

**Environmental Impact Statement (EIS)
assessment report under the
*Environmental Protection Act 1994***

Moranbah South Project
proposed by Anglo American Metallurgical Coal Pty Ltd

Prepared by: Statewide Environmental Assessments, Department of Environment and Heritage Protection

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1 Introduction

This report provides an evaluation of the environmental impact statement (EIS) process pursuant to Chapter 3 of the *Environmental Protection Act 1994* (EP Act) for the Moranbah South Project proposed as a 50:50 unincorporated Joint Venture between Anglo Coal (Grosvenor) Pty Ltd and Exxaro Australia Pty Ltd. Anglo American Metallurgical Coal Pty Ltd is the manager of the proposed project. As of the date of this report no application under section 154 of the EP Act for an environmental authority (EA) has been made. On 16 March 2012, the proponent applied under sections 70 and 71 of the EP Act for approval to voluntarily prepare an EIS. Under section 72 of the EP Act, the Department of Environment and Heritage Protection (EHP) approved the application. The draft terms of reference (TOR) were publicly advertised in June 2012 for comment. Following this public consultation, the TOR were finalised on 8 October 2012.

On 24 May 2012 the project was declared a controlled action under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), including that it be assessed through the EP Act EIS process under the agreement between the Commonwealth of Australia and the State of Queensland (the bilateral agreement) relating to environmental impact assessment. The controlling provisions are sections 18 and 18A (listed threatened species and communities) and sections 24D and 24E (impacts of coal seam gas development and large coal mining development on water resources). This report contains an assessment of the significance of impacts of the action on the controlling provisions. A copy of this report will be given to the Commonwealth Environment Minister, who will decide whether to approve or refuse the controlled action under Part 9 of the EPBC Act.

EHP, as the administering authority of the EP Act, coordinated the EIS process. This EIS assessment report (assessment report) has been prepared and completed pursuant to sections 58, 59 and 60 of the EP Act.

In meeting the requirements of the EP Act, this assessment report describes the proposed project, the places and values likely to be affected by the proposed project. It summarises the key issues associated with the potential adverse and beneficial environmental, economic and social impacts of the proposed project. It also discusses avoidance, planning, management, monitoring and other measures proposed to minimise adverse environmental impacts. Finally, this assessment report identifies those issues of particular concern that were not resolved or that require specific conditions for the proposed project to proceed.

Section 2 of this assessment report describes the proposed project in order to provide context for the findings of the report. Section 3 outlines the EIS process that was followed for the proposed project and the approvals that would be necessary for its commencement. Section 4 addresses the adequacy of the EIS documents in addressing the TOR, discusses the main issues with regard to the environmental management of the proposed project and outlines the environmental protection commitments made in the EIS documents. Section 5 discusses the suitability of the project and identifies outstanding matters required for the proposed project to proceed. Section 6 makes recommendations for conditions for any approval which would set out the operational environmental monitoring, management and reporting requirements for the proposed mine.

The giving of this assessment report to the proponent completes the EIS process for the Moranbah South Project under section 60 the EP Act.

2 Description of the project

2.1 Introduction

The proposed Moranbah South Project would include the construction and operation of an 18 million tonnes per annum (Mtpa) of run of mine (ROM) underground coal mine on a greenfield site in Central Queensland. The project proponent is a 50:50 unincorporated Joint Venture between Anglo Coal (Grosvenor) Pty Ltd and Exxaro Australia Pty Ltd. Anglo American Metallurgical Coal Pty Ltd is the manager of the project. Anglo American Metallurgical Coal Pty Ltd also has interests in the Moranbah North Mine and the Grosvenor Project near Moranbah. Anglo American is the second largest coal exporter in Australia, producing approximately 30Mtpa of saleable thermal and coking coal. Exxaro Australia Pty Ltd is a wholly owned subsidiary of Exxaro Resources Limited which is a South African-based mining group. Exxaro Resources Limited has a diverse portfolio of interests in coal, mineral sands, iron ore and base metals and is the second-largest South African coal producer, mining approximately 45Mtpa of thermal and coking coal. It currently has operational interests in South Africa, Namibia, Australia and China.

The proposed project would be located within parts of exploration permit coal (EPC) 602 and EPC 548, and mineral development licence (MDL) 277 (whole) and MDL 377 (part). The project site was described in the EIS as approximately 17,550 hectares (ha) in area. The MDLs and EPCs are held by the proponent or the joint venture partners. The proposed project would produce up to 14 million tonnes per annum (Mtpa) of high quality coking coal for the export market. Coal would be mined using two longwalls and a bord and pillar operation. The proposed project would target the Goonyella Middle seam. The proposed longwall mining area would be located in the central and southern part of the proposed project site, where the coal seam was found to be deeper. Longwall panels would be approximately 410 metres (m) wide and vary in length from approximately 900m to 6.2 kilometres (km). The proposed extraction height of the Goonyella Middle seam would vary across the proposed project site, with a proposed maximum extraction height of 4.2m. The depth of the target coal seam in this area ranges from approximately 145m to 560m below surface level. The bord and pillar mining area would be in the northern part of the proposed project site.

