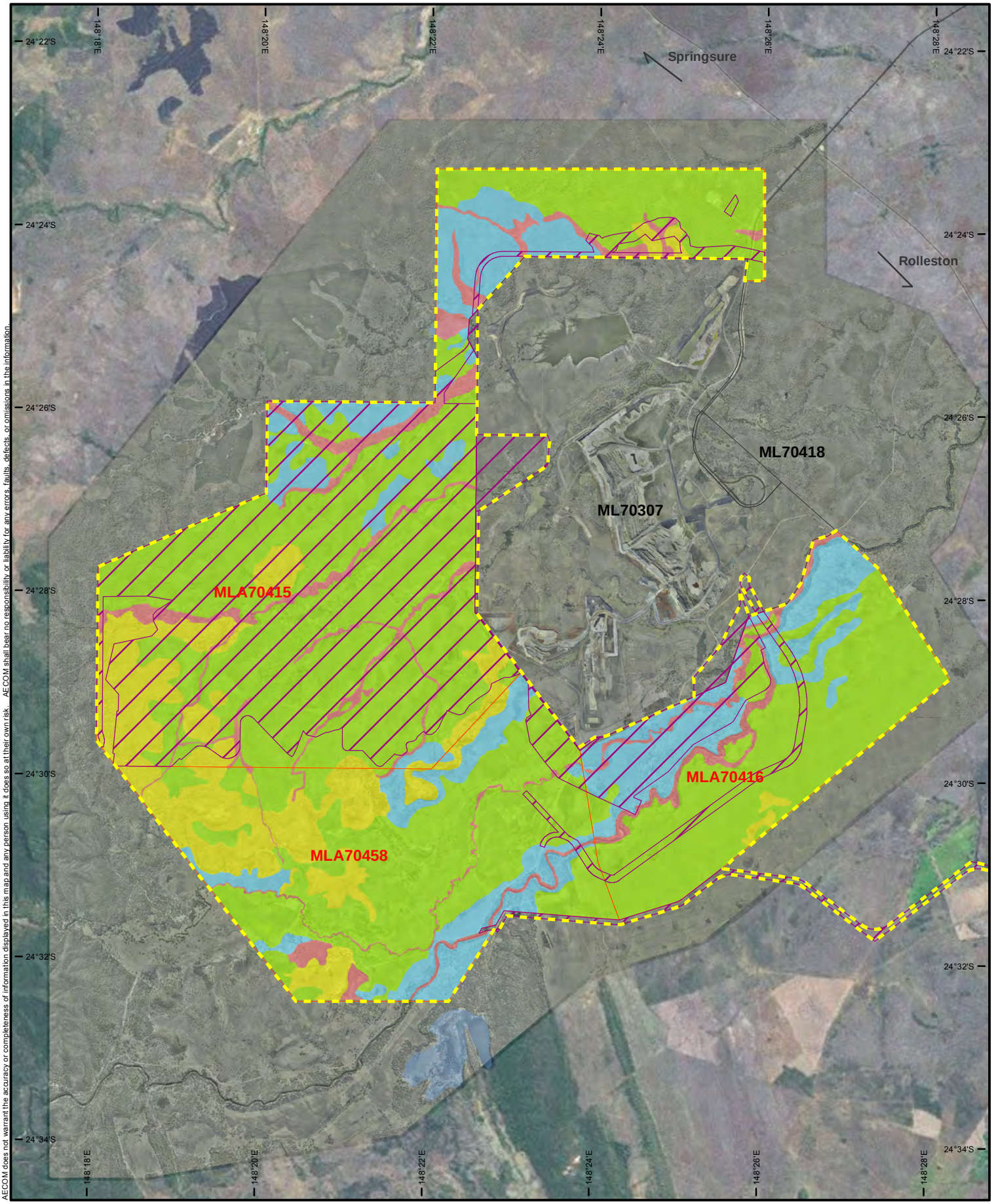

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DATUM GDA 1994, PROJECTION MGA ZONE 55

Legend

- Project Site
- Project Footprint
- Existing Mining Lease
- Proposed Mining Lease

GQAL CLASS

- A
- B
- C
- D

Data sources:
Waterways - StreetPro (c)2013 Pitney Bowes Business Insight, PSMA
Railways - Queensland Rail Network, 2012
Roads - © MapInfo Australia Pty Ltd (2004) Based on [Roads - all – State Digital Road Network (SDRN)] provided with the permission of MapInfo Australia Pty Ltd (2004)
GQAL Dataset - State Government DNRM (2010)
Mining Leases - State Government DME, QLD (2013)
Imagery - Aerial December 2011 - Xstrata Coal, Landsat7 Mosaic

ROLLESTON COAL EXPANSION PROJECT

Revised GQAL Classification Following Detailed Soil Mapping

PROJECT ID	60267739
CREATED BY	VV
LAST MODIFIED	AS - 17 Aug 2014

Figure 6.9

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GQAL comparison

The findings of the Palaris report (Appendix D-1) correlate well with the earlier work of Bourne and Tuck (1993), including the mapped units and suggested GQAL land suitability. Neither Bourne and Tuck (1993) nor Palaris (2013) findings correlate well with GQAL mapping as contained in the Bauhinia Shire Planning Scheme. The Palaris soil survey was a targeted assessment of the Project Site, and should be adopted due to the detailed level of surveying.

Key differences between the Palaris GQAL evaluation and the CHRC GQAL evaluation are as follows:

- CHRC appears to incorporate Class D into Class C.
- CHRC has considerably less Class A land and no Class B land.

The extensive areas of Class A and B land mapped in the current evaluation reflect the broad definitions within accepted GQAL methodology: i.e. Class A land includes all land that is arable with limitations to crop production ranging from none to moderate, whereas Class B land is defined as being marginal for cropping due to severe limitations (DHLGP, 1993).

Priority Agricultural Areas

Mapping from the Central Queensland Regional Plan shows all of MLAs 704715, 704716, 704758, as lying within the PAA except for a small area in the south-east of MLA70458. To fall under those sections of the RPI Act pertaining to protection of PAAs, land must be within a designated PAA, and to have been used for a Priority Agricultural Land Use (PALU) three or more times in the ten years before an application is made under the RPI Act.

6.5.8.3 Cropping

The variability of the rainfall in the Central Highlands region provides the over-riding limitation to dryland cropping. Consequently, there is no Class 1 land within the Project area (Bourne and Tuck, 1993).

Approximately 26% (3,219 ha) of the study area (MLAs 704715, 704716, and 704758) was rated as Suitability Class 2 (soils A1, B3). Of all the soils, these two are most suited to long-term dryland cropping and to irrigation where water supplies may be available. Some 38% of the study area is Suitability Class 3 (A3, B2, C1 and C2 soils) and while suitable for dryland cropping has moderate limitations. Suitability Classes 4 and 5 covered 16% and 18% of the study area respectively. The Class 5 areas included areas of swamp, areas of shallow rocky soils, and levees associated with active creeks (e.g. Meteor Creek).

Land suitability classification for dryland cropping is shown in Figure 6.10 based on the current soil survey and reflecting the soil assessments undertaken by Bourne and Tuck (1993).

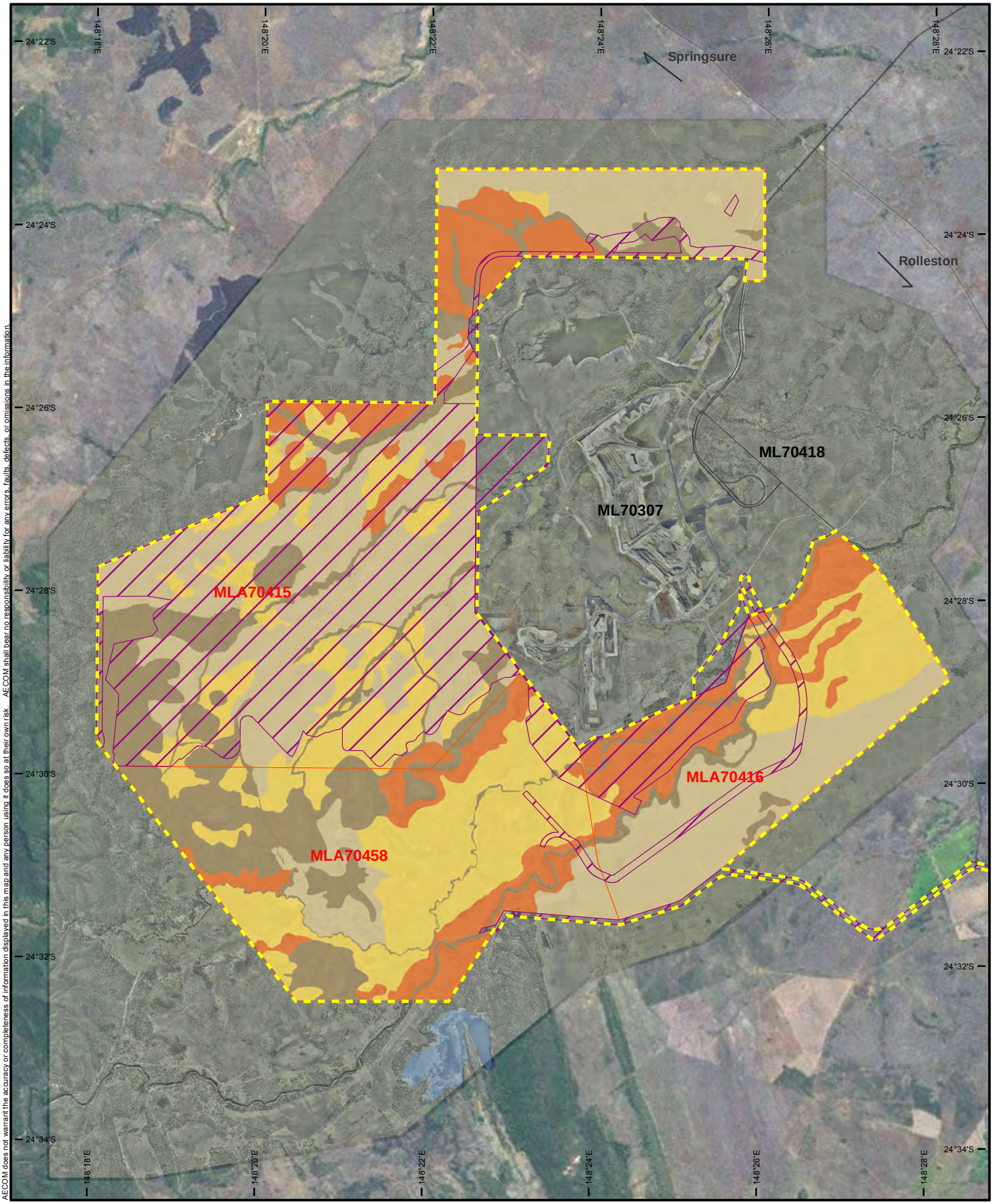
6.5.8.4 Grazing

Grazing land was reported in 2003 as covering 82% of the Central Highlands catchment, according to the Central Highlands Natural Resource Management Plan (CHNRMP). The Project Site contains land, and is adjacent to land, which has historically been used for grazing purposes.

Most of the land within the Project Site was assessed to be suitable for grazing. However, sustainable grazing would require varying levels and intensities of management across the different suitability classes. Approximately 26% (3,219 ha) of the land was rated as Suitability Class 1 (A1, B3 soils) for grazing, with a further 33% and 21% being Classes 2 and 3 respectively. Most of the remaining area was Suitability Class 4 with the exception of the two large areas of swamp within MLA70458 (52 ha or 0.5% of the Project Site) which was identified as Suitability Class 5. Grazing suitability is mapped in Figure 6.11.

6.5.8.5 Acid sulfate soils

The soil survey did not identify the existence of any inland acid sulfate soils (ASS) within the Project Site. The pH of the soils surveyed showed that there are no strongly acidic soils formed from the oxidation of sulfides in the Project Site. The elevation of the Project Site, at approximately RL 200-285 m AHD, makes it unlikely that ASS formed on more recent marine sediments from former estuarine sites will occur. From a regulatory perspective, by virtue of this elevation *State Planning Policy 2/02: Planning and Managing Development in Acid Sulphate Soils* does not apply due to the policy's exclusion of land at or above 20 m AHD (Section 2.2 of SPP 2/02). Inland acid sulfate soils are not common in Queensland, with the only potential ASS occurring on pyritic shales, which have not been identified within the Project Site. Also, the Waste Rock Characterisation Study (Appendix F-1) concluded that waste material to be generated by the Project is likely to be non-acid forming with the exception of some material in the vicinity of coal seams.



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DATUM GDA 1994, PROJECTION MGA ZONE 55

Legend

- Project Site
- Project Footprint
- Existing Mining Lease
- Proposed Mining Lease

Dry Cropping Land

- Class 2
- Class 3
- Class 4
- Class 5

Data sources:
Waterways - StreetPro (c)2013 Pitney Bowes Business Insight, PSMA
Railways - Queensland Rail Network, 2012
Roads - © MapInfo Australia Pty Ltd (2004) Based on [Roads - all – State Digital Road Network (SDRN)] provided with the permission of MapInfo Australia Pty Ltd (2004)
Mining Leases - State Government DME, QLD (2013)
Imagery - Aerial December 2011 - Xstrata Coal, Landsat7 Mosaic

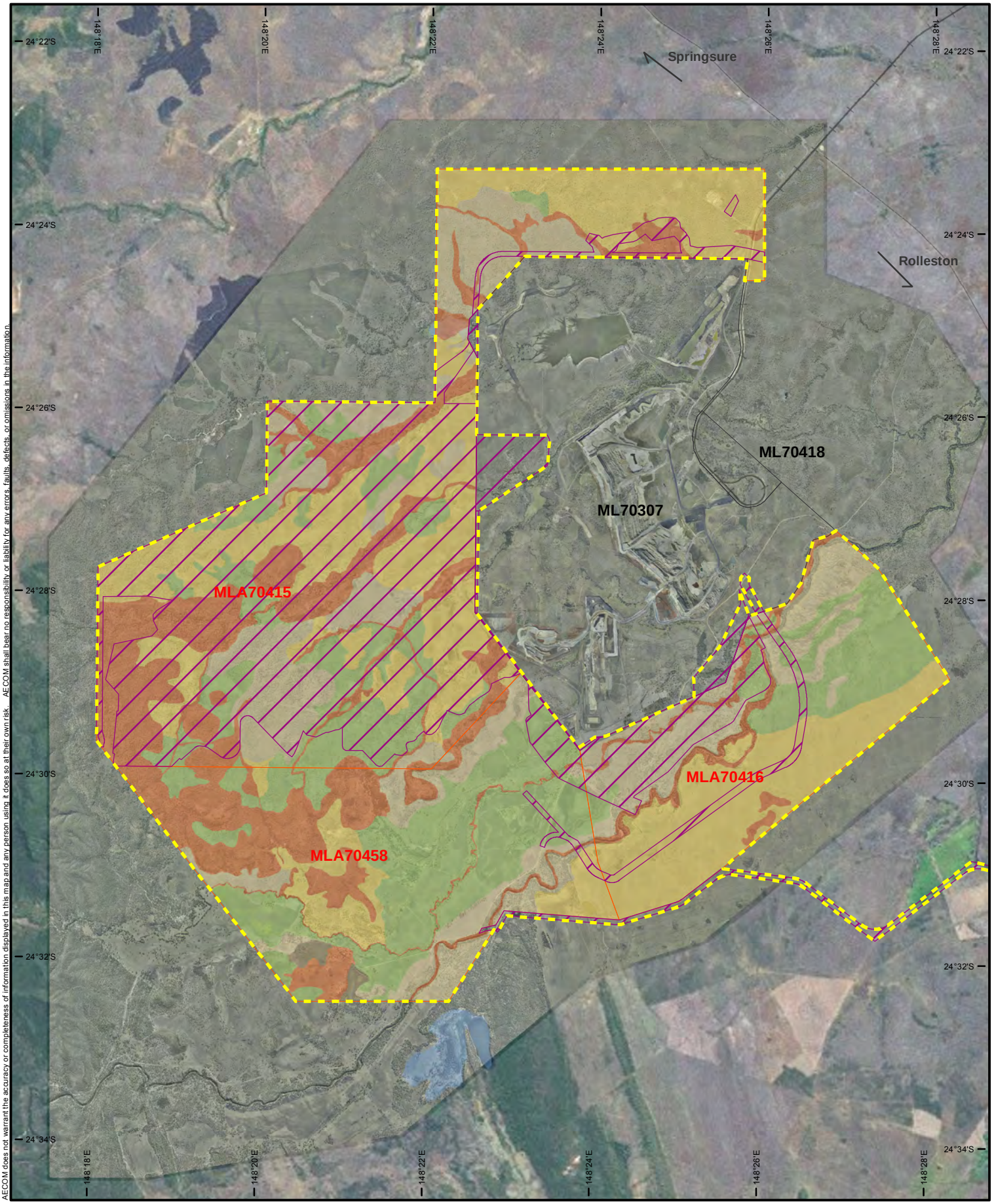
ROLLESTON COAL EXPANSION PROJECT

Land Suitability for Dryland Cropping

PROJECT ID	60267739
CREATED BY	VV
LAST MODIFIED	AS - 17 Aug 2014

Figure 6.10

Filename: P:\Projects\60267739\4. Tech Work Area\4.7 GIS\EIS\4.9_GIS\09_2014_Rolleston_Requests\LandFigs\MXDs\FIG_610.mxd



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DATUM GDA 1994, PROJECTION MGA ZONE 55

Legend

- Project Site
- Project Footprint
- Existing Mining Lease
- Proposed Mining Lease

Grazing

- Class 1
- Class 2
- Class 3
- Class 4
- Class 5

Data sources:
Waterways - StreetPro (c)2013 Pitney Bowes Business Insight, PSMA
Railways - Queensland Rail Network, 2012
Roads - © MapInfo Australia Pty Ltd (2004) Based on [Roads - all – State Digital Road Network (SDRN)] provided with the permission of MapInfo Australia Pty Ltd (2004)
Mining Leases - State Government DME, QLD (2013)
Imagery - Aerial December 2011 - Xstrata Coal, Landsat7 Mosaic

ROLLESTON COAL EXPANSION PROJECT

Land Suitability for Grazing

PROJECT ID	60267739
CREATED BY	VV
LAST MODIFIED	AS - 17 Aug 2014

Figure 6.11

Filename: P:\Projects\60267739\4. Tech Work Area\4.7 GIS\EIS\4.9_GIS\09_2014_Rolleston_Requests\LandFigs\MXDs\FIG_611.mxd

6.5.9 Contaminated land

Searches of the EMR/CLR databases were completed on 27 June 2012 for 16 properties identified within and adjacent to the Project Site. Searches reported nine properties as being included on the EMR for a notifiable activity. The search found that no properties were recorded on the CLR. Results from the EMR/CLR searches are included in Appendix D-3. The properties recorded on the EMR are listed in Table 6-14, and the locations are shown in Figure 6.12.