2.2 Project site

The proposed project site (the area within which the proposed project would be located) would be located directly to the south of the township of Moranbah in Central Queensland, approximately 150km south-west of Mackay. The project site would be located in the Isaac Regional Council area. Project surface facilities were proposed to be located approximately 3km south-east of Moranbah. There are a number of existing and proposed coal mines adjacent to the proposed project site, including the Caval Ridge Project to the west, the Grosvenor Project to the north, the Isaac Plains South Project to the east (with the Isaac Plains South tenement partially overlapping a portion of the Moranbah South Project site), the Eagle Downs Project to the south-east and the Peak Downs Mine to the south.

The proposed project would cover an area of approximately 17,550ha of gently undulating land. Much of the project site has been cleared in the past, primarily for beef cattle grazing activities, although the site contained areas of open woodlands and natural grasslands. The project site is traversed by the Isaac River and its tributaries Grosvenor Creek and Cherwell Creek. Government mapping and ground-truthing confirmed the presence of Strategic Cropping Land (SCL) within the project site.

Current land use identified within the proposed project site included grazing, coal seam gas exploration and basalt quarrying operations. Arrow Energy's coal seam gas tenements cover the northern part of the project site, and Arrow Energy currently has a petroleum licence application for the central part of the project site. Arrow Energy also operates several explorations, development and appraisal coal seam gas wells within the proposed project site. There are two basalt quarry operations on the project site, the Quarrico Quarry Operation located on the north-western part of the project site; and the MCG Quarry Operation located on the southern part of the project site. Other key land uses included the operation of infrastructure (roads, powerlines and water / gas pipelines).

2.3 Underground mining

The proposed project would undertake two types of underground mining, namely longwall mining and bord and pillar mining.

2.3.1 Longwall mining

The proposed longwall mining would include a complex system of mining equipment that would incorporate hydraulic roof supports (called 'chocks' or 'shields'), coal cutting and coal transport equipment. The proposed conceptual Moranbah South mine longwall layout is shown in Figure 1. The proposed longwall panels would be approximately 410m wide and vary in length from approximately 0.9–6.2km. The proposed extraction height of the Goonyella Middle seam would vary across the project site, with a maximum extraction height of 4.2m proposed. The width of the proposed chain pillars (the coal left between the longwall panels) would be approximately 55m.

Longwall panels would be defined by access roadways that would be constructed around the perimeter of each longwall panel. These roadways would provide access for the installation of the longwall mining equipment, mine workers and equipment and services.

The longwall mining equipment (coal shearer) would travel back and forth across the width of the longwall panel, starting from the furthest point progressively removing the coal from the panel back to the main headings. The shearer would cut the coal from the coalface on each pass and would deliver the coal to a face conveyor that would run along the full length of the longwall. The face conveyor would transport the coal from the coalface to another conveyor in an access roadway. Coal would then be transported to the surface via a series of connecting underground conveyors.

The roof at coalface would be held up by a series of hydraulic roof supports. After each shear of coal is removed, the face conveyor, hydraulic roof supports and the shearer would move forward. The roof immediately above the mined seam would collapse into the void (called a 'goaf') that would be left as the roof supports progressively retreat through the panel. As the roof material collapses into the goaf behind the roof supports, the fracturing and settlement of the rocks would progress through the overlying strata and would result in the sagging and bending of the near surface rocks. This would result in the progressive formation of gentle trough-like depressions on the surface relative to the natural topography (called subsidence). The anticipated subsidence effect would move across the ground at approximately the same speed as the advance of the mining face, which would be typically up to 100m per week. The majority of subsidence at a point on the surface would occur within three months of undermining and all subsidence is generally completed within 12 months.

Mine access roadways would be developed to provide access to the longwalls for mine workers, ventilation and equipment. These roadways would be developed within the coal seam and are typically 5m wide and 3–4 m high.

2.3.2 Bord and pillar mining

The proposed bord and pillar mining method would involve dividing the target coal seam with underground roadway excavations into a regular block like array. Main headings (mined roadways) would be intersected at regular intervals by connecting cut-throughs (mined roadways perpendicular to the primary headings). The bords would be the headings and cut-throughs and the panel pillars would be blocks of coal bounded by the bords. The target coal seam in the bord and pillar mining area would be at a depth of between approximately 40 and 440m.

Mining would be carried out by a continuous miner (cutting machine) that loads coal onto a shuttle car which transports and loads the coal onto an underground conveyor belt system. Once a bord is excavated to the required distance, the continuous miner would move to the next mining area and roof support would be installed in the previous bord. The coal pillars would support the overlying strata as the bords would be mined and would remain in place after the completion of mining. The proposed roadways (bords) would be 6.5m wide while the coal pillars would be approximately 30 by 30 m. The mining height would be between 2 and 3m. The bord and pillar mine layout has been specifically designed with sufficient roadway and pillar strength and stability to ensure that there is no surface subsidence above the underground bord and pillar workings.

Mine access roadways would be developed to provide access to the bord and pillar mining area for mine workers, ventilation and equipment. The roadways would be constructed using continuous miners.

2.4 Mine infrastructure

The proposed mine surface facilities would include:

- box cuts providing access to the underground mine portals
- surface conveyors
- coal stockpiles
- coal preparation plant and associated equipment
- a conveyor for transporting dry rejects to the dry rejects emplacement area (DREA)
- emergency tailings cell
- rail loop and train loading facilities
- mine industrial area including:
 - administration buildings, bathhouse, employee facilities and car parks
 - workshop, warehouses, vehicle wash down, servicing and refuelling facilities
 - security, first aid, mine rescue and fire services facilities
- various sediment, raw and mine water storage dams
- power and water supply infrastructure
- buildings specifically associated with the bord and pillar operations, including a radio control centre, offices and employee facilities
- underground support facilities such as compressed air, ventilation shaft and mine air conditioners
- gas drainage plants.

The majority of the mine surface facilities would be located to the east of the Moranbah Airport (Figure 1). Coal would be washed and processed onsite, and product coal would be transported from site by rail. A sealed mine access road would be constructed from Moranbah Access Road to the mine surface facilities. The disturbance footprint of the mine surface facilities would be approximately 510ha (Figure 2).

Auxiliary mine surface facilities would be developed approximately 7km to the south-east of the primary mine surface facilities in approximately project year 11. These would cover a small area (approximately 20ha) and would include facilities such as a personnel and materials shaft, minor workshops and administration buildings. Minor surface facilities, such as ventilation shafts, underground communication cables, gas drainage and mine dewatering boreholes, would also be constructed progressively above the underground mining areas. The EIS stated that there would be considerable flexibility with respect to the location of these surface facilities. This would allow avoidance of waterways and other significant surface landscape features. Raw coal from the proposed project would be washed at the coal preparation plant, resulting in tailings and rejects. Tailings would be dewatered using belt presses and mixed with rejects. The resultant dry rejects material would be emplaced in the proposed DREA that is proposed to be located 3.5km to the south-east of the mine surface facilities. Rejects from the coal preparation plant would be transported to the DREA via an overland conveyor terminating at a surge bin. Trucks and dozers would then place rejects in the DREA in accordance with the DREA staging plans. Completed areas of the DREA would be progressively rehabilitated.

An accommodation village would be constructed to the north of the mine surface facilities area to accommodate the project workforce. Access to the village would be via a sealed access road to be constructed off the Moranbah Access Road. The accommodation village would comprise 1100 rooms and would include facilities, such as a dining room and kitchens, wet mess, common rooms and recreational facilities. The proposed project would require the construction of a 132 kilovolt (kV) powerline and a raw water pipeline. The EIS stated that the proponent is currently in discussions with utility providers SunWater, Powerlink and Ergon in relation to this infrastructure with the aim that this infrastructure would be constructed by the utility provider. The project would also require a rail connection between the proposed project site and the Blair Athol Rail Line and the proponent is in discussions with Aurizon in relation to this rail line. An ongoing exploration program would be

undertaken over the life of the mine. The EIS stated that this may include installation of exploration boreholes, as well as seismic survey in some areas. These activities would be similar to the exploration activities currently being undertaken on the project site. However, the EIS further outlined that there would be considerable flexibility with respect to the location of exploration bores and, as per current practice. The exploration bores would be to be sited to avoid significant landscape surface features, as far as possible.

2.5 Off lease infrastructure

Potential off lease infrastructure would include a rail connection between the project site and the Blair Athol Rail Line, a water pipeline, and a powerline. The off lease infrastructure was not assessed in the EIS.

2.6 Overlap area with the proposed Isaac Plains South Project

The EIS stated the eastern part of the Moranbah South project site would overlap with part of the mining lease application area for the Isaac Plains South Project (the 'overlap area'; Figure 3). The Isaac Plains South Project is unrelated to the Moranbah South Project and is applying for mining leases to mine the Rangal Coal measures, from the surface to a depth of approximately 160m, within the overlap area. Mining would be via open cut mining methods.

The EIS further stated that the Moranbah South Project would apply for mining leases to mine the Moranbah Coal Measures below 160m within the overlap area using underground mining methods. It was concluded in the EIS that this arrangement would allow for the optimum utilisation of the total coal resource in the overlap area. The proponents of the two projects are currently working together under the terms of the agreement to enable their respective exploration programs to take place in the overlap area.

It was stated in the EIS that the proponent for the Isaac Plains South Project has indicated that the construction of the Isaac Plains South Project would commence in 2013, with mining activities in the overlap area scheduled to be completed by 2027. In contrast, the Moranbah South Project's underground longwall mining activities in the overlap area was scheduled in the EIS to commence in approximately 2028 (project year 15), after the Isaac Plains South Project has completed mining in the overlap area and rehabilitated the area.

According to the EIS the Moranbah South Project's mining in the overlap area would result in subsidence of a portion of the Isaac Plains South Project's rehabilitated overburden emplacement and drainage infrastructure. In accordance with the agreement between the two proponents, the Moranbah South Project would be responsible for remediating the subsidence effects on Isaac Plains South's completed rehabilitation in the overlap area.

2.7 Project justification

Coking coal resources identified on the project site would allow a proposed project life of over 30 years. The EIS stated that coking coal is currently in high demand around the world. It further described that despite some recent softening in the price of coking coal, the long-term forecast is for demand would remain strong, particularly in Asia. The proposed project would provide substantial economic benefits to the region, Queensland and Australia. The operations phase of the proposed project would create approximately 1300 full time equivalent jobs, and 6000 indirect full time equivalent jobs in Queensland. The EIS estimated that the proposed project would contribute up to \$1.6 billion annually to the economy of the Mackay, Isaac and Whitsunday Region during the operations phase. The proposed project would also contribute significant Queensland and Australian government revenue through coal royalties (identified in the EIS as potentially \$1.5 billion over the life of the mine) and additional revenues associated with government taxes.