Table 6-14 Notifiable activity listings

Lot/plan details	Property sub-division	Property amalgamation	Notifiable activity listing				
			Livestock dip or race spray	Petroleum product or oil storage	Mineral processing	Waste storage, treatment or disposal	Explosive production or storage
1SP164061				✓		✓	✓
1SP164068	✓		✓	✓			
2SP164061				✓		✓	✓
3DSN590			✓				
4CUE59			✓				
4RP617701			✓				
211FTY1812					✓		
1SP174071		✓	✓				
2SP174071		✓	✓				

Contaminants of potential concern at each EMR listed land parcel are expected to be related to notifiable activities and are listed in Table 6-15. The type of registered notifiable activity dictates the method of assessment required to address potential soil contaminants associated with the previous use of the land.

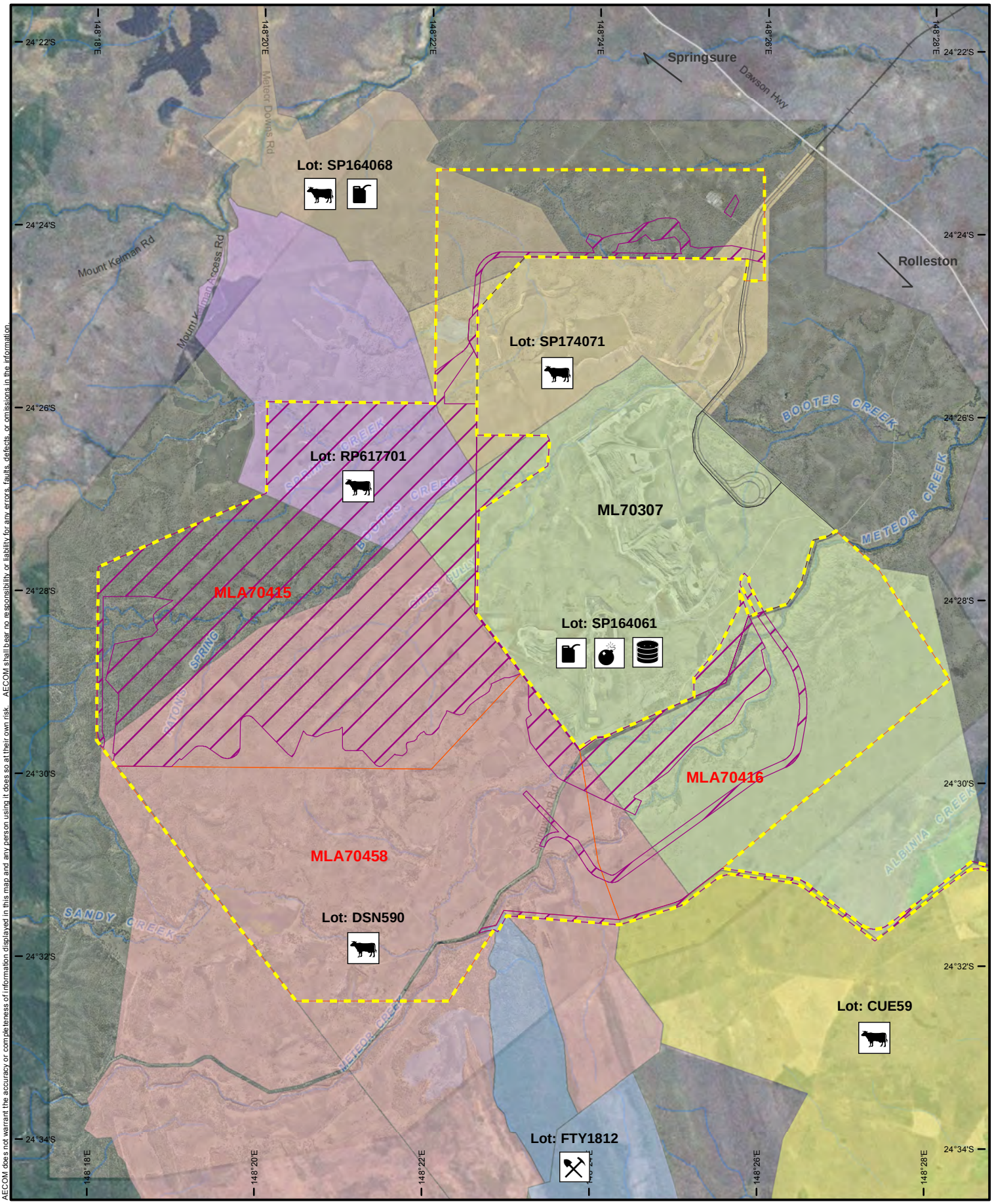
It should be noted that an entire allotment is listed on the EMR for a notifiable activity, even if the activity only occurred on a portion of the land. It is therefore possible that Project works may not impact any potentially contaminated land on an EMR listed property.

Of the sites within the Project area included on the EMR search, three have been subdivided from or amalgamated with a site which has been included on the EMR. According to DEHP procedure, each reconfigured lot would remain on the EMR unless documentation can be provided that demonstrates that contamination does not exist on that new land parcel. On this basis, the subdivided site may be listed for an activity that did not occur within the property boundary.

Table 6-15 Potential soil contaminants

Notifiable activity	Description	Contaminants of potential concern
Livestock Dip or Race Spray	Operating a livestock dip or spray race facility.	Arsenic, Total Petroleum Hydrocarbons (TPH), Organochloride Pesticides (OCs) for example DDT and Organophosphorous Pesticides (OPs).

Notifiable activity	Description	Contaminants of potential concern
Mineral Processing	Chemically or physically extracting or processing metalliferous ores.	Metals and metalloids, phenols, oil and grease including TPH, PAH (Benzo(a)pyrene), and ash.
Waste Storage, Treatment or Disposal	Storing, treating, reprocessing or disposing of regulated waste (other than at the place it is generated).	Metals and metalloids, OC/OPs, phenols, BTEX, asbestos, acids, oil and grease including TPH, PAH, and ash.
Explosive Production or Storage	Operating a factory under the *Explosives Act 1952.*	Metals and metalloids, TPH, oil and grease including TPH.
Petroleum or Oil Storage	Storing petroleum products or oil- ▶ in underground tanks with more than 200 L capacity; or ▶ in aboveground tanks with- ▶ for petroleum products or oil in class 3 in packaging groups 1 and 2 of the dangerous goods code – more than 2,500 L capacity; or ▶ for petroleum products or oil in class 3 in packaging groups 3 of the dangerous goods code – more than 5,000 L capacity; or ▶ for petroleum products that are combustible liquids in class C1 or C2 in Australian Standards AS1940, 'The storage and handling of flammable and combustible liquids' published by Standards Australia – more than 25,000 L capacity.	Metals and metalloids, acids, BTEX, PAH, oil and grease including TPH.



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DATUM GDA 1994, PROJECTION MGA ZONE 55

Legend

- Roads
- Railways
- Watercourses
- Project Site
- Project Footprint
- Existing Mining Lease
- Proposed Mining Lease

Lot / Plan

- CUE59
- DSN590
- FTY1812
- RP617701
- SP164061
- SP164068
- SP174071

- Livestock Dip or Race Spray
- Petroleum Product or Oil Storage
- Mineral Processing
- Waste Storage, Treatment or Disposal
- Explosive Production or Storage

Data sources:
Waterways - StreetPro (c)2013 Pitney Bowes Business Insight, PSMA
Railways - Queensland Rail Network, 2012

Roads - © MapInfo Australia Pty Ltd (2004) Based on [Roads - all – State Digital Road Network (SDRN)] provided with the permission of MapInfo Australia Pty Ltd (2004)

DCDB Cadastral Boundaries - State Government DNRM (2012)
Mining Leases - State Government DME, QLD (2013)
Imagery - Aerial December 2011 - Xstrata Coal, Landsat7 Mosaic

ROLLESTON COAL EXPANSION PROJECT

EMR/CLR Map

PROJECT ID	60267739
CREATED BY	VV
LAST MODIFIED	AS - 21 Jan 2014

Figure 6.12

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6.5.9.1 Historical land uses

A review of historical land uses was undertaken within the Project area. This can be used as a way of assisting the identification of potential land contamination not currently identified.

The Project Site and surrounding lands were extensively grazed from 1850 to the present. Much of this area was reportedly covered in brigalow and prickly pear scrub until it was cleared in the 1960's for new farming allotments.

Records from the Titles Registry (DNRM) indicate that historical land uses can be traced from the original land that has been known as Meteor Downs since the 1880s. The area was first settled in the 1860s and amalgamated with other adjoining properties in 1885 to form the Meteor – Albinia Downs complex. The estate housed a series of woolsheds and sheep stations up until the late 1930s, after which cattle were run on the property. Since 1967 several parts of Meteor Downs have been sold or subleased to different parties. All current buildings associated with this area, and nearby expansions are reportedly of relatively recent construction.

Previous investigations indicated that initial exploration of the Project area was carried out in the early 1970s for a mining area known as 'Meteor Creek Coal Mine'. By 1975 sufficient information had been obtained to allow Brigalow Mines Pty Ltd to submit a tender proposal in 1979 to provide coal for power generation in Queensland. Prefeasibility studies based on dragline mining were continuously updated from 1980, and finalised in 1984. Prior to 1985, the Project area was subject to intense geological exploration and mining feasibility studies (The Minserve Group Pty Ltd, 1994). Prefeasibility continued and environmental approvals were sought prior to the existing Rolleston Coal Mine's construction. Mining operations commenced in the area in 2005 and are still active today.

6.5.9.2 DEHP request for information

Site Management Plans (SMPs) for the properties listed on the EMR were requested from DEHP's Contaminated Land Unit on 27 June 2012. SMPs are recorded on the EMR and are provided with any related searches of the Registers. A SMP is used to manage contamination such that the existing or intended land use does not present a human health or environmental risk.

This can include prescribing the safe management of contamination, rather than the complete remediation of a site. This approach is an effective solution for managing contamination on specific sites, allowing development and environmental objectives to be met without excessive expenditure.

Response from a DEHP representative indicated that no SMPs are held for the nine identified sites listed on the EMR. A summary of information regarding the notifiable activity detail provided by DEHP is included in Appendix D-3.

6.5.9.3 Unexploded ordnance search

Unexploded ordnance (UXO) is military ammunition or explosive, which has failed to explode as intended. It includes sea mines or shells used by the Navy, mortar bombs, mines, artillery shells or hand grenades used by the Army; bombs, rockets or missiles used by the Air Force; and many other types of ammunition and explosives including training munitions. Military ammunition is designed to explode at the time it is used, but for a variety of reasons some of it fails to do so (Department of Defence website, accessed June, 2012).

In Queensland, DEHP works with the Department of Defence (Defence) in managing UXO contamination (*Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland 1998*). UXO is listed as a contaminant under Section 11 of the EP Act. Under the *Commonwealth Policy on the Management of Land Affected by Unexploded Ordnance*, Defence records all land in Queensland that has been identified and assessed by Defence as having been used by the military in a way that may result in residual UXO (DEHP website, accessed May 2012).

A review of Defence UXO mapping identified that the Project Site does not contain known UXO contaminated areas.

6.5.10 Infrastructure and stock routes

The major types of infrastructure overlying the Project Site include buildings, plant and fixed machinery, roads, power lines and pipelines supporting the existing Rolleston Coal Mine (refer Chapter 3 Description of the Project). Planned upgrades and additional infrastructure proposed for the Project are also discussed in Chapter 3 Description of the Project.

The environmental values affected by infrastructure depend upon the type of infrastructure being considered, its use and the surrounding uses.

Environmental values potentially impacted by the construction and operation of infrastructure within the Project Site are discussed in the relevant chapters of the EIS. Potential impacts to these environmental values are typical of the Project operations and include:

- Water quality impacts within the Project Site (Chapter 9).
- Air quality impacts to sensitive receptors (Chapter 11).
- Noise impacts to sensitive receptors (Chapter 12).

The magnitude of impacts resulting from infrastructure upgrades and construction over the life of the Project is anticipated to be low, with only intermittent periods of relatively minor construction activities planned.

Stock routes are present throughout Queensland to move stock 'on the hoof' along a network of state and locally controlled roads. The routes are managed according to the Land Protection Act. Springwood Road, intersecting ML70307, MLA70416 and MLA70458, is the only stock route in the Project Site, and is designated as an 'inactive' stock route according to Bauhinia Shire Council's stock route map. Realignment of Springwood Road is required to maintain public access whilst facilitating the additional area of mining associated with the Project. The road would not be used by mine vehicles, however limited access by road registered vehicles would be required from time to time. The primary and preferred access to the mine (and Project Area) is the Rolleston Coal Mine Access Road.

Two options for the realignment of Springwood Road have been developed, with Option 1 located in an area not to be used for mining within MLA70416 and MLA70458. Option 2 is situated further to the south and joins with Bottle Tree Downs Road in the east.

Preliminary design and consultation with CHRC and DNRM has commenced in relation to each road option. Both options provide continued access however Option 1 is the shorter of the two corridors minimising capital and maintenance costs over the life of the asset. Option 1 is also situated on-lease, avoiding the need to resume private land. On this basis, Option 1 is currently the preferred corridor for the realignment of Springwood Road. Detailed design and consultation is proposed post approval (of the Project) to confirm the above benefits. Until this time both options are proposed for approval however only one corridor and road would be formed. Consultation during detailed design would include CHRC and DNRM as well as nearby landholders, DTMR and regional emergency services.

6.5.11 Environmentally Sensitive Areas

The *Environmental Protection Regulation 2008* provides three classes of Environmentally Sensitive Areas (ESAs) that need to be considered for potential impacts resulting from mining activities. The DEHP website provides maps of mining leases, showing any overlapping or surrounding ESAs. A summary of the ESAs found in the Project area is provided in Table 6-16. The maps obtained from the DEHP website have been used to identify the location of ESAs in the Project area as shown in Figure 6.13, with the desktop searches contained in Appendix D-2.

Table 6-16 Summary of ESAs

Lease	ESA Category	Description	Location
MLA70415	A	National Park	E - adjacent
	B	Endangered Regional Ecosystems (Biodiversity status)	S – within/adjacent NW, SE - proximity
	C	State Forest	W – adjacent SE - proximity
MLA70416	A	National Park	NE – adjacent
	B	Endangered Regional Ecosystems (Biodiversity status)	NE – within lease All directions – proximity
	C	State Forest	SW – proximity

Lease	ESA Category	Description	Location
MLA70458	B	Endangered Regional Ecosystems (Biodiversity status)	Within, various. S – proximity
	C	State forest	W, SE – adjacent/proximity

A desktop study was conducted to identify further sensitive areas in the vicinity of the Project Site. These sensitive areas were searched using the EPBC Protected Matters search tool, DEHP's WetlandInfo interactive mapping tool and the DNRM IRTM tool. The results from each search are summarised in Table 6-17.

These searches revealed no new areas that are not already considered under the various terrestrial and aquatic assessments of flora, fauna or land values contained in this chapter, Chapter 13 Terrestrial Flora, Chapter 14 Terrestrial Fauna or Chapter 15 Aquatic Ecology.

Table 6-17 Summary of ESA database search results

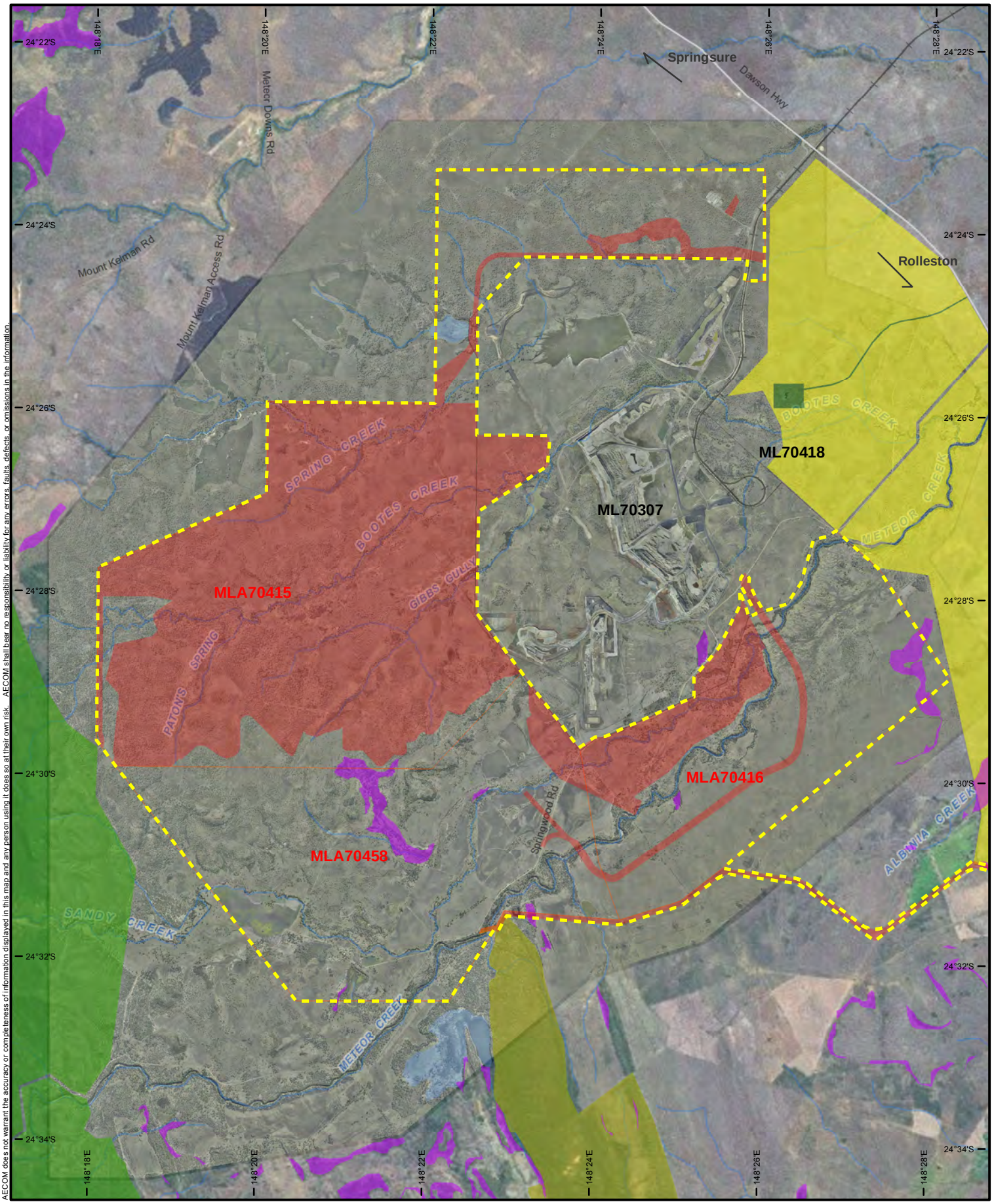
Search tool	Description of sensitive areas		Sensitive receptor
EPBC Protected Matters search tool	▶ No World Heritage Areas. ▶ No Great Barrier Reef Marine Park or Commonwealth Marine Areas. ▶ No Commonwealth Lands. ▶ No Commonwealth or National Heritage Places. ▶ No Critical Habitats. ▶ No Commonwealth Reserves.	▶ No Internationally or Nationally Important Wetlands. ▶ No Regional Forestry Agreements. ▶ State or Territory Reserves (Albinia National Park).	▶ Albinia National Park.
WetlandInfo	▶ Areas of lacustrine systems. ▶ Areas of palustrine systems.	▶ Areas of riverine systems. ▶ Conservation parks, national forests, state forests and reserves present in Project surrounds.	▶ State-significant wetlands present. ▶ Mount Hope and Mount Pleasant State Forests border the Project Site.
IRTM	▶ No Wild Rivers. ▶ No Constrained areas (except State Forests – already captured as Category C ESA).	▶ Sterile land east of Project Site. ▶ Restricted area (for facilitation of exploration under MR Act 1989).	▶ No significant sensitive receptors identified.

6.5.11.1 Protected area estate

The NC Act lists 'protected areas' as a means of protecting the biodiversity of forest areas. Areas listed as national parks, conservation parks or resource reserves are protected areas under the NC Act. Areas listed as 'forest reserves' are designated for transition into an NC Act protected area status. A list of the protected areas and state forests adjacent, or within the general surrounds of the Project, is as follows:

- Albinia National Park.
- Mount Hope State Forest.
- Mount Pleasant State Forest.

Matters protected by the Japan Australia Migratory Birds Agreement (JAMBA), Chinese Australia Migratory Birds Agreement (CAMBA), or the Ramsar treaty's legislated mechanisms under the EPBC Act are not known to exist on the Project Site.



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DATUM GDA 1994, PROJECTION MGA ZONE 55

Legend

- Roads
- Railways
- Watercourses
- Project Site
- Project Footprint
- Existing Mining Lease
- Proposed Mining Lease

Criterion B1: State Ecosystem Value.

- Very High

QLD Protected Areas

- Albinia National Park
- Albinia Resources Reserve
- Mount Hope State Forest
- Mount Pleasant State Forest

Data sources:
Waterways - StreetPro (c)2013 Pitney Bowes Business Insight, PSMA
Railways - Queensland Rail Network, 2012
Roads - © MapInfo Australia Pty Ltd (2004)
Based on [Roads - all – State Digital Road Network (SDRN)] provided with the permission of MapInfo Australia Pty Ltd (2004)
Protected Areas, Regional Ecosystems - State Government DNRM (2012)
Mining Leases - State Government DME, QLD (2013)
Imagery - Aerial December 2011 - Xstrata Coal, Landsat7 Mosaic

ROLLESTON COAL EXPANSION PROJECT

Location of ESAs
Proximate to the Project

PROJECT ID	60267739
CREATED BY	VV
LAST MODIFIED	AS - 21 Jan 2014

Figure 6.13

Filename: J:\Interoffice\60103583\4. Tech Work Area\4.7 GIS\EIS\4.9_GIS\02_MXDs\2_EIS_Chapters\06_Land\20130913\FIG_613.mxd

6.5.12 Landscape character and visual amenity

6.5.12.1 General landscape context

The landscape context of the Project forms part of the wider Brigalow Belt bioregion. Bioregions have been defined by the Commonwealth Government's Environmental Resources Information Network (ERIN) as part of the Interim Biogeographic Regionalisation for Australia (IBRA), Version 6.1. IBRA represents a landscape-based approach to classifying the land surface of Australia. The IBRA data consists of two datasets: IBRA bioregions, as a larger scale regional classification of homogenous ecosystems; and sub regions, which are more localised. Version 6.1 delineates 85 biogeographic regions and 405 sub regions, each reflecting a unifying set of major environmental influences which shape the occurrence of flora and fauna and their interaction with the physical environment across Australia.

Whilst bioregions have been defined mainly for the purposes of ecosystem planning and monitoring, the nominal attributes that make up IBRA are climate, lithology/geology, landform, vegetation, flora and fauna, and land use. As these are the themes that are normally used to define landscape character at a high level, use of the IBRA subregions is appropriate for the purposes of informing the likely sensitivities/impacts on landscape character.

Within this area there are a number of key landscape characteristics that assist in understanding landscape character. The Project Site and its immediate context form part of the Basalt Downs sub-bioregion of the Brigalow Belt North (BBN) region, but also lies close to the Brigalow Belt South (BBS) bioregion boundary.

The key landscape characteristics of the Brigalow Belt bioregion can generally be summarised as follows:

- Characterised by the tree *Acacia harpophylla* (Brigalow) which forms forest and woodland on clay soils.
- Brigalow communities are not predominant through the entire region and large areas are characterised by a range of ecosystems, including eucalypt forest and woodland, grassland, dry rainforest, cypress pine woodland and riparian communities.
- Extensively cleared for agriculture.

The specific relevant characteristics of the BBN are as follows:

- Undulating to rugged ranges and alluvial plains.
- Rangelands are predominantly pastoral leasehold.
- Several nature reserves, such as the Narrien Range and Blackwood National Parks.
- Coal deposits occur in the Bowen and Galilee Basin resulting in the presence of open cut mines.

The specific relevant characteristics of the Basalt Downs sub-bioregion are as follows:

- Formed almost entirely on Tertiary basalts, but with outcrops of Permian sediments to the south of the sub-region.
- Climate is sub-humid to semi-arid.
- Undulating southern areas of the sub-region support *Dichanthium seiceum* (Bluegrass) grassland with, *Eucalyptus orgadophila* (Mountain coolibah) prolific on hillier terrain, often with, *E. melanophloia*, and, *Corymbia erythrophloia* (Red bloodwood). *Eucalyptus coolabah* (Coolibah) occurs on floodplains.

A number of 'landscape character types' (LCT) have been defined that provide a framework for describing these areas methodically. The four broad LCT that have been identified within the Project area are:

- LCT A: Rural Rangelands and Croplands.
- LCT B: Wooded Creek Valleys.
- LCT C: Wooded Hills and Tablelands.
- LCT D: Transitional Mining Areas.

A description of each LCT and their locations relative to the Project Site is provided in Appendix D-4.

6.5.12.2 Visual context

The broad visual context of the landscape surrounding the Project site is of open spaces and paddocks (predominantly due to clearing for agricultural purposes) which allow a wide field of view, both horizontally and vertically. There are few built elements in this predominantly rural landscape. Mountainous ranges can be seen in the distant background from a number of locations.

Albinia National Park is located to the east of the existing Rolleston Coal Mine. This National Park shows minimal signs of recreational facilities or activity, with signage the only obvious feature. This largely open landscape has some low undulations with patches of vegetation commonly evident in the lowest valleys and creeks.

The existing visual setting is described in terms of views from 10 representative points that surround the Project Site. These viewpoints (VP) have largely been selected due to the fact that they correspond to the location of existing residents, frequently used roads or highways and recreational areas. These are considered representative of the types of views likely to be experienced by receptors around the site, including those locations from where there are the greatest potential visual impacts.

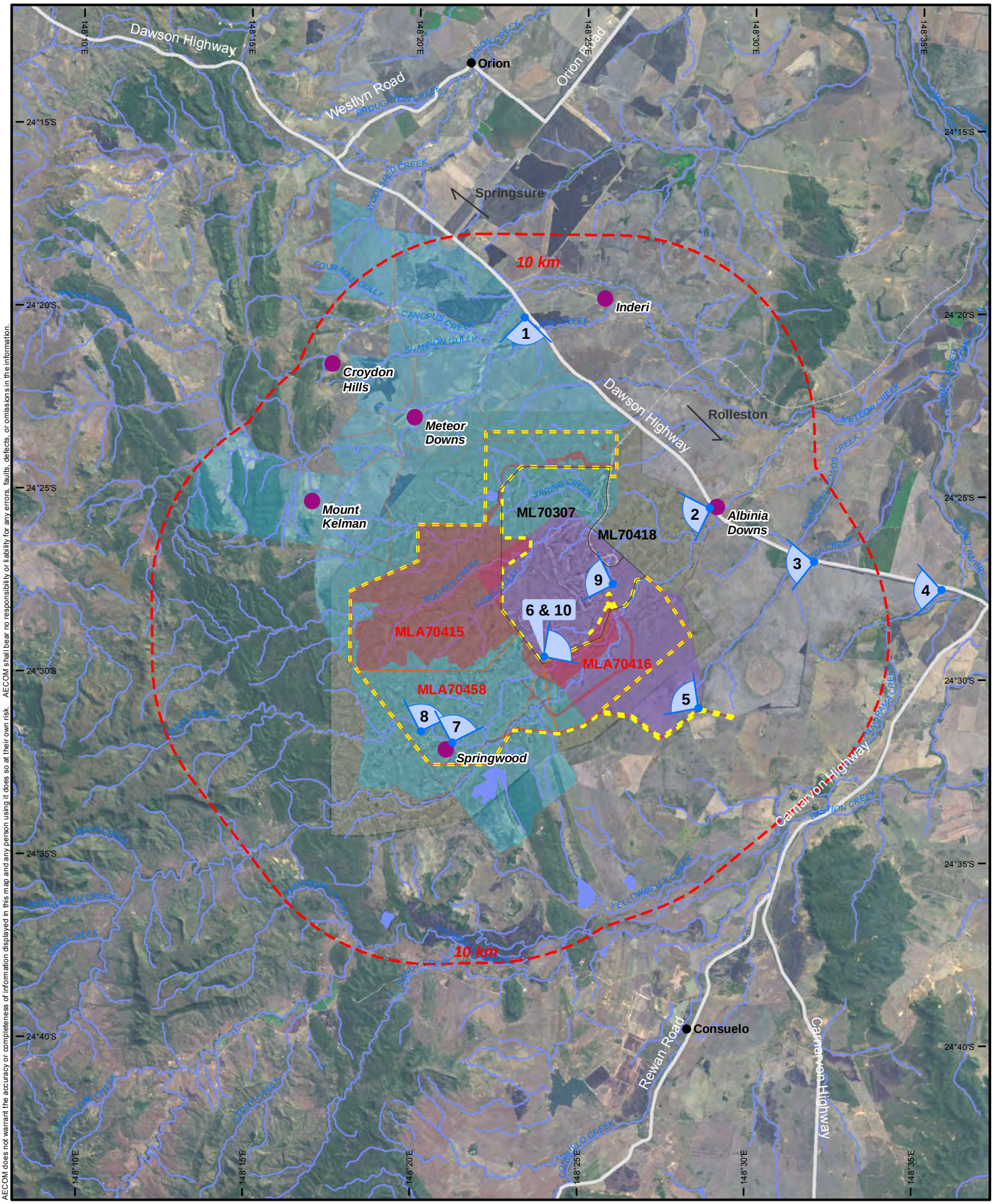
Eight representative VPs were used to assess the Projects impact on visual amenity. These were:

- VP01 – Dawson Highway – looking south from Inderi Farm entrance.
- VP02 – Dawson Highway – looking west from entrance to Albinia Downs entrance.
- VP03 – Bottle Tree Downs Road – perpendicular to Dawson Highway.
- VP04 – Dawson Highway Lay-by.
- VP05 – Bottle Tree Downs.
- VP06 – Springwood Road – entry to Springwood Homestead (Located on land owned by Glencore).
- VP07 – Springwood Homestead (Located on land owned by Glencore).
- VP08 – Springwood property (western section) (Located on land owned by Glencore).

Two representative VPs were used to consider Project lighting and its potential impact at night. These were:

- VP09 – Night viewpoint looking north east from Springwood Road (Located on land owned by Glencore).
- VP10 – Night viewpoint looking north from entry to Springwood Homestead (Located on land owned by Glencore).

The VPs are illustrated in Figure 6.14. Further detail on visual amenity, including location and viewing direction of VPs, is presented in Appendix D-4.



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DATUM GDA 1994, PROJECTION MGA ZONE 55

Legend

- Sensitive Receptors
- Towns
- Roads
- Railways
- Watercourses
- Project Site
- Project Footprint
- Existing Mining Lease
- Proposed Mining Lease
- Project Site Study Area
- Meteor Park
- Glencore Owned Property
- Viewpoint

Data sources:
Waterways - StreetPro (c)2013 Pitney Bowes Business Insight, PSMA
Railways - Queensland Rail Network, 2012
Roads - © MapInfo Australia Pty Ltd (2004)
Based on [Roads - all – State Digital Road Network (SDRN)] provided with the permission of MapInfo Australia Pty Ltd (2004)
Mining Leases - State Government DME, QLD 2013
Imagery - Aerial December 2011 - Xstrata Coal, Landsat7 Mosaic

ROLLESTON COAL EXPANSION PROJECT

Viewpoint Location Plan

PROJECT ID	60267739
CREATED BY	GW
LAST MODIFIED	VV - 20 Oct 2014

Figure 6.14

Path: P:\Projects\60267739\4. Tech Work Area\4.7 GIS\EIS\4.9_GIS\02_MXDs\2_EIS_Chapters\06_Land\FIG614vv.mxd

6.6 Potential impacts

The Project's construction and operation phases have the potential to impact upon existing land use and land-related environmental values on site, and potentially on areas adjacent to and downstream from the Project Site.

The following major activities are part of the Project's construction and operational phases and may potentially impact upon the environmental values of land if not managed effectively:

- Clearing established vegetation where this remains (much has been cleared previously).
- Stripping of topsoil.
- Relocation of stock routes.
- Construction of mine infrastructure including on-site tracks, equipment, and buildings.
- Water management infrastructure, including potential dams and levees.
- Stockpiling of coal and out of pit dumps.

Ancillary infrastructure required for the Project, such as power lines and water pipelines, has largely been constructed for the existing mine. Further ancillary infrastructure would be constructed within existing corridors where possible, reducing the need for additional land disturbance. Project infrastructure plans are discussed in Chapter 3 Description of the Project.

As an extension of an operating mine, the Project would will incorporate a number of existing practices that have proven to be effective in the local environment. New practices are also proposed where aspects of the environment or impacts differ to those of the existing Rolleston Coal Mine. These existing practices are outlined where applicable in Section 6.7.1.

6.6.1 Resource utilisation

6.6.1.1 Mining operation

The Project would increase the existing Rolleston Coal Mine's production tonnage by 5 Mt ROM per annum to 19 Mt ROM per annum. To meet the increased tonnage profile, a Marion 8750 dragline and P&H4100 XPC electric rope shovel, with additional support equipment, would operate within MLA70415 and MLA70416. The Project would allow an extension of mining within areas of the existing ML70307, and the establishment of mining within MLA70415 and MLA70416. For a summary of mining lease areas and pits for the Project, refer to Chapter 3 Description of the Project.

The open cut mining operations within the Project Site are to extract the full economic seam, with the mine development sequence preferentially targeting coal resources exhibiting low strip ratios, reducing processing costs and energy usage.

The stratigraphy and identified coal seams are described in Section 6.5.5 of this chapter. The mining plan highlights that while seams A, B, C and D are present in the Project Site, D Seam is the most important individual seam in the deposit. The D Seam makes up about 65% of the total resource (measured and indicated) of the Rolleston area. The plies or 'seams' which are not included in the in situ resources are very dirty, extensively intruded and/or poorly developed and are not considered as a resource. Therefore, the targeting A, B, C and D seams in the mine planning allows for the most efficient use of processing costs and energy usage.

6.6.1.2 Residual resources

Xstrata Coal encourages maximum resource utilisation, ensuring that low grade or currently uneconomic deposits are not sterilised for future extraction and use. The materials in the mining product cycle likely to contain amounts of residual product are to be sustainably developed and managed, including:

- Overburden.
- Uneconomic in situ deposits.

The continual monitoring and evaluation of these resources is already considered as part of the existing Rolleston Coal Mine's operation, and would continue to be considered and evaluated through the Project's various phases.

The stockpiles are to become encased in waste rock areas, as detailed in Chapter 8 Waste. Final areas of overburden emplacement are shown in Chapter 4 Decommissioning and Rehabilitation.

6.6.2 Land use and suitability

6.6.2.1 Land use

Land use within the proposed Project Footprint would change upon construction and operation of the Project. This change is most evident within MLA70415 and MLA70416, with large areas dedicated to open cut mining. Development within MLA70458 is smaller in scale and area, and concerns ancillary infrastructure for the management of water. An overview of mining infrastructure and activities within the Project Site, and their timing is provided in Figures 3.4 to 3.10 of Chapter 3 Description of the Project.

Mining would result in a combination of changes to landform within the 5,649 ha of the Project Footprint. These would be more substantial and longer term in the area of mine pits and overburden dumps. Land use within these areas would change from agricultural (predominantly grazing) to extraction over the life of mine.