3 The EIS process

3.1 EIS legislative basis

The EIS for the proposed Moranbah South Project was assessed under two pieces of legislation, — the EP Act and the EPBC Act. These are discussed in more detail below.

3.1.1 *Environmental Protection Act 1994 (EP Act)*

EHP is responsible for the administration and regulation of resource activities under EP Act. Resource activities include mining, petroleum (including coal seam gas; CSG), geothermal, and greenhouse gas storage activities. Resource activities that are proposed to be carried out under one or more resource tenures, in any combination, as a single integrated operation are known as resource projects.

A resource project may be required to be assessed through an EIS process under chapter 3, part 1 of the EP Act. An EIS is a written document for a project that is undergoing the EIS process pursuant to the EP Act. The purpose of an EIS and the EIS process, as defined under section 40 of the EP Act, includes:

- Assess the potential adverse and beneficial environmental, economic and social impacts of the project.
- Assess management, monitoring, planning and other measures proposed to minimise any adverse environmental impacts of the project.
- Consider feasible alternative ways to carry out the project.
- Give information to the public.
- Help the administering authority decide an EA application for which the EIS is required.
- Give information to other Commonwealth and state authorities to help them make informed decisions.
- Allow the Queensland Government to meet its obligations under a bilateral agreement with the Australian Government (refer to section 3.1.2 of this report).

3.1.1.1 EIS process timeline under the EP Act

The proponent applied on 19 March 2012 for approval to prepare a voluntary EIS for the proposed project under Chapter 3 of the EP Act and the former Department of Environment and Resource Management (now EHP) granted approval on 23 March 2012. The proponent has not lodged an EA application with EHP and/or a mining lease application under the *Mineral Resources Act 1989* with the Department of Natural Resources and Mines (DNRM).

The EIS process for the proposed Moranbah South Project was conducted under Chapter 3 of the EP Act. Table 1 provides a timeline of the key steps undertaken during the EIS process under the EP Act.

Table 1 Milestones for the Moranbah South Project EIS process

Step in the EIS process	Section of the EP Act	Responsibility	Statutory due date	Date completed
Application to voluntarily prepare an EIS was received by EHP.	70 and 71	Proponent	N/A	19/03/2012
EHP decision on application for voluntary EIS.	72	EHP	N/A	27/03/2012
The draft terms of reference (TOR) and initial advice statement accompanying the application to voluntarily prepare an EIS were determined to not be in the approved form.	40(a)(i) 41(1)(2)	EHP	N/A	17/04/2012

Step in the EIS process	Section of the EP Act	Responsibility	Statutory due date	Date completed
Letter given to proponent stating that the draft TOR was not in the approved form and outlining why the draft TOR did not allow the purposes of the EIS to be achieved.	41(1)(2)	EHP	N/A	17/04/2012
The proponent prepared and submitted a new draft TOR to EHP.	41	Proponent	N/A	03/05/2012
EHP finalised TOR notice and provided it to the proponent.	42	EHP	30/05/2012	30/05/2012
EHP published TOR notice in the Central Queensland News, Mackay Daily Mercury, The Australian and in The Courier-Mail.	43(1)	EHP	2/06/2012	2/06/2012 & 1/06/2012
Proponent gave TOR notice to affected and interested persons.	43(3)	Proponent	8/06/2012	8/06/2012
Comment period for the draft TOR.	42(3)	EHP	4/06/2012 to 16/07/2012	16/07/2012
EHP provided comments to the proponent.	44	EHP	30/07/2012	30/07/2012
The proponent responded to comments and made amendments to the draft TOR. The period within which the proponent had to prepare a response to submissions was changed by agreement.	45	Proponent	7/09/2012	7/09/2012
EHP finalised and published final TOR.	46	EHP	8/10/2012	8/10/2012
Proponent prepared and submitted the EIS.	47	Proponent	8/10/2014	31/05/2013
EHP decision on whether to allow the EIS to proceed.	49(1)(2)	EHP	1/07/2013	1/07/2013
EHP decided on minimum period for making of the submissions about the EIS (at least 30 business days after EIS notice is published).	49(3)(4)	EHP	1/07/2013	1/07/2013
EHP prepared and gave notice of decision to proponent.	49(5)	EHP	15/07/2013	8/07/2013
The proponent gave EIS notice to affected and interested persons.	51(2)	Proponent	5/08/2013	29/07/2013
The EIS notice was published in The Australian, The Courier-Mail, The Central Queensland News and the Mackay Mercury newspapers and made submitted EIS available on a website.	51(2)(b)	Proponent	5/08/2013	29/07/2013
The EIS submission period.	52(2)(a)	EHP	29/7/2013 to 9/09/2013	9/09/2013
The proponent provided statutory declaration of compliance with notice	53	Proponent	12/08/2013	30/07/2013