Areas within the Project Site but beyond the Project Footprint would not experience significant changes in landform or use. Current practices, such as cropping and grazing, are anticipated to continue with the latter used to manage potential fuel loads and the risk of fire. Significant changes in land use outside the Project Site and as a result of the Project are not anticipated. In the regional context, the Project's overall impact on land use is considered to be minor in scale and would reduce over the life of mine.

In terms of future land uses, the CHRC planning scheme has not targeted the use of the Project site for any conflicting or particular type of development. Should the Project not proceed, the land use is likely to remain as its current rural designation. Upon closure of the mine, the land's form and suitability will be converted to allow the desired rehabilitation of land to proceed. For an overview of rehabilitation and post-closure land uses, including an assessment of factors favouring or limiting rehabilitated land use options, refer to Chapter 4 Decommissioning and Rehabilitation.

The Project site is not situated adjacent to any incompatible land uses, with the Rolleston area generally designated as agricultural or rural by the local authority (CHRC). This zoning extends for 10 km around the Project site's boundary, with the nearest change in land use occurring outside this buffer, being the Rolleston Township. To this extent, the likelihood of encountering incompatible land uses is low, considering that most ancillary infrastructure required for the Project, such as powerlines, has been constructed to service the existing operations at the Rolleston Coal mine. Therefore the overall impact on land use is considered to be low.

Chapter 4 Rehabilitation and Decommissioning describes the progressive rehabilitation strategy to deliver a post mining land use within the Project Site would be conducive to:

- Grazing.
- Infrastructure (including roads, hardstands).
- Final Voids.
- Drainage (regulated structures/diversions).

In terms of the Project Site, these uses are considered consistent with prior land use, would not incur greater maintenance costs and are conducive or able to accommodate the resulting changes in land suitability due to mining. The potential impact to post mining land use and suitability is therefore considered to be low.

6.6.2.2 Agricultural suitability and zoning

The soil survey conducted for the Project (Palaris, 2013) has identified areas containing GQAL within the Project Site. Parts of the Project Site are generally suitable for dryland cropping and grazing. Under the former SPP 1/92 and supporting planning guidelines *Separating Agricultural and Residential Land Use*, consideration has been given to the following in order to quantify the potential impacts upon GQAL:

- The potential land use conflicts between the proposed extractive industry and adjacent agricultural uses.
- Indirect impacts on agricultural lands and operations through potential dust, noise and water.
- The prolonged alienation of GQAL within the Project Site.

The Project Site is suitable for both mining and agricultural uses, with the surrounding use being predominately pastoral with ancillary associated light agricultural industry.

Potential downstream and ambient impacts on cropping and grazing land as a result of the Project are discussed further within Chapter 11 Air Quality, Chapter 12 Noise and Vibration and Chapter 9 Surface Water. Typically, nuisance levels are prescribed in guidelines and policy to supply standards against which impacts may be gauged. A summary of potential impacts upon GQAL in reference to acceptable impact levels can be found in Table 6-18.

Deposited dust has potential to impact on crops and livestock, through the potential to inhibit plant growth or impair livestock development. Research on vegetation response to dust deposition impact (Doley, 2003) has shown that, for sunny conditions, a dust deposition rate of up to 500 mg/m²/day is unlikely to have a detectable effect on crop growth and it is not until a deposition rate of up to 1,000 mg/m²/day occurs that there is a measureable reduction in crop growth under overcast conditions. Livestock research on dairy cows (Andrews & Skriskandarajah, 1992) has shown that a dust deposition rate of up to 4,000 mg/m²/day does not influence the amount of feed cattle eat or the amount of milk produced. The dust deposition nuisance limit nominated for Project in Chapter 11 Air Quality is 120 mg/m²/month. This is below the 500 mg/m²/day limit for detectable effect on cropping and the 4000 mg/m²/day that is shown to not influence livestock feeding or production, and as such the dust deposition as a result of the Project is considered unlikely to adversely affect crops or livestock.

Table 6-18 Assessment of potential impacts on GQAL and agricultural productivity

Receptor	Impact	Summary of impact
Cropping GQAL	Dust	Chapter 11 Air Quality – The dust deposition nuisance limit of 120 mg/m²/month is lower than the 500 mg/m²/day limit for detectable effect on cropping. As the nuisance limit is not exceeded, potential adverse impacts due to dust deposition are not considered likely.
	Noise	Chapter 12 Noise and Vibration – Correlation with noise is not considered applicable to cropping lands.
	Water quality	Chapter 9 Surface Water – No adverse impacts are considered likely upon downstream extraction. Changes to overland flow regime may alter stock watering points.
Grazing GQAL	Dust	Chapter 11 Air Quality – The dust deposition nuisance limit of 120 mg/m²/month is lower than the 4000 mg/m²/day limit that is shown to not influence livestock feeding or production. As the nuisance limit is not exceeded, potential adverse impacts due to dust deposition are not considered likely.
	Noise	Chapter 12 Noise and Vibration – *Environmental Protection (Noise) Policy 2008* (EPP (Noise)) does not legislate to protect grazing cattle from noise impacts. Potential adverse impacts are considered minimal due to adherence to human nuisance levels.
	Water quality	Chapter 9 Surface Water – No adverse impacts are considered likely upon downstream extraction. Changes to overland flow regime may alter stock watering points.

Under the former SPP 1/92, GQAL would have been directly impacted due to the conversion of agricultural land to the proposed mining activities. The areas disturbed are shown in Figure 6.15. Though a substantial part of the area within the Project Footprint is GQAL Class A, grazing of cattle is the main land use in the undeveloped sections of the Project Site, and in the general vicinity of the Project. Although part of the Project Site's land is suitable for agricultural purposes, suitable land for cropping is relatively common in the surrounding Central Highlands region. Therefore, the Project is not considered to represent a significant adverse impact on this land type and potential land use. The impact upon GQAL is unavoidable due to the nature of the open cut mining methods.

6.6.2.3 Strategic cropping land

The Project fell under the transitional arrangements of Chapter 9 of the SCL Act, but consideration was given to avoidance, mitigation and management measures in any event.

The statutory SCL trigger maps indicate that some 1,813 ha of SCL potentially exists on MLA70416 and MLA70458. No SCL was identified on the trigger maps for MLA70415. On-site assessment and subsequent mapping (Figures 6.16 and 6.17) (Palaris, 2013) found that around 263 ha of the trigger mapping did not meet the Western Management Zone criteria for one or more of the slope, depth, and water storage attributes, or might be excluded on dimensional parameters (i.e. residual area <100 ha) for both MLA70416 and MLA70458. This finding has not yet been validated by the statutory process nor an application made for consideration at this time.

The potential impact on SCL under the repealed SCL Act as a result of the Project related in part to non-mining activities (i.e. the proposed road realignment) and would therefore ultimately have been determined upon finalisation of the Springwood Road realignment options. The impact assessment based on detailed soil mapping indicates that the potential impact on SCL may be either:

- 445 ha with the inclusion of Springwood Road Option 1 (approximately 8% of the Project Footprint); or
- 257 ha with the inclusion of Springwood Road Option 2 (approximately 4.5% of the Project Footprint).

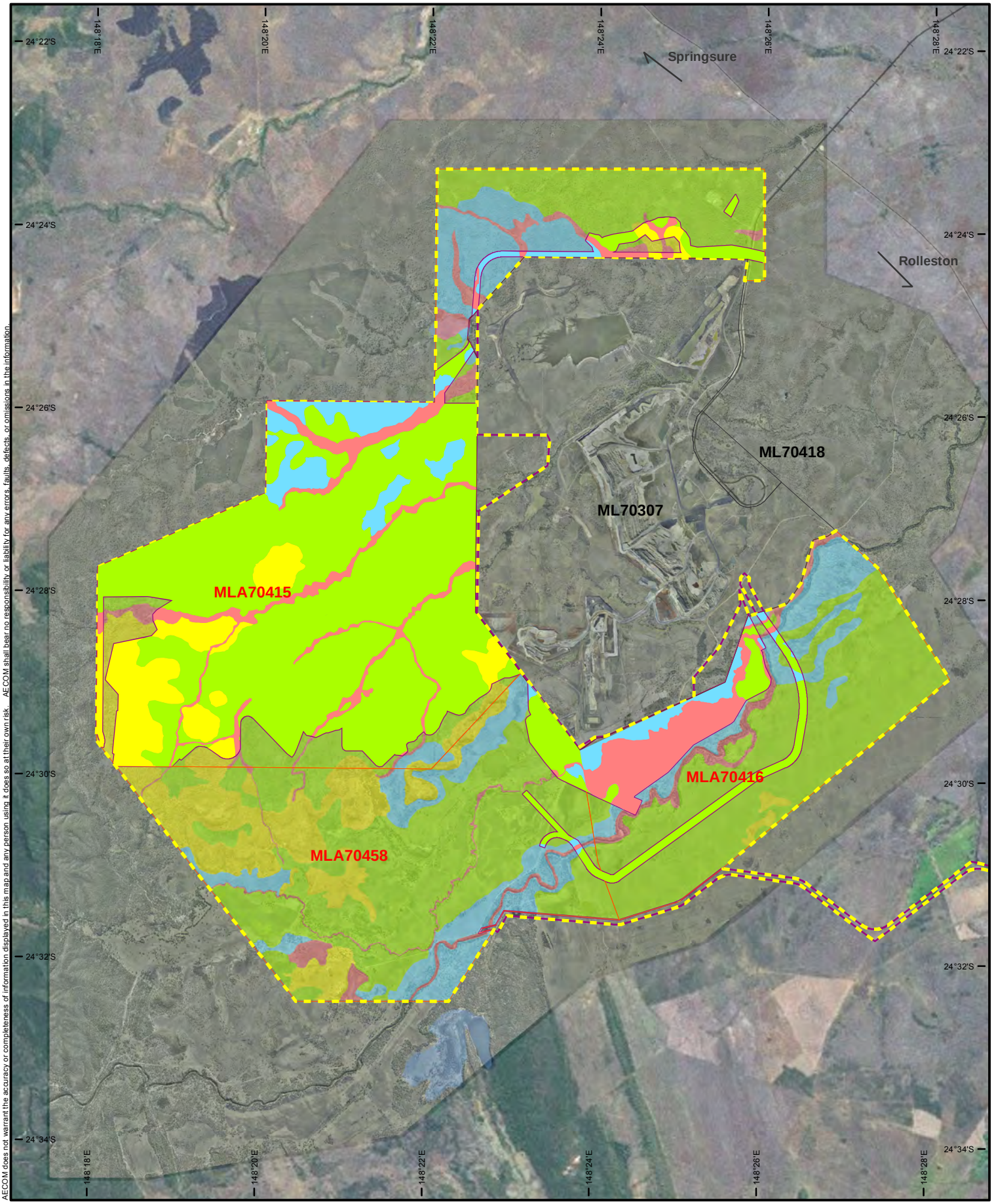
However, this disturbance area was defined using a worst case approach that considered a 100 m ‘road development corridor’ and the assumption that the total amount of SCL within this corridor area would be impacted. This approach was adopted to provide flexibility in the final alignment of the road within the defined corridor.

These impacts will now be considered as part of a RIDA application and assessment process under the RPI Act, with which Glencore will comply fully. It is likely that the PAA criteria under the RPI Act and associated documents will be applied rather than the SCA criteria. The PAA criteria are based more on actual land use. Glencore is in the process of preparing the relevant documentation for this application, and will progress it in consultation with the relevant government departments.

6.6.2.4 Stock routes

Springwood Road is gazetted as part of Queensland’s stock route network. The road intersects and traverses the southern ML70307 boundary, and would be realigned according to the corridor options shown in Chapter 3 Description of the Project. The realignment of Springwood Road (an inactive stock route) will be constructed off-line and then connected simultaneously with the closure of the existing alignment. It is therefore not expected that the potential movement of stock will be impeded as a result of the realignment. All work will be completed in consultation with the DNRM Stock Route Officer

The potential impact to stock routes as a result of the Project is therefore considered to be minor.



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DATUM GDA 1994, PROJECTION MGA ZONE 55

Legend

- Project Site
- Project Footprint
- Existing Mining Lease
- Proposed Mining Lease

GQAL CLASS

- A
- B
- C
- D

GQAL Intersecting Areas

- A (3621 Hectares)
- B (734 Hectares)
- C (552 Hectares)
- D (659 Hectares)

Data sources:
Waterways - StreetPro (c)2013 Pitney Bowes Business Insight, PSMA
Railways - Queensland Rail Network, 2012
Roads - © MapInfo Australia Pty Ltd (2004) Based on [Roads - all – State Digital Road Network (SDRN)] provided with the permission of MapInfo Australia Pty Ltd (2004)
GQAL Dataset - State Government DNRM (2011)
Mining Leases - State Government DME, QLD (2013)
Imagery - Aerial December 2011 - Xstrata Coal, Landsat7 Mosaic

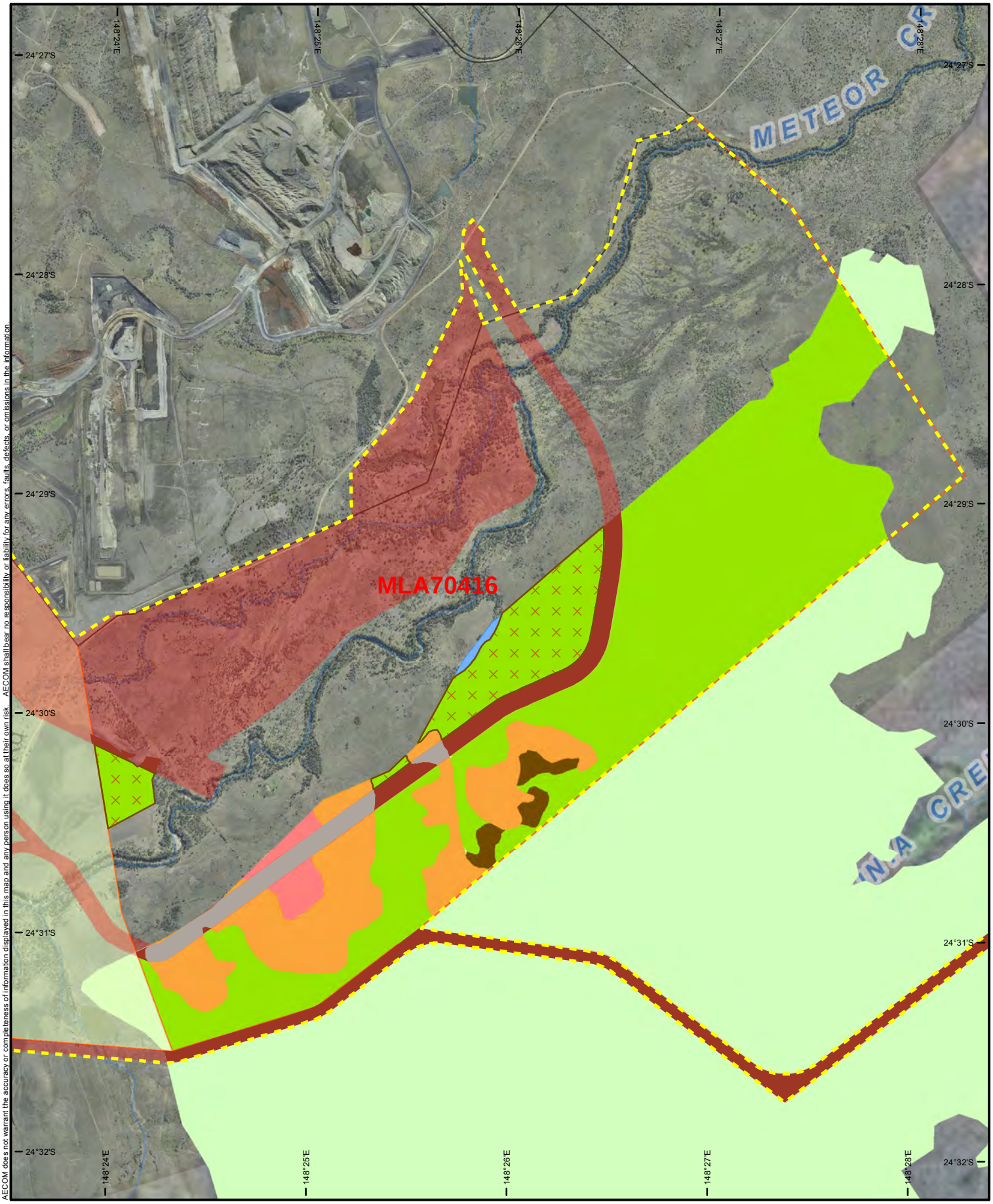
ROLLESTON COAL EXPANSION PROJECT

GQAL Disturbance

PROJECT ID	60267739
CREATED BY	VV
LAST MODIFIED	AS - 17 Aug 2014

Figure 6.15

Filename: P:\Projects\60267739\4. Tech Work Area\4.7 GIS\EIS\4.9_GIS\09_2014_Rolleston_Requests\LandFigs\MXDs\FIG_615.mxd



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DATUM GDA 1994, PROJECTION MGA ZONE 55

Legend

- Roads
- Railways
- Watercourses
- Project Site
- Project Footprint
- Existing Mining Lease
- Proposed Mining Lease
- SCL Trigger Map
- SCL Outside MLA 70416
- Not Triggered as SCL

Forecasted Disturbance

- Areas Reduced to <100 ha
- Not SCL
- SCL

SCL Exclusions

- Active stream channel
- Area < 100 ha
- Shallow < 60 cm, stony
- Slope > 3%

Data sources:
Waterways - StreetPro (c)2013 Pitney Bowes Business Insight, PSMA
Railways - Queensland Rail Network, 2012
Roads - © MapInfo Australia Pty Ltd (2004) Based on [Roads - all – State Digital Road Network (SDRN)] provided with the permission of MapInfo Australia Pty Ltd (2004)
SCL Trigger Map and Not SCL - Data created by Palaris for Xstrata Coal
Mining Leases - State Government DME, QLD 2013
Imagery - Aerial December 2011 - Xstrata Coal, Landsat7 Mosaic