Step in the EIS process	Section of the EP Act	Responsibility	Statutory due date	Date completed
requirements.				
Twenty-seven received and accepted submissions about the submitted EIS together with EHP's submission were forwarded to the proponent.	56(1)	EHP	23/09/2013	23/09/2013
The period within which the proponent had to prepare a response to submissions was changed by agreement.	56(2)-(3)(b)	Proponent	22/10/2013	23/09/2014
The proponent responded to submissions, provided any amendments of the EIS and submitted an EIS amendment notice to EHP.	56(2) and (3) 66	Proponent	23/09/2014	9/05/2014
EHP decided if EIS and response to submissions and submitted EIS were adequate for the EIS process to proceed.	56A(2) and (3)	EHP	6/06/2014	6/06/2014
EHP prepared and gave decision notice to the proponent.	56A(4)	EHP	23/06/2014	23/06/2014
EHP prepared the EIS assessment report.	57	EHP	4/08/2014	4/08/2014
EIS assessment report completed and issued to the proponent completing the EIS process.	60(1)	EHP	4/08/2014	4/08/2014

3.1.2 *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*

The project was referred to the Commonwealth Environment Minister for a decision on whether assessment and approval is required under the EPBC Act. On 24 May 2012 the delegate of the Commonwealth Environment Minister determined the project to be a controlled action pursuant to section 75 of the EPBC Act. The relevant controlling provisions for the project were determined as:

- sections 18 and 18A (listed threatened species and communities).

The Commonwealth Environment Minister determined on 24 October 2013 that water resources were also a controlling provision for the Moranbah South Project under:

- sections 24D and 24E (impacts of coal seam gas development and large coal mining development on water resources).

The impact of the project on the controlling provisions was assessed under Chapter 3 of the EP Act as a certified process under the bilateral agreement between the Commonwealth and Queensland.

3.1.2.1 Independent Expert Scientific Committee

The Australian Government established an Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC) in late 2012 through amendment to the EPBC Act. The IESC provides advice to the Commonwealth Environment Minister on research priorities to improve the understanding of potential impacts of coal seam gas and large mining developments on water resources. The committee can be requested by federal, state and territory governments to provide advice on water-related aspects of environmental impact assessments.

The Moranbah South Project EIS and supplementary materials were referred to the IESC on 20 December 2013 by the Department of the Environment and the Queensland Department of Environment and Heritage. The committee's advice to the departments dated 11 February 2014 has been considered in the preparation of this assessment report (see sections 4.19.8.3 of this report).

3.1.2.2 Requirements under the EPBC Act

An EIS subject to the bilateral agreement must include a stand-alone assessment report for MNES included in the controlling provisions. The report should provide enough information about the project and relevant impacts on MNES to allow the Commonwealth Environment Minister to make an informed decision on the project (i.e. approval or refusal) and, if relevant, impose appropriate conditions of approval.

The information provided in the report must be consistent with the relevant aspects of other sections of the EIS. Proposed mitigation measures for MNES must be consistent with those proposed under Queensland legislation while offsets for impacts on MNES must meet Commonwealth requirements (refer to section 4.19 and Appendix 3 of this assessment report).

3.2 Approvals

An overview of the necessary key approvals for the proposed project are summarised in Table 2. The EIS identified that several other permits would need to be sought by the proponent with local authorities or private entities (e.g. SunWater). These have not been included in this assessment report.

Table 2 Overview of the key approvals required for the Moranbah South Project

Approval	Legislation (administering authority)	Detail
Key state approvals		
Environmental authority (mining activities) (EA)	<i>Environmental Protection Act 1994</i> (EHP)	EIS process completed. EHP requires additional information with regard to some matters before a draft EA can be issued (see section 4). For more information refer to section 0 and recommended draft EA conditions in Appendix 2 of this report.
Granting of mining leases (ML)	<i>Mineral Resources Act 1989</i> (DNRM)	After EHP has issued the EA to the proponent, DNRM would decide whether or not to grant MLs (application not yet made).
Water licence – to take or interfere with water Riverine protection permit – for the excavation or placement of fill in a watercourse Water permit – to take water (surface water or groundwater) for a activity with a reasonably	<i>Water Act 2000</i> , <i>Water Regulation 2002</i> , <i>Water Resource (Fitzroy Basin) Plan 2011</i> (DNRM)	The proponent will need to consult with DNRM on: <ul style="list-style-type: none"> Approvals required prior to the take of water including water permits to take surface water or groundwater and/or water licence for dewatering groundwater.

Approval	Legislation (administering authority)	Detail
foreseeable conclusion		<ul style="list-style-type: none"> • A riverine protection permit under the <i>Water Act 2000</i> may be required to excavate or place fill in a watercourse. However, the proponent indicated that it would undertake subsidence rehabilitation works in a watercourse in accordance with a subsidence management plan (approved under the project EA) and therefore would be exempt from the riverine protection permitting process. Activities may also be exempt under the <i>Water Act 2000</i> and/or <i>Water Regulation 2002</i>. • Where the proposed subsidence mitigation works will cause interference with the flow of water, a water license may be required prior to undertaking any works.
Strategic cropping areas and other regional interests	<p><i>Regional Planning Interests Act 2014</i> (Department of State Development, Infrastructure and Planning; DSDIP)</p> <p>Referral and assessment of strategic cropping areas will be undertaken by DNRM</p>	Before carrying out the mining activity (refer to section 3.2.2.1 of this assessment report).
Exemption for removal of plants Species management programs	<i>Nature Conservation Act 1992</i> ; <i>Nature Conservation (Wildlife Management) Regulation 2006</i> (EHP)	<p>Adequate management of the animal's population and habitat where clearing of vegetation or any other works occur that will potentially impact on vegetation which is the potential habitat for fauna.</p> <ul style="list-style-type: none"> • Prior to clearing of listed threatened species. • Prior to interfering with an animal breeding place.
Various road improvement, rehabilitation, maintenance and road use management approvals over the life of the project	<i>Transport Infrastructure Act 1994</i> and <i>Transport Operations (Road Use Management) Act 1995</i> (Department of Transport and Main Roads; TMR)	<p>The proponent will need to consult with TMR on all matters concerning:</p> <ul style="list-style-type: none"> • Updated road impact assessment and road-use management plan • Updated traffic management plan • Undertaking road impact mitigation strategies and provision of new infrastructure • Infrastructure agreements • Rail-related conditions with Aurizon (e.g. managing coal