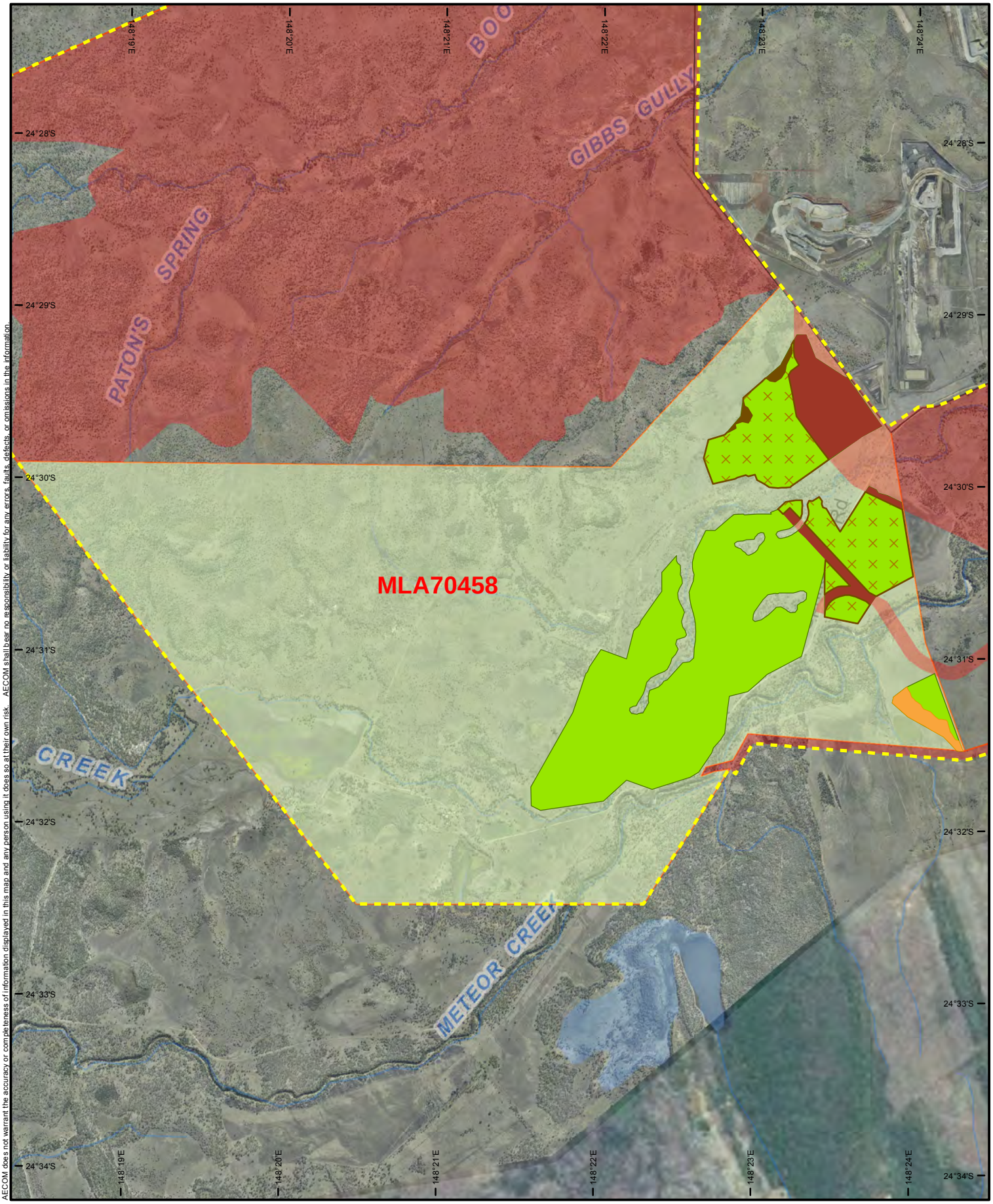
ROLLESTON COAL EXPANSION PROJECT

Areas of SCL on MLA70416 and Outside MLA70416

PROJECT ID	60267739
CREATED BY	VV
LAST MODIFIED	AS - 21 Jan 2014

Figure 6.16

Filename: J:\Interoffice\60103583\4. Tech Work Area\4.7 GIS\EIS\4.9_GIS\02_MXDs\2_EIS_Chapters\06_Land\FIG_615.mxd



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DATUM GDA 1994, PROJECTION MGA ZONE 55

Legend

- Roads
- Railways
- Watercourses
- Project Site
- Project Footprint
- SCL Trigger Area
- Not Triggered as SCL

Forecasted Disturbance

- SCL
- Areas Reduced to <100 ha

SCL Exclusions

- Slope >3 %
- Shallow <60 cm, stoney

Data sources:
Waterways - StreetPro (c)2013 Pitney Bowes Business Insight, PSMA
Railways - Queensland Rail Network, 2012
Roads - © MapInfo Australia Pty Ltd (2004) Based on [Roads - all – State Digital Road Network (SDRN)] provided with the permission of MapInfo Australia Pty Ltd (2004)
SCL Trigger Map and Not SCL - Data created by Palaris for Xstrata Coal
Mining Leases - State Government DME, QLD 2013
Imagery - Aerial December 2011 - Xstrata Coal, Landsat7 Mosaic

ROLLESTON COAL EXPANSION PROJECT

Areas of SCL on MLA70458

PROJECT ID	60267739
CREATED BY	VV
LAST MODIFIED	AS - 21 Jan 2014

Figure 6.17

Filename: J:\Interoffice\60103583\4. Tech Work Area\4.7 GIS\EIS\4.9_GIS\02_MXDs\2_EIS_Chapters\06_Land\Fig616_AreasOfSCLImpactedOnMLA70458.mxd

6.6.3 Land disturbance

The Project's construction and operational activities would be carried out with the aim of minimising the amount of land disturbed at any one time. The Project would disturb approximately 5,649 ha of land as a result of construction, open cut mining activities and supporting infrastructure. Works would be progressive and staged, minimising the period of disturbance and the potential for harm to the environment. The existing Rolleston Coal mine has established plans and procedures to mitigate and control land disturbed as a result of mining activities. Plans such as the Conceptual Mine Closure Plan, the Rehabilitation Management Plan and the Environmental Management Plan would be updated to ensure compliance with the site environmental authority and commitments within the EIS. This process would clearly define the standard and actions for rehabilitation. At the end of the mine's life, final voids would remain and are indicatively shown in Figure 6.18. Further detail on the overall approach to rehabilitation is provided in Chapter 4 Rehabilitation and Decommissioning.

Soil units across the Project Site are also mapped, with the full extent of all pit crests and dump toes overlying the affected soil units, in Figure 6.19.

The disturbance of land due to mining would result in an increased potential for wind and water erosion, causing the propagation of sediment into receiving downstream environments. Detailed descriptions of the erosion and sediment controls are described in Section 6.6.5.

6.6.3.1 Diversions

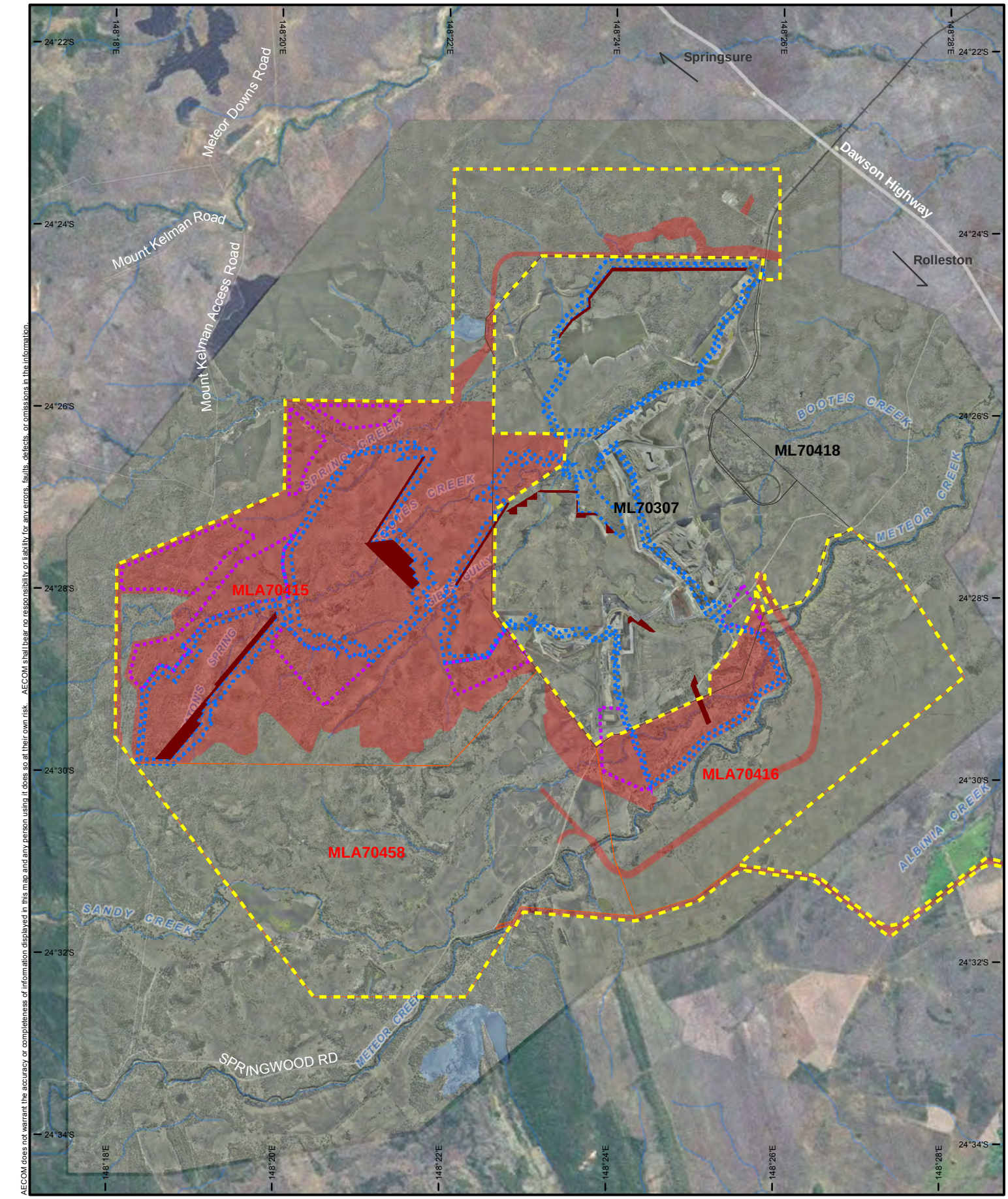
A staged diversion of drainage channels, namely sections of Bootes and Meteor Creeks, would occur through Year 1 to Year 9 of the Project's construction (refer to Chapter 3 Description of the Project). An assessment of the potential impacts of these diversions upon surface water flows and water quality is presented in Chapter 9 Surface Water. The civil earthworks involved in constructing the water infrastructure on the Project Site have been described conceptually in Section 6.6.5. Further information on the location and extent of the diversions and supporting earthen infrastructure can be found in Chapter 9 Surface Water.

6.6.3.2 Post-mining landform

The successful implementation of the decommissioning and rehabilitation strategy contained in Chapter 4 will result in a post mining landform appropriate for grazing on non-operational lands, native ecosystems, or another land use.

The dominant pre-mining landform was suitable for agricultural use; predominately grazing with some areas of cropping. Areas surrounding the Project site also include state forest or national parks and reserves. By comparison, the suggested rehabilitation of the Project site landform to suit grazing applications and native ecosystems is in accordance with and reflective of the pre-mining landform.

Further mapping and detail of the final rehabilitated landform can be found in Chapter 4 Rehabilitation and Decommissioning. The surface and groundwater aspects of the rehabilitation strategy have been designed to promote a low-impact overland and sub-surface flow of water across the Project site and surrounding areas. The drainage patterns have been indicated at contour levels sufficient to identify the course of water across the Project site.



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DATUM GDA 1994, PROJECTION MGA ZONE 55

Legend

- Roads
- Railways
- Watercourses
- Project Site
- Project Footprint
- Existing Mining Lease
- Proposed Mining Lease
- Dump Area
- Pit Area
- Final Void Area

Data sources:
Waterways - StreetPro (c)2013 Pitney Bowes Business Insight, PSMA
Railways - Queensland Rail Network, 2012
Roads - © MapInfo Australia Pty Ltd (2004) Based on [Roads - all – State Digital Road Network (SDRN)] provided with the permission of MapInfo Australia Pty Ltd (2004)
Pits, Dumps, Final Voids - Xstrata Coal
Mining Leases - State Government DME, QLD (2013)
Imagery - Aerial December 2011 - Xstrata Coal, Landsat7 Mosaic

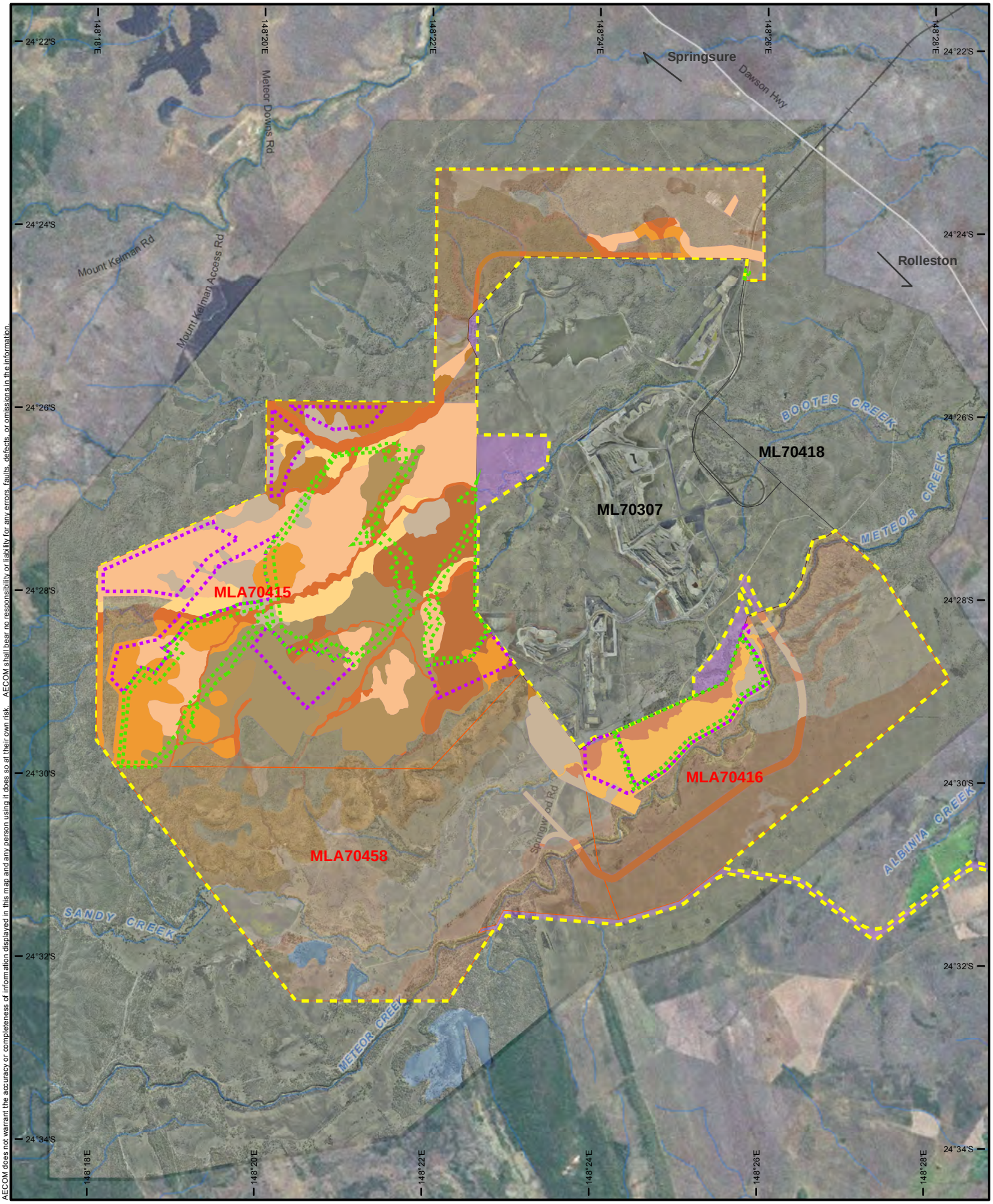
ROLLESTON COAL EXPANSION PROJECT

Proposed Location Of Final Voids

PROJECT ID	60267739
CREATED BY	VV
LAST MODIFIED	AS - 23 Oct 2014

Figure 6.18

Filename: P:\Projects\60267739\4. Tech Work Area\4.7 GIS\EIS\4.9_GIS\02_MXDs\2_EIS_Chapters\06_Land\FIG_618.mxd



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1:100,000 (when printed at A4)

DATUM GDA 1994, PROJECTION MGA ZONE 55

Legend

- Project Site
- Project Footprint
- Existing Mining Lease
- Proposed Mining Lease
- Dump Area
- Pit Area

Intersecting Soil Areas (Hectares)

- A1 (499 Hectares)
- A2 (348 Hectares)
- A3 (264 Hectares)
- A4 (311 Hectares)
- A5 (404 Hectares)
- B1 (331 Hectares)
- B2 (1198 Hectares)
- B3 (596 Hectares)
- B4 (552 Hectares)
- C1 (587 Hectares)
- C2 (476 Hectares)

Data sources:
Pits, Dumps - Xstrata Coal
Waterways - StreetPro (c)2013 Pitney Bowes Business Insight, PSMA
Railways - Queensland Rail Network, 2012

Roads - © MapInfo Australia Pty Ltd (2004) Based on [Roads - all – State Digital Road Network (SDRN)] provided with the permission of MapInfo Australia Pty Ltd (2004)

Mining Leases
State Government DME, QLD 2013
Imagery - Aerial December 2011
Xstrata Coal, Landsat7 Mosaic

ROLLESTON COAL EXPANSION PROJECT

Soil Disturbance Map

PROJECT ID	60267739
CREATED BY	VV
LAST MODIFIED	VV - 23 Oct 2014

Figure 6.19

Filename: P:\Projects\60267739\4. Tech Work Area\4.7 GIS\EIS\4.9_GIS\02_MXDs\2_EIS_Chapters\06_Land\FIG_619.mxd

6.6.4 Land degradation and contamination

6.6.4.1 Potential contamination impacts

The Project would include a number of activities that have a relatively high potential to cause contamination if not managed effectively. Construction and operations activities such as waste management and chemical and fuel handling and storage have the potential to release contaminants.