Approval	Legislation (administering authority)	Detail
		<p>dust during transportation).</p> <p>Refer to sections 4.6 and Appendix 1 of this report for further information about likely transport related approvals.</p>
Quarry materials	<i>Forestry Act 1959</i> (Department of Agriculture, Fisheries and Forestry; DAFF)	The proponent will need to consult with DAFF concerning quarry material located within the proposed project site.
Waterway barrier permit	<i>Fisheries Act 1994</i> (DAFF)	The proponent will need to consult with DAFF concerning potential impacts to fish movements including waterway barrier works, irrespective of their location with respect to the mining lease.
Biosecurity management strategies, e.g. weed and pest management	<i>Land Protection (Pest and Stock Route Management) Act 2002</i> , <i>Chemical Usage (Agricultural and Veterinary) Control Act 1988</i> (use controls) and <i>Agricultural Chemicals Distribution Controls Act 1966</i> (DAFF)	<p>The proponent will need to consult DAFF concerning biosecurity management including:</p> <ul style="list-style-type: none"> • Species that are declared under the <i>Land Protection (Pest and Stock Route Management) Act 2002</i> or declared under local government laws need to be identified and managed to guide best practice management and disposal of weeds. • The use of agricultural chemicals or other industrial chemicals would need to be managed to not adversely impact on human health. • Regulation of machinery contaminated with plant pests (e.g. insects) or disease (e.g. fungi) that have the ability to move to, or from, sensitive zones.
Cultural heritage management plan	<i>Aboriginal Cultural Heritage Act 2003</i> (Department of Aboriginal and Torres Strait Islander and Multicultural Affairs; DATSIMA)	<p>A cultural heritage management plan is not required for projects that have existing agreements with the Aboriginal parties, prior to the commencement of the Aboriginal Cultural Heritage Act.</p> <p>The proponent signed a cultural heritage management agreement (CHMA) with the Barada Barna Kabalbara & Yetimarla in December 2003 for all tenements controlled by Anglo American within their claim area, including the proposed project site. The CHMA is considered to be an existing agreement under the <i>Aboriginal Cultural Heritage Act 2003</i>; hence Indigenous heritage on</p>

Approval	Legislation (administering authority)	Detail
		the proposed project area would be managed in accordance with this agreement.
Reporting of previously unrecorded sites of non-Indigenous cultural heritage significance	<i>Queensland Heritage Act 1992</i> (EHP)	Notification to EHP as soon as practical and include location and description of discovery.
Commonwealth approval		
Approval to undertake an action that may impact on MNES (nationally listed threatened species and ecological communities; and water resources).	<p>Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> (Department of the Environment):</p> <ul style="list-style-type: none"> • assessment of listed threatened species and communities (section 18 and 18A of the controlling provisions) • assessment of impacts on water resources by a large coal mining development (sections 24D and 24E of the controlling provisions). 	A copy of this report will be given to the Commonwealth Environment Minister to assist with making a decision about the approval of the project and any conditions that should apply under Part 9 of the EPBC Act (refer to section 3.1.2 of this report).
Offsets		
Offset requirements for matters of national and/or state environmental significance	<p>Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>; EPBC Act Environmental Offsets Policy 2012 (Department of the Environment):</p> <ul style="list-style-type: none"> • assessment of matters of national environmental significance (MNES). <p>Queensland <i>Environmental Offsets Act 2014</i>, Environmental Offsets Regulation 2014, Queensland Environmental Offsets Policy (EHP):</p> <ul style="list-style-type: none"> • assessment of matters of state environmental significance (MSES). 	<p>Under the <i>Environmental Offsets Act 2014</i> an offset condition cannot be required by:</p> <ul style="list-style-type: none"> • the state if the Commonwealth has imposed a condition for the same, or substantially the same, impact on the same matter OR if the Commonwealth has decided an offset is not required. <p>Refer to sections □ and 4.19.6 of this assessment report for more information.</p>

3.2.1 Environmental authority under the *Environmental Protection Act 1994*

A granted EA for the proposed project would allow the proponent to mine black coal (environmentally relevant activity 13 under Schedule 2A of the Environmental Protection Regulations 2008) and would also cover the following activities that are directly associated with, or facilitate or support, the mining activities, and which would otherwise require approval under the EP Act as environmentally relevant activities (ERAs) listed under the Environmental Protection Regulations 2008:

- ERA 8 – chemical storage, threshold 1 and 3
- ERA 10 – gas producing
- ERA 31 – mineral processing, threshold 2(b)
- ERA 56 – regulated waste storage
- ERA 63 – sewage treatment, threshold 1(b)(i).