Project elements with an increased potential to cause land contamination include:

- Coal transportation.
- Coal handling facility (including conveyor areas).
- Refuelling areas.
- Chemical stores.
- Water treatment plants (oily water separator, sewage separator).
- Maintenance areas.
- Spoil and over burden storage and disposal.
- Haul roads.

The Project's construction stage will include various construction activities which may disturb, remove or transfer material from land previously contaminated with potentially hazardous substances. Potential contamination sources include properties recorded on the EMR. Potentially contaminated sites are summarised in Table 6-19 and illustrated on Figure 6.12.

Table 6-19 Potential sources of contamination from existing sites/activities

Lot/Plan details	Property name	Property amalga-mation/ subdivision	Notifiable activity listing	Contaminants of concern
1SP164061	Meteor Park	-	Petroleum Product or Oil Storage Waste Storage, Treatment of Disposal Explosive Production or Storage	Metals and metalloids, OC/OPs, phenols, BTEX, asbestos, acids, oil and grease including TPH, PAH, and ash.
1SP164068	Meteor Downs	Yes	Livestock Dip or Race Spray Petroleum Product or Oil Storage	Metals and metalloids, acids, BTEX, PAH, oil and grease including TPH, OC/Ops.
2SP164061	Not Listed	-	Petroleum product or oil storage Waste Storage, Treatment of Disposal Explosive Production or Storage	Metals and metalloids, OC/OPs, phenols, BTEX, asbestos, acids, oil and grease including TPH, PAH, and ash.
3DSN590	Springwood	-	Livestock Dip or Race Spray	Arsenic, TPH, OC/OPs
4CUE59	Bottle Tree Downs	-	Livestock Dip or Race Spray	Arsenic, TPH, OC/OPs
4RP617701	Meteor Downs	-	Livestock Dip or Race Spray	Arsenic, TPH, OC/OPs
211FTY1812	Mount Pleasant State Forest	-	Mineral Processing	Metals and metalloids, phenols, oil and grease including TPH, PAH (Benzo(a)pyrene), and ash.
1SP174071	Not Listed	Yes	Livestock Dip or Race Spray	Arsenic, TPH, OC/OPs
2SP174071	Not Listed	Yes	Livestock dip or race spray	Arsenic, TPH, OC/OPs

Potential contamination impacts during Project operations include, but are not limited to the following activities:

- Spills of fuels, greases and lubricating oils which may cause localised contamination.
- Ineffective waste rock disposal leading to soil and groundwater contamination as a result of leaching. Cargo spills during coal transportation on mine haul roads.
- Ignition of unprocessed coal releasing fly ash and other harmful emissions.
- Change in chemical or physical composition of natural soil in areas where mining has occurred, or overburden is buried.

Demolition of buildings and infrastructure from within the Project Site also has the potential to contaminate soils if not managed effectively. These processes have the potential to add to the risk of contaminants impacting human health and sensitive environmental receptors. Exposure to contaminants can occur through the following pathways:

- Inhalation of contaminants attached to dust particles produced through the disturbance of contaminated soil. These dust particles also have the potential to travel offsite during dry, windy conditions and deposit on nearby waterways or vegetation.
- Leaching of contaminants into groundwater or overland flow (runoff) travelling over the contaminated area and distributing contaminants downstream and to nearby waterways.
- Physical removal of contamination due to cross contamination of equipment, or inappropriate reuse or disposal of impacted material.

In consideration of the scale of the Project, environmental and/or health risks could occur if contaminated material was not identified prior to construction works, potentially exposing workers, members of the community and the environment to contaminants.

6.6.5 Erosion and stability

The Project's mining and related land development activities involve land disturbance presenting erosion risks during construction, operation and decommissioning phases. The activities likely to occur during site construction and operation are considered with respect to the geological and climatic erosion risk.

The rate of soil loss through erosional processes is dependent on a combination of environmental and situational factors, including:

- Rainfall erosivity.
- Soil erodibility.
- Topographic factors (slope gradient and length).
- Land disturbance such as vegetation cover removal that results in an increased coefficient of runoff.
- Existing soil conservation practices.

An assessment of erosion potential within the Project Site has been made on the basis of soil types and land units, as described in the following sections.

6.6.5.1 Soil types

The erosion potential of each soil type across the Project Site is described in Table 6-20. The erosion potential has been determined based on each soil's chemical and physical properties, as provided in Appendix D-1, and with an appreciation for the landscape position and localised landforms.

Table 6-20 Erosion potential of soils across the Project Site

Soil group	Soil type (Australian Soil Classification)	Erosion potential
Soils derived from alluvial deposition		
A1 (Adelong)	Dark Grey and Black Vertosols	The self-mulching nature of this soil is considered to present a medium soil erosion risk. The landform is flat (<1%) generally with grazed pasture vegetation cover. Bourne and Tuck (1993) nominate a medium water erosion hazard for Adelong soils.
A2 (Moramana)	Black Vertosols	Landform is active drainage channel in undulating plains with a slope of between 1 and 2%. Vegetation cover is good with little disturbance. Soil erosion risk is considered to be low based on soil structure but close association with active drainage channels poses considerable erosion hazard. Bourne and Tuck (1993) nominate a medium water erosion hazard for Moramana soils.
A3 (Glen Idol)	Brown Dermosol	This soil type is considered to have a medium soil erosion risk based on assessments given by Bourne and Tuck (1993). The landform has good level of vegetation cover. Slope is approximately 2% and drainage is moderate. Bourne and Tuck (1993) nominate a medium water erosion hazard for Glen Idol soils.
A4 (Isaac)	Brown Chromosol	Landform is an alluvial plain with a slope of typically <1%. Vegetation cover is predominantly pasture. Soil erosion risk is considered to be moderate based on soil structure. Bourne and Tuck (1993) nominate a low water erosion hazard for Isaac soils.
A5 (No similar AMU)	Brown Dermosols	Landform is slightly elevated levee on old alluvial plain with a slope of between 1 and 2%. Vegetation cover is good. Soil erosion risk is considered to be medium based on dispersion measurements. Bourne and Tuck (1993) nominate an extremely high water erosion hazard for Glengallan soils which may have some similarities to this soil type.
Mainly colluvial soils on basaltic undulating plains		
B1 (Jimbaroo)	Black and grey Vertosol	Landform is mid slope of undulating plains with a slope of between 4 and6%. Vegetation cover is good. Soil erodibility is considered to be low based on dispersion measurements. Drainage is considered to be slow. Bourne and Tuck (1993) nominate a high water erosion hazard for Jimbaroo soils.
B2 (Orion)	Black and grey Vertosol	Landform is mid slope of undulating plains with a slope of between 3 and 4%. Vegetation cover is good. Soil erosion risk is considered to be medium based on soil structure. Bourne and Tuck (1993) nominate a high water erosion hazard for Orion soils.
B3 (Orion)	Black and grey Vertosol	Landform is mid slope of gently undulating plains with a slope of between 2 and 3%. Majority of the land is pasture including grazed former cultivation. Soil erosion risk is considered to be low based on soil structure and dispersion measurements. Bourne and Tuck (1993) nominate a high water erosion hazard for Orion soils.
B4 (Highlands)	Dark Brown and Reddish Brown Rudosols	Landform is upper slope of undulating plain with a slope of between 4 and 7%. Vegetation is predominantly pasture, some uncleared trees remain. Soil erosion risk is considered to be medium based on soil structure and dispersion measurements. Bourne and Tuck (1993) provide a medium water erosion hazard for Highlands soils.
B5 (Highlands)	Brown Rudosol and Brown Chromosol	Landform is low ridge in undulating plain with a slope of between 3 and 4%.Vegetation is predominantly pasture, some uncleared trees remain. Soil erosion risk is considered to be medium based on soil structure and dispersion measurements. Bourne and Tuck (1993) nominate a medium water erosion hazard for Highlands soils.

Soil group	Soil type (Australian Soil Classification)	Erosion potential
Colluvial and sedentary soils on mixed calcareous sediments		
C1 (Rolleston/ Springton)	Brown Vertosols	Landform is lower slope of undulating plains with a slope of between 2 and 3%. Vegetation is mainly grazed pasture with scrub and brigalow regrowth. Soil erosion risk is considered to be low based on soil structure. Bourne and Tuck (1993) nominate a low to medium water erosion hazard for Rolleston/Springton soils.
C2 (No similar AMU)	Brown Dermosol	Landform is upper slope of undulating plains with a slope of between 3 and 4%. Partial clearing of vegetation. Soil erosion risk is considered to be medium based on soil structure. Bourne and Tuck (1993) nominate an extremely high water erosion hazard for similar soils.

6.6.5.2 Land disturbance

Activities which broadly constitute land disturbance are those which involve the removal of topsoil, for example pits, roads and creek diversions. The following impacts associated with land disturbance activities are specifically those which give rise to erosion and stability issues:

- Loss of the protective vegetative cover.
- Loss/alteration of soil structure, where compaction leads to increased erosion potential.
- Loss of topsoil depth.
- Re-configuration of soil profiles upon rehabilitation.

The risks associated with these activities have been considered in this section with control measures designed to limit the potential impacts provided in Section 6.7. Mitigation measures are proposed for each activity based on the general guidance of the following erosion control principles for mine sites regarding:

- The long term stability of waste dumps and voids.
- Preventing soil loss in order to maintain land capability/suitability.
- Preventing significant degradation of local waterways due to suspended solids and sediment deposition.
- Selective handling of waste rock and capping material to maximise long-term stability of final landforms, particularly considering slumping and erosion both on and below the surface.

Land cleared of vegetation

Land clearing on-site would occur throughout various stages of construction and operation. Clearing removes protective cover media, specifically topsoil and vegetation, which can expose sub-soils. In sloping areas this may increase the potential for erosion. If not managed, this erosion and resulting sedimentation can have downstream effects on receiving land and waterways.

The pre-control risk of land clearing is therefore considered to be high, with unplanned and broad-scale clearing potentially exposing a large surface area of topsoil which could be eroded and discharged as sediment without proper pre-planning and control.

Topsoil

Topsoil would be directly placed onto reshaped overburden areas following the clearing and development of open cut mining areas. The pre-control risk of topsoil erosion and sedimentation is considered to be high, due to the large amount of topsoil material to be stripped and placed on overburden.

Waste dumps

Excavated rock produced during the mining operations would be placed in overburden stockpiles at specific locations within the Project Footprint. The location of these dumps is provided in the mine staging figures of Chapter 3 Description of the Project (Figures 3.3 - 3.10). The location and design of the overburden stockpiles have been considered so that infiltration of water into the rehabilitated mine waste stockpiles is prevented.

The ratio of non acid-forming waste rock to potentially acid-forming/uncertain acid-forming potential was estimated to be >20:1 for the Project. These ratios and the potential amount of sulfides and buffering capacity within the overall waste rock stream suggests that there appears to be sufficient acid neutralising capacity (ANC) within the system to buffer any potential acidity generated (EES, 2013). Furthermore, it is likely that leachate generated from the waste rock is alkaline. As such, co-disposal of near seam and interburden material and overburden within a waste rock enclosure is likely to be an acceptable practice, provided standard environmental controls and monitoring/ management procedures are in place and audited regularly.

However, the pre-control risk of waste dump erosion and sedimentation is considered to be high, with potential for downstream impacts, if not appropriately managed and controlled.

Dams, banks and creek crossings

The integrity of waterways, in terms of bank stability and the entrainment of sediments within the watercourse, is a key environmental value which needs to be managed through effective erosion and sedimentation control. The pre-mitigated risk to the receiving environment is considered to be high.

Uncontrolled erosion and sedimentation can potentially impact key creeks and tributaries of the Fitzroy River catchment, part of the upstream section of the Great Barrier Reef catchment (refer Chapter 9 Surface Water). The major risk occurs due to the deposition of coarse and fine sediments causing adverse effects on aquatic and estuarine ecosystems along the Fitzroy River catchment. Benthic communities can also be impacted due to a decrease in light transmission through water, affecting the function of aquatic plants and the organisms that rely on these plants for food and habitat.

Building/plant sites

The existing Rolleston Coal Mine operation and proposed mining activities incorporates site areas for fixed or temporary infrastructure and lay-down areas. These areas, typically gravelled or cleared, introduce altered run-off coefficients, hold-up times, courses and diversions for overland flows across the infrastructure boundaries. The pre-control risks to areas downstream and upstream of infrastructure areas are not considered to be of great material consequence and are therefore considered to only introduce a low risk due to the small size and impact of infrastructure areas.

Access roads and transport corridors

Site access roads and transport corridors, operating as roads for operational and maintenance vehicles, are featured across the Project Site. These roads and corridors would be cleared and levelled to allow vehicles to travel between areas on-site. The clearing and pavement impacts can however present erosion and stability issues.

The wind erosion of soils or materials paving these site roads is the predominant risk to sensitive receptors, as assessed in Chapter 11 Air Quality.

Water supply pipeline and electricity transmission corridors

The expansion of mining activity would require potential upgrades to ancillary infrastructure including water pipelines and electricity transmission corridors. The alignments for these upgrades are largely within existing easements and disturbed areas, however at this point in the Project's development the alignments are only conceptually finalised. The major erosion, sedimentation and stability impacts associated with this type of development include clearing of land and various levels of potentially erosive construction activity. The pre-control risks to the receiving environment varies with the linear infrastructure being considered for construction, but generally can be considered as a moderate risk.

Final landform and rehabilitation

Without proper design and appropriate management, the final landform produced by the Project has the potential to cause adverse environmental impacts, both in the short and the long term. The most likely potential impact is considered to be the pollution of waterways through erosion of post-mining landforms and movement of sediment into watercourses. If not appropriately controlled, impacts on water quality caused by excessive levels of suspended sediment and can be considered to be a high potential risk.

6.6.6 Landscape character and visual amenity

A number of Project components are likely to have the potential to impact on the character and amenity of the surrounding landscape. Project components and activities, such as spoil dumps, excavated voids and broad-scale clearing activities, are likely to change the broad-scale topography and vegetation character of the Project area. The primary sources of potential landscape and visual impact are associated with the following Project components and activities:

- Construction and operation of haul roads (light and heavy vehicle) and relocation of Springwood Road.
- Powerline infrastructure.
- Installation of security fencing.
- Construction and operation of supporting buildings.
- Construction and operation of water management infrastructure (levees and dams).
- Removal of vegetation within the Project Site.
- Removal and storage of topsoil.
- Removal of overburden and creation of out of pit spoil dumps.
- Open cut coal extraction.
- ROM stockpiling.
- Rehabilitation and decommissioning.

An assessment has been undertaken to evaluate the Project's potential impacts on the four broad LCTs and VPs identified within the Project area (refer to Section 6.5.12). Potential impacts to LCTs and VPs are based on the primary contribution sources of landscape impact associated with the Project. These sources and their potential impacts are outlined in Table 6-21.

Table 6-21 Potential impacts

Facility / Component	Potential impact
Construction and operation of haul roads (light and heavy vehicle) and relocation of Springwood Road	The construction of new sealed and unsealed haul roads within the Project Site would result in the presence of construction traffic to and within the mining lease areas resulting in shorter term impacts on landscape and visual values. Once operating, the roads would generate longer term adverse impacts on landscape and visual values, particularly associated with the presence of intermittent vehicular traffic. Key changes to road infrastructure are the new haul roads on MLA70415/MLA70416, the relocation of the Springwood Road.
Power Infrastructure	Power infrastructure would include the construction and operation of new 66 kV power lines from the existing line to the Project. Other likely sources of impact include the presence of construction traffic to and within the Project Site.
Construction and operation of support buildings	The Project would result in an increase to the number of buildings that are present on the existing Rolleston Coal Mine site. This would include upgrades to the offices and workshops as well as the crib hut facilities and car parking areas within the mine services area (MSA). This construction would bring additional traffic, staff and machinery to the Project Site. Whilst existing Rolleston Coal Mine related buildings may not currently be prominent in the wider landscape, the introduction of the new built form may be seen as uncharacteristic elements in a predominantly rural landscape.

Facility / Component	Potential impact
Construction and operation of water management infrastructure	Water management infrastructure currently occurs within the existing Rolleston Coal Mine in the form of levees, dams, diversions and drains. New dams would be created to accommodate the Project. These dams are commonly large open voids which act to assist in managing water within the Project Site. While these dams are commonly embanked above existing ground level, they do commonly exist at lower topographical points within the Project Site. Levees, diversions and drains are also proposed for the Project Site. New water infrastructure required for the project is provided in Chapter 3 Description of the Project.
Removal of vegetation within the mining lease areas	The site is already considerably cleared of vegetation. The removal of remaining areas would result in the presence of machinery (i.e. dozers) Temporary stockpiles of cleared vegetation may also be present.
Removal and storage of topsoil	Wherever possible topsoil will be used immediately in rehabilitation activities. Where this is not possible, topsoil would be collected and stored in topsoil stockpiles which would later be used in the rehabilitation phase of the Project. These topsoil stockpiles are likely to reach up to approximately 4 m in height and are likely to appear as grassed mounds.
Removal of overburden and creation of out of pit spoil dumps	Overburden removal activities would be carried out by using truck/excavator, scrapers and dozer push. Dozer push would be used to develop the first blast pad prior to the drilling and loading of explosives which would then blast the overburden to a pre-strip horizon (usually to the base of Tertiary basalts and clays). The blast itself may create minor temporary visual impacts associated with dust if not appropriately managed. Overburden removal would then be undertaken either using an excavator/truck fleet or dragline. The overburden would initially be stored in “out of pit spoil dumps” until required as backfill for the rehabilitation process. These out of pit spoil dumps can occasionally exceed heights of 50 meters above the existing ground level. The newly created mining pit, along with the presence of out of pit dumps and associated machinery, are likely to cause some of the most prominent sources of impacts within the Project Site. From a landscape character perspective, this is due to the contrast between the Project’s footprint and the surrounding rural landscape. However, visual impacts are likely to be associated with size and height of the out of pit spoil dumps and the machinery that is used to create them and transfer overburden materials.
Open cut coal extraction, open cut pits and coal seam recovery	The extraction of coal from the open cut pits is known as the coal recovery processes. The process is anticipated to result in cleaning the top of the coal seam with dozers as well as recovering the seam by excavator/truck fleet. Furthermore, excavators and trucks would be used to remove inter-burden. Changes to landscape character and visual amenity are likely to occur where the colour and landform of the Project Site would be in contrast to the surrounding undisturbed landscape.
ROM stockpiles	Coal stockpiles would continuously change in size and form.
Rehabilitation	Progressive rehabilitation is proposed throughout the life of the Project in accordance with the strategy implemented at the existing Rolleston Coal Mine. The final land use objectives would be stable and self-sustainable native grass and woodlands consistent with the surrounding undisturbed areas. The process would concentrate on the collection of topsoil resources prior to disturbance for future rehabilitation activities, and the detailed design and construction of mined landforms that promote spoil stabilisation. As rehabilitation is undertaken it is likely that machinery and staff would be present in these parts of the Project Site. This is likely to involve re-grading, planting and maintenance. Rehabilitated landscapes are unlikely to look the same as they did prior to the existence of the Rolleston Coal Mine. However, they would blend more consistently into their wider surroundings than they would if left un-rehabilitated. Initially the colour of the freshly germinated seed may be visibly greener than the surrounding pasturelands but would quickly blend into the wider landscape.

6.6.6.1 Landscape character type assessment

An assessment of the potential impacts on landscape character is provided in the LVIA (refer Appendix D-4). A summary of the sensitivity, magnitude of change and overall significance of potential impacts to landscape character is provided in Table 6-22.

Table 6-22 Summary of likely impacts to landscape character

Receptor	Sensitivity of receptor	Magnitude of change	Level of adverse impact	Significance of impact
Construction				
LCT A within the Project Site	Medium	High	Moderate to Major	Significant
LCT A adjacent to the Project Site	Medium	Medium	Moderate	Not Significant
LCT B	Low	Medium	Minor to Moderate	Not Significant
LCT C	Medium	Negligible	Minor	Not Significant
LCT D	Low	Low	Minor	Not Significant
Operation				
LCT A within the Project Site	Medium	High	Moderate to Major	Significant
LCT A adjacent to the Project Site	Medium	Medium	Moderate	Not Significant
LCT B	Low	Medium	Minor to Moderate	Not Significant
LCT C	Medium	Negligible	Minor	Not Significant
LCT D	Low	Low	Minor	Not Significant
Decommissioning				
LCT A within the Project Site	Medium	Medium	Moderate	Not Significant
LCT A adjacent to the Project Site	Medium	Medium	Moderate	Not Significant
LCT B	Low	Medium	Minor to Moderate	Not Significant
LCT C	Medium	Negligible	Minor	Not Significant
LCT D	Low	Low	Minor	Not Significant

6.6.6.2 Viewpoint assessment

Viewpoint assessments have been undertaken that focus on sensitivity, magnitude of change and overall significance of impact. An assessment of the anticipated impacts is provided in Appendix D-4 and summarised in Table 6-23.

Table 6-23 Summary of impacts to visual amenity

Viewpoint receptor	Viewpoint description	Sensitivity of receptor	Magnitude of change to receptor	Level of adverse impact	Significance of impact
Construction					
VP01	Dawson Highway – looking south from Inderi Farm entrance	Low	Negligible	Minor to Negligible	Not Significant
VP02	Dawson Highway – looking west from entrance to Albinia Downs	Low	Negligible	Minor to Negligible	Not Significant

Viewpoint receptor	Viewpoint description	Sensitivity of receptor	Magnitude of change to receptor	Level of adverse impact	Significance of impact
VP03	Bottle Tree Downs Road – perpendicular to Dawson Highway	Low	Negligible	Minor to Negligible	Not Significant
VP04	Dawson Highway Lay-by	Low	Negligible	Minor to Negligible	Not Significant
VP05	Bottle Tree Downs	Medium	Negligible	Minor	Not Significant
VP06	*Springwood Road – entry to Springwood Homestead	Medium	Low	Minor to moderate	Not Significant
VP07	*Springwood Homestead	Medium	Negligible	Minor	Not Significant
VP08	*Springwood property (western section)	Medium	Low	Minor to moderate	Not Significant
Operation					
VP01	Dawson Highway – looking south from Inderi Farm entrance	Low	Negligible	Minor to Negligible	Not Significant
VP02	Dawson Highway – looking west from entrance to Albinia Downs	Low	Negligible	Minor to Negligible	Not Significant
VP03	Bottle Tree Downs Road – perpendicular to Dawson Highway	Low	Negligible	Minor to Negligible	Not Significant
VP04	Dawson Highway Lay-by	Low	Negligible	Minor to Negligible	Not Significant
VP05	Bottle Tree Downs	Medium	Negligible	Minor	Not Significant
VP06	*Springwood Road – entry to Springwood Homestead	Medium	Low	Minor to moderate	Not Significant
VP07	*Springwood Homestead	Medium	Negligible	Minor	Not Significant
VP08	*Springwood property (western section)	Medium	Low	Minor to moderate	Not Significant
Decommissioning					
VP01	Dawson Highway – looking south from Inderi Farm entrance	Low	Negligible	Minor to negligible	Not Significant
VP02	Dawson Highway – looking west from entrance to Albinia Downs	Low	Negligible	No impact	Not Significant
VP03	Bottle Tree Downs Road – perpendicular to Dawson Highway	Low	Negligible	No impact	Not Significant
VP04	Dawson Highway Lay-by	Low	Negligible	No impact	Not Significant
VP05	Bottle Tree Downs	Medium	Negligible	Minor	Not Significant

Viewpoint receptor	Viewpoint description	Sensitivity of receptor	Magnitude of change to receptor	Level of adverse impact	Significance of impact
VP06	*Springwood Road – entry to Springwood Homestead	Medium	Low	Minor to moderate beneficial (compared to existing situation)	Not Significant
VP07	*Springwood Homestead	Medium	Negligible	Minor	Not Significant
VP08	*Springwood property (western section)	Medium	Low	Minor	Not Significant

* Part of the property (and by mutual agreement with the owners) has been acquired by Xstrata Coal Queensland.

6.6.6.3 Lighting

An analysis of visual sensitivity, based on proximity and sensitivity has been undertaken prior to judgements being made on the potential magnitude of change that may be experienced. The magnitude of change is established by comparing existing lighting conditions to the potential lighting conditions that may occur as a result of the Project. An evaluation of significance is then drawn based on sensitivity and the magnitude of change that would be experienced at each representative viewpoint.

Two night time VPs (refer Appendix D-1 for locations) have been used to inform the lighting impact assessment. A summary of anticipated impacts on visual amenity associated with lighting is provided in Table 6-24. More detailed assessment to lighting is provided in Appendix D-4.

Table 6-24 Summary of lighting impacts

Receptor	Description of receptor	Sensitivity of receptor	Magnitude of change of receptor	Level of impact	Significance of impact
VP09 Existing viewpoint viewing the mine	Night viewpoint looking north east from Springwood Road*	Low	Low	Minor beneficial	Not Significant
VP09 Future viewpoints viewing the proposed mine expansion from similar locations	Night viewpoint looking north east from Springwood Road*	Low	Low	Minor adverse	Not Significant
VP10 Existing viewpoint viewing the mine	Night viewpoint looking north from entry to Springwood Homestead*	Negligible	Low	Minor beneficial	Not Significant
VP10 Future viewpoints viewing the proposed mine expansion from similar locations	Night viewpoint looking north from entry to Springwood Homestead*	Negligible	Low	Minor adverse	Not Significant

* Part of the property (and by mutual agreement with the owners) has been acquired by Xstrata Coal Queensland.

6.7 Mitigation measures

6.7.1 Existing Rolleston Coal Mine plans and procedures

Construction and operation of the existing Rolleston Coal Mine is managed under an Environmental Management System which includes various management plans and procedures to minimise the potential for environmental impacts both on and off site.

These documents have proven to be effective in managing land based environmental values and would be amended post approval; thereby allowing existing processes to be applied to the Project. An overview of plans, procedures and guidelines relevant to the management of land is provided in the following sections.

6.7.1.1 Life of Mine Plan

The Rolleston Coal Mine *Life of Mine Plan* (LOMP) is a long range operational feasibility and strategies document that provides a benchmark for site departments to develop their more detailed plans and schedules. The LOMP incorporates site specific inputs from the resource model and production profile that ultimately contribute to the development of production schedules. Furthermore, and specifically in terms of effective resource utilisation, exploration is undertaken in line with recognised standards to determine the location of viable deposits. This guides the location of waste dumps and provides confidence that in situ reserves are not sterilised.

6.7.1.2 Plan of Operations

The *Plan of Operations* is prepared pursuant to Part 12, Division 1 of the EP Act and describes the actions and programs in order to achieve compliance with the conditions of the Rolleston Coal Mine Environmental Authority (EA). The *Plan of Operations* includes:

- Descriptions of all mining activities during the period of *the Plan of Operations*.
- Proposed action programs for complying with EA conditions and implementing the relevant control strategies.
- Proposed rehabilitation programs for land significantly disturbed or proposed to be significantly disturbed during the period of the *Plan of Operations*.
- Calculations of maximum financial assurance for the mining project during the term of the *Plan of Operations*.

The Plan of Operations is updated annually and subject to external audits to provide compliance against the EA. The method of calculation for Financial Assurance is also subject to external audit to verify its accuracy.

6.7.1.3 Rolleston Coal Environmental Management Plan

The *Environmental Management Plan* is an approved plan that is currently used to manage environmental impacts on the existing Rolleston Coal Mine. The Plan provides mitigation and management techniques for potential land impacts relating to:

- Mineral resources and ore reserves.
- Land use and suitability.
- Land disturbance.
- Geology and soils.
- Contaminated land.
- Landscape character and visual amenity.

The *Environmental Management Plan* will detail key commitments that would apply to the Project including:

- Limit disturbance only to that which is necessary and within the Project Footprint.
- All rehabilitation works to meet the design criteria.
- Topsoil resources would be appropriately mapped in terms of type and quality with sufficient quantities stockpiled for rehabilitation.
- Rehabilitation designs would incorporate strategies to manage limitations from poor quality spoil.

- Appropriate erosion and sediment control works would be incorporated as/if required.
- Progressive rehabilitation must commence within three years of availability of areas larger than 5 ha.
- Rehabilitation of mine areas using cracking black clay topsoil would aim to complement the Albinia National Park's objectives to facilitate regional conservation of the Endangered Ecological Community (EEC) Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin under the EPBC Act.
- Storage of potentially hazardous waste products (sludges and residues) would be contained within signed, weatherproofed, sealed and bunded areas prior to disposal to a suitable location.
- Inspections would be carried out regularly to ensure the integrity of all storage containers and compliance to regulatory frameworks.
- In accordance with the existing Rolleston Coal Mine's *Hydrocarbon Spill Procedure*, all spills and leaks would be cleaned up immediately, with the contamination source investigated and preventative measures undertaken.
- A well maintained spill kit including personal protective equipment would be readily available at locations near where hazardous materials and used and stored.
- All employees and contractors would be familiar with spill response plans implemented across the Project Site.

As a result of amendments to the EP Act, the Environmental Management Plan will be subject to transitional arrangements.

6.7.1.4 Biodiversity and Land Management Plan

The *Biodiversity and Land Management Plan* has been developed to manage the biological integrity of the Rolleston Coal Mine and surrounding areas during and after operations. In the context of land based values, the plan contains procedures and references to other relevant site plans to manage potential impacts related to:

- Land use, topography and soils.
- Land contamination.

The following actions are prescribed within the *Biodiversity and Land Management Plan* to manage impacts on land within the Rolleston Coal Mine site and would be updated to include the Project.

- Soil movement would be managed so that minimal impacts on biodiversity occur.
- Bunding would occur for all flammable and combustible liquids as per Australian Standard 1940 *Storage and Handling of Flammable and Combustible Liquids of 2004.*

6.7.1.5 Rehabilitation Management Plan

The *Rolleston Coal Mine Rehabilitation Management Plan* details rehabilitation strategies that are specific to the existing mine site; however the objectives for rehabilitation are uniform across the State. The Queensland Government requires that land disturbed by mining is rehabilitated so that it is:

- Safe to humans and wildlife.
- Non-polluting.
- Stable.
- Able to sustain an agreed post-mining land use.

For the existing mine, the above objectives are clarified within conditions of the EA, as issued under the EP Act. The *Rolleston Coal Mine Rehabilitation Management Plan* (detailed further in Chapter 4 Decommissioning and Rehabilitation) is the primary document that has been developed by Xstrata Coal Queensland to comply with these requirements.

In terms of land values, the *Rolleston Coal Mine Rehabilitation Management Plan* provides mitigation and management actions that cover the following potential impacts:

- Land use and suitability.
- Land disturbance.

- Geology and soils.
- Contaminated land.
- Landscape character and visual amenity.

Key actions or desired outcomes within this plan include:

- Land is left in a safe, stable condition that promotes post-mining land use such as grazing.
- Overburden dumps undulate and are comparable with regional landforms.
- Water infrastructure dams and mine voids provide beneficial uses, including the supply of water for stock.
- Resultant landforms don't pose a threat to the health and safety of local communities or the environment, providing appropriate controls are in place to prevent unauthorised or unsafe access.
- Rehabilitation and mine closure practices are in accordance with the requirements of the Environmental Authority.

For an overview of rehabilitation and post-closure land use, including an assessment of factors favouring or limiting rehabilitation, post mining land form and rehabilitation success criteria, refer to Chapter 4 Decommissioning and Rehabilitation.

6.7.1.6 Cover Material Management Guideline

The *Cover Material Management Guideline* documents the conservation and management of this resource to meet post mining objectives. The guideline provides mitigation and management procedures for the following potential land impacts:

- Land use and suitability.
- Land disturbance.
- Erosion and stability.
- Landscape character and visual amenity.

The majority of stripped topsoil will be placed directly on to reshaped overburden dumps. Any stockpiled topsoil would also be used as rehabilitation and cover media. The stockpiles, although an important part of the life-cycle management approach taken in conserving natural resources on-site, can present erosion, sedimentation and stability risks if not managed appropriately. The control and mitigation measures for reducing the risk from the stockpiles include the following:

- Where possible, preferential direct placement of stripped topsoil on reshaped spoil areas during rehabilitation, as opposed to stockpiling.
- Stockpiles would not be located within an overland flow path where possible.
- If required, a flow diversion bank would be constructed upstream to direct the run-off around the stockpile.
- Run-off from the stockpile would be directed to appropriate sediment-controlling structures or facilities.
- Where required, stockpiles would be seeded to provide vegetation cover to limit erosion potential, if stockpile hasn't self-vegetated after one wet season.

The *Cover Material Management Guideline* requires the following actions with regards to the management of land at the existing Rolleston Coal Mine site and would be updated for the Project:

- Identify the type and characteristics of the topsoil and its suitability for re-use.
- Obtain a permit to disturb from the Environment and Community Manager.
- Where practical, topsoil stockpiles are to remain below 4 m in height and with a maximum batter grade of 1 in 3.
- Maintain an inventory of topsoil stockpiled against the volume required for rehabilitation based on the area of disturbance.
- Stockpiles to be surveyed and volumes recorded annually.

6.7.1.7 Disturbance of Land Procedure

This procedure outlines the process to be followed prior to disturbing land within the Rolleston Coal Mine site. It is an internal form of regulation that requires an authority (a 'Permit to Disturb') to be issued from the Environment and Community Manager prior to ground disturbance activities.

This involves an assessment of risk and compliance to ensure the disturbance is consistent with statutory approvals and that all necessary controls have been provided or proposed.

Contamination

The history of the Project Site has been reviewed through historical title searches and aerial photography to determine the likelihood of actual or potential contamination. The review did not identify any potential sites within the Project Footprint that may suggest the presence of significant contamination. Detailed site investigations were, therefore, not considered necessary.

Should contamination sources be identified within the Project Footprint, a range of measures are available to manage any potential adverse impacts on human or environmental health. Where necessary, the following options will be implemented prior to the Project development:

- Undertake environmental assessments on potentially contaminated sites that will be impacted through the operational stages of the Project.
- Directing excavation works, spoil or topsoil storage during planned operations and remediation to avoid potentially contaminated areas.
- Plan the drainage of the site to minimise the run-off that occurs near or across potentially contaminated land.
- Once the detailed design phase of the Project has been finalised, a more detailed environmental assessment on potentially contaminated sites may be undertaken, if required.

A detailed site investigation will be undertaken if construction activities are to be completed in areas where gross visual or contamination is identified. The objective of this investigation would be to identify the location, extent and nature of contamination that will potentially be encountered during Project works. Contamination is considered significant if the current condition is likely to result in unacceptable levels of human exposure or environmental impacts. A management and remediation plan will then be developed in order to minimise the impact of these contaminants.

Management and control of chemical storage is an important consideration in controlling the potential for contamination events to occur. The measures and controls to be implemented are discussed in Chapter 20 Hazard and Risk.

Activities undertaken as part of operations that have the potential to cause land degradation would only be executed under approved conditions of the EA that would minimise the potential for harm to human or environmental health. In addition, site specific environmental management would be implemented across the Project Site. This is expected to include, but is not limited to the following mitigation and management actions, to significantly reduce the potential for land contamination:

- All storage areas for chemicals, oils, fuels, solvents and other potentially hazardous materials would have adequate signage and comply with Australian Standards. All storage and handling areas would be sufficiently bunded and constructed to minimise the potential for leaks to reduce harm to the environment.
- The storage, handling and use of chemicals would adhere to the provisions outlined in the relevant Materials Safety Data Sheet (MSDS).
- All potentially hazardous materials would be transported in accordance with the Australian Code for the Transportation of Dangerous Goods by Road and Rails (ADG) Code.
- Monitoring of environmental practices would be undertaken across the Project Site through regular site inspections. Environmental sampling and monitoring may be required to identify the level of contamination present, or used to track decontamination progress.
- Potential contamination containment sources (coal handling facility, oily water separators etc.) would be located away from existing watercourses and overland catchment areas where possible.

- Drainage systems would be implemented to divert potentially contaminated surface water away from exposed soil, and contain it within a designated land area to minimise the potential for soil contamination and future remediation requirements.
- Where applicable, site workers would be trained in visually identifying gross contamination. Workers would be familiar with response strategies or else would contact the site environmental officer.