The following notifiable activities prescribed under Schedule 3 of the EP Act would also be authorised under the EA as part of the proposed project:

- notifiable activity 1 – abrasive blasting
- notifiable activity 7 – chemical storage
- notifiable activity 14 – engine reconditioning works
- notifiable activity 29 – petroleum product or oil storage.

However, the EIS also stated that the list would be updated during the operations planning phase where details of areas with notifiable activities would be provided to EHP in accordance with legislative requirements.

3.2.2 Other approvals associated with the project but not part of the EIS

The project would require the following infrastructure to the proposed project site, namely:

- a rail connection between the project site and the Blair Athol Rail Line
- a water pipeline
- a powerline.

This infrastructure was not part of the EIS assessment process and will be assessed under relevant separate processes.

3.2.2.1 *Regional Planning Interests Act 2014*

The EIS identified that the proposed project site contains areas of potential strategic cropping land (SCL) identified on the SCL trigger maps under the *Strategic Cropping Land Act 2011*. A SCL validation process decision in March 2014 reduced the SCL area within the project site identified in the SCL trigger map to approximately 1140ha. Since then, the *Regional Planning Interests Act 2014* (RPI Act) and Regional Planning Interests Regulation 2014 commenced on 13 June 2014. The *Strategic Cropping Land Act 2011* was repealed and transitional provisions were imposed in the RPI Act.

The new legislation aims to better manage the impact of certain activities in declared areas of 'regional interest' by integrating them into the planning framework (i.e. to promote coexistence). While the RPI Act is managed by DSDIP, EHP will have a role in administering some aspects of the framework and referral and assessment of strategic cropping areas will be undertaken by DNRM.

The RPI Act identifies and protects areas of Queensland that are of regional interest. In doing this, the RPI Act seeks to manage the impact and support coexistence of resource activities and other regulated activities in areas of regional interest. The RPI Act is supported by the RPI Regulation. In addition, the RPI Act provides the framework for implementing the policies of the government's new generation statutory regional plans.

The RPI Act ensures land use planning can protect:

- priority agricultural areas
- priority living areas
- strategic cropping areas
- strategic environmental areas.

Of interest for the proposed Moranbah South Project would be the strategic cropping area which is defined by reference to the strategic cropping land trigger map. Under the section 22(2) of the RPI Act, a resource activity is an exempt resource activity for a priority agricultural area or area that is in the strategic cropping area if:

- either—
 - if a conduct and compensation agreement requirement applies to the authority holder under a resource Act—
 - the land owner and the authority holder are parties to a conduct and compensation agreement under the resource Act, other than because of the order of a court; and
 - the authority holder has complied with the requirement; or
 - the land owner has voluntarily entered into a written agreement with the authority holder and the carrying out of the activity is consistent with the agreement; and
- the activity is not likely to have a significant impact on the priority agricultural area or area that is in the strategic cropping area; and
- the activity is not likely to have an impact on land owned by a person other than the land owner.

Under the RTI Act, a resource activity has an impact on land if the activity has an impact on:

- for land in a priority agricultural area—the suitability of the land to be used for a priority agricultural land use for the area;
- or for land in an area that is in the strategic cropping area—the land’s soil, climate and landscape features that make that area highly suitable, or likely to be highly suitable, for cropping.

The proponent for the Moranbah South Project will need to refer to the new regional plans and the strategic cropping land trigger map (and any regulations) in order to identify whether their proposed activities are in one of these areas. However, areas of regional interest may potentially change over time so the proponent will need to check these areas when new activities are proposed or when their projects will move into new areas. Part 8 of the RPI Act outlines the transitional provisions for repeal of the *Strategic Cropping Land Act 2011*.

3.3 Consultation program

3.3.1 Public consultation

In addition to the statutory requirements for advertising the TOR and EIS notices and the mailing of the notices to interested and affected parties, the proponent undertook community consultation with members of the public and other stakeholders before, during and after the public submission period of the EIS. Community information sessions have been conducted in Moranbah and surrounding region and have contributed to the social impact assessment for the proposed project.

3.3.2 Advisory body

EHP invited the following organisations to assist in the assessment of the TOR and EIS by participating as members of the advisory body for the Moranbah South Project:

- Department of Community Safety
- Department of Communities, Child Safety, and Disability Services
- Department of Transport and Main Roads
- Department of State Development, Infrastructure and Planning (Social Impact Assessment Unit)
- Department of Energy and Water Supply
- Department of Tourism, Major Events, Small Business and the Commonwealth Games
- Department of Housing and Public Works
- Department of Justice and Attorney-General (Hazardous Industries and Chemicals Branch)
- Department of Natural Resources and Mines
- Department of Agriculture, Fisheries and Forestry
- Department of Education, Training and Employment
- Queensland Health (Mackay)
- Department of Aboriginal and Torres Strait Islander and Multicultural Affairs
- Department of Local Government Community Recovery and Resilience
- Department of National Parks, Recreation Sport and Racing
- Department of Justice and Attorney-General
- Former Skills Queensland
- Queensland Police Service
- Queensland Treasury and Trade
- SunWater Limited
- Mackay Conservation Group
- Aurizon
- Fitzroy Basin Association
- Powerlink Queensland
- Bureau of Meteorology
- Ergon Energy
- Civil Aviation Safety Authority
- Isaac Regional Council
- Mackay Regional Council
- Central Highlands Regional Council
- Mackay Whitsunday Road Accident Action Group
- Former Commonwealth Department of Sustainability, Environment, Water, Population and Communities, now Department of the Environment.