6.7.1.8 Pest Management Plan

The purpose of the *Pest Management Plan* is to reduce the risk of environmental harm caused by pests and to comply with applicable statutory requirements regarding pest management. The risks associated with pests at the Rolleston Coal Mine have been identified and are documented in an Environmental Risk Register which would continue to be utilised for the Project.

The key objectives of the Plan are to:

- Reduce the extent and/or density of pest infestations on land under the control of Rolleston Coal.
- Control the spread of pests from on land under the control of Rolleston Coal to other areas.
- To prevent the establishment of new pest species on or around the Mining Lease area.

Pesticides and herbicides would be applied by a trained professional. Where applicable, weed management and clearing techniques would be adopted so that potential impacts on environmental indicators would be minimised or avoided, wherever practicable. The *Pest Management Plan* identifies procedures to manage the removal/control of pest species in accordance with Department of Primary Industries (DPI) Pest Facts Sheet.

6.7.1.9 Water Management Plan

One of the objectives of the *Water Management Plan* is to provide facilities and procedures to enable the Rolleston Coal Mine to meet the water quality conditions stipulated in the EA. This includes a sediment system that is designed to discharge runoff from rehabilitated areas to the environment in accordance with the EA conditions.

The *Water Management Plan* and the *Rolleston Coal Environmental Management Plan* provide the necessary mitigation and management measures to effectively control the following potential impacts to Land values:

- Land disturbance, including the appropriate design of diversions and sediment dams.
- Land degradation, including potential for contamination.
- Erosion and stability.

6.7.1.10 Maintenance Management Plan

In accordance with the Rolleston Coal Mine *Maintenance Management Plan*, regular maintenance and testing schedules for equipment would be carried out to provide reliable performance and prevent spills of mechanical oils and lubricants. Ignition sources would be strictly controlled to reduce the likelihood of fires. This plan minimises the potential for land degradation caused by contamination.

6.7.2 Additional mitigation for the Project

6.7.2.1 Land use and suitability

Strategic cropping land

Measures to avoid and minimise impacts on SCL / the SCA have been considered during design of the Project. Given recent legislative changes, Glencore will proceed with the necessary assessment for impacts of the Project on areas of regional interest under the RPI Act. This is a distinct and separate process from the EIS. In the case of the Project, assessment will be required in relation to the PAA and areas of PALU. Areas of PALU largely overlap the mapped SCA within the Project Site. Glencore will comply with all requirements of the relevant state legislation as in effect at the relevant times for the Project.

Stock routes

Such impacts, if they were to occur, would be minimised through simultaneous opening and closing of the new and old road corridor (refer Chapter 7 Transport) as well as public notification of the pending road work.

This process and the authority to realign Springwood Road (and associated stock route) would be undertaken in accordance with the *Land Act 1994, Local Government Act 2009* and *Transport Infrastructure Act 1994* and would be coordinated through the Department of Transport and Main Roads, DNRM and CHRC. Consideration would also be given to *Land Dealings affecting the Stock Route Network*, as published by the State Land Asset Management Unit.

Fossil specimen management

There is a potential for fossilised material to be discovered during mining activities on the Project Site. It is anticipated that most fossils uncovered by mining activities would be common. If a large potential fossil is discovered during mining activities, then work in the vicinity of the find would stop, to preserve the potential fossil, while the Queensland Museum is alerted to the find.

6.7.2.2 Land degradation

All existing controls and process that are currently undertaken as part of the existing Rolleston Coal Mine operation for contamination will be updated to include the new areas of planned disturbance as a result of the Project. Any new facilities requiring the storage and handling of flammable and combustible liquids will be designed and installed to comply with AS1940.

6.7.2.3 Erosion and stability

Land cleared of vegetation

The majority of land at the Project Site has already been cleared for grazing purposes and few trees remain. In areas that have been cleared for grazing, significant pasture ground cover remains resulting in minimal potential for erosion caused by increased water runoff. Additional clearing of trees is likely to be minimal and would be carried out in accordance with the *Disturbance of Land Procedure* and *Vegetation Management Guideline* established for the existing Rolleston Coal Mine. The additional control and mitigation measures that would be applied to limit the effects of clearing include the following principles of operation:

- Progressive clearing, restricting clearing to areas of imminent development.
- Minimise length of time bare ground is exposed should stockpiling of topsoil be undertaken.
- Undertake clearing outside the wet season, where possible.
- Prevent run-off from undisturbed areas flowing over cleared land.
- Direct run-off from cleared land to appropriate sediment-controlling structures or facilities.

Waste dumps

The following mitigation and controls would be adopted to protect the integrity of the dumps and the downstream environment:

- Outer dump slopes would be designed at no greater than 16% slope (also known as 1V:6H) until site specific trials indicate alternative design options. The outer pit dump slopes would have maximum slope lengths with erosion control measures conforming to current guidelines and external slopes would drain to sedimentation dams.
- The surface of waste dumps would be shaped to an undulating landform to promote a self-sustaining ecosystem compatible with the surrounding environment. Surface run-off would be directed towards drainage channels that minimise erosion.
- Surface drainage would be controlled to minimise the formation of active gullies.
- Placement of sodic waste material on final external batters would be avoided.

The combination of upstream control design and downstream water quality monitoring would be used to give cyclic feedback on the effectiveness of the environmental management techniques used to limit downstream impacts upon waterways.

The drainage channels, overland water flow and sedimentation dams would also be engineered to prevent the land disturbed by Project activities from increasing sediment loads in local waterways. Details of the preliminary design of water infrastructure, water modelling and water management systems preventing and minimising erosion and sedimentation are contained in Chapter 9 Surface Water.

Building/plant sites

The mitigation and control of erosion and sedimentation risks in these areas are generally covered by compliance with building codes and construction by Australian Standards, utilising the following principles of construction and operation:

- Follow suggested methods of land clearance and topsoil handling prior to and throughout construction, including temporary diversion and drainage construction.
- Disturbed areas would be stabilised as quickly as practical to limit erosion, with progressive revegetation undertaken.
- Once operational, buildings and paved areas would have sufficient surface drainage channels and controls to prevent runoff eroding adjacent areas.
- Appropriate erosion control measures and bunding of areas storing or utilising fuels, oils and other potential contaminants, especially works near waterways and drainage lines to provide minimal impacts to downstream aquatic communities.

Access roads and transport corridors

The mitigation of these impacts would be considered when designing, planning and maintaining the haul routes across the Project Site. The control measures to be incorporated into erosion or sediment control procedures for roads and transport corridors would include:

- Follow suggested methods of land clearance and topsoil management prior to and throughout construction, including temporary diversion and drainage construction.
- Once operational, access/haul roads would have sufficient surface drainage to prevent run-off eroding the road or adjacent areas.
- Road-side drains would direct sediment flow to an appropriate sediment processing or holding structure on-site.
- Adherence to controls in Chapter 11 Air Quality for minimising airborne dust propagation across site and off-site.

Water supply pipeline and electricity transmission corridors

The potentially impacting activities would be mitigated and controlled from an erosion perspective by adhering to the following governing principles of environmental and construction management:

- Clear progressively, restricting clearing to areas to be imminently developed.
- Disturbed areas would be stabilised as quickly as practical to limit erosion, with progressive revegetation undertaken.
- Construct according to the approved schedule by suitably trained and inducted contractors or employees, taking into account the continual temporary construction of sediment controls.

Final landform and rehabilitation

Chapter 4 Decommissioning and Rehabilitation provides the approach to rehabilitation which aims to ensure erosion sedimentation and stability impacts are suitably managed. In summary the following objectives would be applied to the Project:

- The low wall of final voids would remain as dumped (angle of repose) and would be benched as required. The wall drains internally into the final void.
- Post-mining landform run-off would be directed away from the final void, as steep slopes and length of fall to the bottom of the final void has the potential to scour and erode. Water would drain into a series of sediment basins located around the rehabilitated spoil dump where sediment may settle prior to entering the local catchments.
- Seed and fertiliser would be applied as necessary to provide rapid re-establishment of grasses and native trees.
- A stormwater diversion drain shall be designed and installed to divert clean water from disturbance areas.
- Prior to reaching establishment criteria, surface run-off from all rehabilitated areas would pass through sediment control structures to reduce the sediment loads reporting to waterways downstream of the Project Site.
- Final voids within the project area will be incorporated into the existing site Final Void Management Plan. Dispersive and non-dispersive spoil would be identified to provide either appropriate selective placement in the post mining landform or treatment prior to rehabilitation. The relevant identification and selective placement procedures would be included in the site *Rehabilitation Management Plan*.

6.7.3 Landscape character and visual amenity

Mitigation measures to reduce and manage the impact on landscape character and visual amenity are divided into two categories:

- At site treatments: planning, design, mitigation and rehabilitation treatments that would lower the impact of the Project on the receiving environment and/or receptors. These measures relate to opportunities to decrease the impact of particular phases or activities on the wider landscape.

A summary of the 'at site' mitigation measures is presented in Table 6-25. A detailed discussion on appropriate 'at site' mitigation measures can be found in the LVIA Technical Report (Appendix D-4).

Table 6-25 At site mitigation measures

Mine element	Mitigation measure
Construction / Operation	
Vegetation removal	Vegetation would remain in-situ for the greatest length of time possible prior to removal to retain the screening effects for as long as possible.
Diversions	Stream diversions would be designed to produce stable watercourses, with reinstatement of appropriate riparian habitat.
Stripping of topsoil from Project Site and storage	Immediate reuse of stripped topsoil for on-going rehabilitation works to maximise the potential of the stored seed bank. Management in accordance with the *Rehabilitation Management Plan.* Minimise the height of topsoil stockpiles to the greatest extent possible should stockpiling be required. Seeding of topsoil stockpiles if required using appropriate grass species.
Removal of overburden and creation of overburden dumps	Management in accordance with the *Rehabilitation Management Plan.* Establish stable vegetated overburden dumps where these would be beneficial to provide screening of mine activities, including minimising light spill. Where overburden dumps are anticipated to remain following pit closure, they would, wherever possible, mimic local landforms to the greatest extent possible during establishment to minimise re-work. Where re-work of overburden dumps is unavoidable, rapid stabilisation using seeding of appropriate species would be undertaken.
Open cut coal extraction, open cut pits and coal seam recovery	Rehabilitation of mined-out areas would occur.

Mine element	Mitigation measure
Lighting associated with permanent facilities and moving plant (including dragline excavators)	The number of lights would be kept to the minimum needed to meet operational health and safety requirements. Light spill would be contained to the greatest extent possible (e.g. by using directional lighting wherever possible).
General Site Landscape	The Project Site would be maintained in good condition, particularly adjacent to neighbouring properties.
Rehabilitation	
Progressive Rehabilitation	Restoration processes would commence progressively as soon as possible following completion of mining activities in any given area. Seek to emulate pre-operation landforms to the greatest extent possible using naturally flowing contours that integrate smoothly into undisturbed areas.

No actions to manage the impacts on individual affected landholders are proposed.

6.8 Residual impacts

Residual impacts are those that consider the risk to land based values following the application of mitigation and management measures. This chapter has considered the risks and potential impacts to land based environmental values as a result of the Project and the outcome of the various assessments have shown that there are high risk activities that require mitigation to reduce potential impacts to an acceptable level. The following sections outline the residual impact for each identified impact once mitigation has been implemented.

6.8.1 Resource utilisation

The continual monitoring and evaluation of resources is already considered as part of the existing Rolleston Coal Mine's operation, and would continue to be considered and evaluated through the Project's various phases. The residual impact on resource wastage or sterilisation is therefore considered to be low and not significant.

6.8.2 Land use

Strategic cropping land

A reduced disturbance footprint following detailed design would result in a much smaller area of SCL/the SCA or PAA to be impacted for construction and operation of the Project. Glencore anticipates additional requirements for any impacts to areas of regional interest may also arise from the assessment and approval process now required to be conducted under the RPI Act. At this stage, residual impact to the SCA and PAA are considered to be minor and not significant.

Stock routes

Residual impacts to stock routes, specifically Springwood Road, are considered to be negligible and not significant following the implementation of mitigation and consultation with DNRM, CHRC and other relevant stakeholders.

6.8.3 Land disturbance

A suitable rehabilitation strategy would be implemented to limit the impacts of erosion, sterilisation, vegetation clearance, and general disturbance and to guide the progressive rehabilitation and ongoing reduction of the land disturbance footprint. The rehabilitation strategy also covers all strategic aspects of the progressive rehabilitation and post-mine operation of the Project Site. Although disturbance of land cannot be avoided, residual impacts are considered to be minor and not significant following application of the strategy throughout the life of the mine and acceptable in terms of this environmental impact assessment.

6.8.4 Land degradation

Impacts as a result of contamination incidents causing land degradation are considered to be unlikely with the application of mitigation and control measures. The residual impact to land based environmental values as a result of land degradation is therefore considered to be minor and not significant in terms of this environmental impact assessment.

6.8.5 Erosion and stability

In terms of erosion and sediment control, the following potential impacts were considered to present a risk to land based values:

- Land cleared of vegetation.
- Waste dumps.
- Dams, banks and creek crossings.
- Building/plant sites.
- Access roads and transport corridors.
- Water supply pipeline and electricity transmission corridors.
- Final landform.

Following the application of mitigation outlined in Section 6.7, particularly in consideration of the already established plans, procedures and guidelines at the existing Rolleston Coal Mine that would be applied to the Project, the residual risk to land based values as a result of erosion and sedimentation is considered to be low and not significant in terms of this environmental impact assessment.

6.8.6 Landscape character and visual amenity

Although a number of reasonable mitigation measures would be applied to help reduce the extent of the Project's effect on landscape character and visual amenity, such mitigation measures are considered unlikely to significantly alter the level of impact assessed in Section 6.6.6. Subsequently, the residual impacts are considered to mimic the pre-mitigation impacts and are not considered to be significant in terms of this environmental impact assessment.

6.8.7 Cumulative impacts

Cumulative impacts of the Project on land values were considered relative to surrounding land use, current and proposed. Assessment indicated that land use values in the local area is predominantly related to agriculture and grazing. Development proposed (refer Table 6-26) in the area includes mining and the extraction of gas.

Table 6-26 Other proposals located near the Project Site

Tenement	Project name	Holder	Status	Location (distance from Project Site)
ML70167	Humboldt	South Blackwater Coal Pty Ltd	Granted	50 km north-east
ML70149	Togara North	Enex Togara Pty Ltd	Granted	60 km north
ML70486	Springsure Creek Coal Mine	Springsure Creek Coal Pty Ltd	Application	40 km north
MLA70452	Meteor Downs South	U&D Mining Industry	Application	0 km west
PL231	Pipeline	Victoria Oil	Granted	20 km south
PL173	Pipeline	Australia Pacific LNG	Granted	20 km north-west
PL42	Pipeline	Australia Pacific LNG	Granted	10 km east

Limited information is available on the projects listed in Table 6-26. However, it is considered likely that cumulative impacts relating to land based environmental values would largely relate to loss of agricultural land. In this instance, the Project would result in an in-combination impact for the region. However, the level of similar, suitable agricultural land is relatively common in the surrounding Central Highlands region, and more broadly the Central Queensland region, and therefore the Project is not considered to represent a significant adverse impact to this land type at the local or regional scale. Furthermore, with progressive rehabilitation, the impacts will be managed with the Project Site eventually returning to grazing, the pre-mining land-use over much of the area. Therefore, post mining residual impacts are likely to be negligible and not significantly contribute to cumulative impacts in the region.

An MLA by U&D Mining Industry has been made for the 'Meteor Downs South' open cut project on MLA70452 (U&D Mining Industries, 2013). The proposal is a greenfield coal mine, exporting up to 1.5 Mt per annum of thermal coal product through a link to Aurizon's Bauhinia rail network over an approximately 10 year mine life. Should this proposal go ahead, there would be an in-combination impact with the Project. However, given the relatively small scale of the proposed operation and the likelihood that the same mitigation and control measures would be applied to the Meteor Downs South proposal to protect land based environmental values, residual cumulative impacts are considered to be low and therefore not significant in terms of environmental impact assessment.

6.9 Summary and conclusions

This chapter has outlined the land based environmental values that would be affected by the Project. Due to the nature of the Project, existing environmental values pertaining to land use would be altered. Assessments were therefore carried out on a range land based topics to appropriately define the baseline environment and consider the likely impacts to the receiving environment.

Several broad, land based topics were considered. These included: geology and geomorphology; mineral resources and ore reserves; land tenure and use; existing infrastructure; potential land degradation and likelihood of land contamination, land suitability and agriculture, alterations to existing stock routes, sensitive environmental areas, and landscape and visual amenity.

The Project Site is suitable for both mining and agricultural uses, with the surrounding land use being predominately pastoral and associated light agricultural industry.

The potential environmental impact on adjacent uses is largely limited due to the land disturbance and vegetation clearing occurring only within the Project Site's boundaries. In terms of future land uses, the CHRC planning scheme has not targeted the use of the Project Site for any conflicting or particular type of development.

The Project Site has been evaluated as containing areas of GQAL and some of these would be directly impacted due to the conversion of agricultural land to the proposed mining activities. Although the Project Site land is of a suitable quality for agricultural purposes, the level of suitability is relatively common in the surrounding Central Highlands and, more broadly, the Central Queensland region and is therefore not considered to present a significant impact.

The Project fell under the transitional arrangements of the SCL Act and is also an exempt resource activity for SCA under the RPI Act. The potential impact on the SCA and PAA as a result of the Project is considered to be minor, and will be considered under the RPI Act RIDA application and assessment process as required. The impact assessment using mapping undertaken for this Project indicates that the total potential impact on SCL/the SCA may be as little as 257 ha depending on which road deviation option is taken forward. This estimated area of impact requires validation under the assessment process.

An assessment into erosion risks as a result of the Project's activities considered that residual risks were low following the application of suitable mitigation and control measures.

An unavoidable significant impact on landscape character would occur within the Project Site. However, no significant impacts were considered likely on LCT outside the Project Site. An assessment into visual amenity and lighting was conducted at nearby sensitive receptors. The assessment considered that minor to moderate adverse impacts are likely to occur. However, impacts were not considered significant.

The chapter has demonstrated that although high risk activities would occur which have the potential to impact on land based environmental values, the application of mitigation and control measures where appropriate, as well as adherence to existing Rolleston Coal Mine plans and procedures, reduces the residual risks to an acceptable level in terms of this environmental impact assessment.

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