Advisory body briefings for the project were held in Moranbah and Brisbane on Wednesday 7 August 2013 and Wednesday 21 August 2013 respectively during the EIS public submission period.

3.3.3 Public notification

In accordance with the statutory requirements, public notices were placed in The Australian, The Courier-Mail, Mackay Daily Mercury and Central Queensland News to notify the availability of the draft TOR and EIS for review and public comment. In addition, notices advising the availability of the draft TOR and the EIS for public comment were displayed on the EHP website.

The draft TOR and EIS were placed on public display at the following locations during their respective public comment and submission periods:

- EHP website (draft TOR only) <http://www.ehp.qld.gov.au/management/impact-assessment/eis-processes/moranbah-south-project.html>
- EHP office, level 3 400 George Street Brisbane (draft TOR and EIS)
- EHP office, 22–30 Wood Street Mackay (draft TOR and EIS)
- Isaac Regional Council library at Moranbah (draft TOR and EIS)
- Hansen Bailey web site (EIS only) www.hansenbailey.com.au

3.4 Matters considered in the EIS assessment report

Section 58 of the EP Act requires, when preparing this EIS assessment report, the consideration of the following matters:

- the final TOR for the EIS
- the submitted EIS
- all properly made submissions and any other submissions accepted by the chief executive
- the standard criteria
- another matter prescribed under a regulation.

These matters are addressed in the following subsections.

3.4.1 The final TOR

The final TOR document, issued on 8 October 2012, was considered when preparing this EIS assessment report. While the TOR were written to include all the major issues associated with the proposed project that were required to be addressed in the EIS, they were not exhaustive, nor were they to be interpreted as excluding all other matters from consideration.

Where matters outside of those listed in the final TOR were addressed in the EIS, those matters have been considered when preparing this EIS assessment report.

3.4.2 The submitted EIS

The submitted EIS was considered when preparing this report. The submitted EIS comprised:

- Moranbah South Project Environmental Impact Statement, July 2013 (referred to as the 'EIS' in this assessment report) that was made available for public review from 29 July to 9 September 2013
- Amendments to the EIS (referred to as the 'amended EIS' in this assessment report) which consists of:
 - the Moranbah South Project Environmental Impact Statement, Formal Response to Public Submissions on the EIS, May 2014 (referred to as the 'Response to Submissions' in this assessment report)
 - the Moranbah South Project Environmental Impact Statement, Formal EIS Addendum, May 2014 (referred to as the 'EIS Addendum').

In this assessment report, the term 'EIS' refers to the combined submitted EIS documents consisting of all Moranbah South Project EIS and amended EIS documents provided by the proponent.

3.4.3 Properly made submissions

EHP received 27 submissions on the published EIS within the submission period—three from federal, 13 from state and 2 from local government organisations; as well as nine non-government submissions. EHP also made its own submission on the EIS.

All government agencies that made submissions stating outstanding issues arising from their review of the EIS were given the opportunity to review and provide comments on any amendments made to the EIS. This included comments on conditions that should apply to the project and on the adequacy or otherwise of the amended EIS chapters in addressing concerns raised in submissions. Letters were sent to all private submitters advising them on the submission of the amended EIS together with details for obtaining the proponent's response to their submission.

All submissions and other comments made by the advisory body on the EIS documents were considered when preparing this EIS assessment report.

3.4.4 The standard criteria

Section 58 of the EP Act requires that, among other matters, the standard criteria listed in Schedule 3 of the EP Act must be considered when preparing the EIS assessment report. The key standard criteria considered for the assessment of the proposed project were:

- any applicable environmental protection policy
- any applicable federal, state or local government plans, standards, agreements or requirements
- any applicable environmental impact study, assessment or report
- the character, resilience and values of the receiving environment
- all submissions made by the applicant and submitters
- the public interest
- any applicable site management plan
- any relevant integrated environmental management system or proposed integrated environmental management system
- any other matter prescribed under a regulation.

3.4.5 Prescribed matters for EIS assessment report

Section 9 of the Environmental Protection Regulation 2008 requires an EIS assessment report to contain the following matters:

- a description of the following:
 - the project
 - the places affected by the project
 - any matters of national environmental significance (MNES) likely to be affected by the project
- a summary of the project's relevant impacts
- a summary of feasible mitigation measures or changes to the project or procedures to prevent or minimise the project's relevant impacts, proposed by the proponent or suggested in a relevant submission
- to the extent practicable, a summary of feasible alternatives to the project identified in the assessment process and the likely impact of the alternatives on MNES
- to the extent practicable, a recommendation for any conditions of approval for the project that may be imposed to address impacts identified in the assessment process on MNES.

A description of the project and places affected by the project are outlined in section 2 of this report. Any MNES likely to be affected by the project are outlined in section 4.19 of this assessment report. A summary of the projects relevant impacts and feasible mitigation measures or changes to the project are discussed throughout section 4 of this report. A summary of feasible alternatives were also are discussed in the MNES section of this assessment report. Conditions of approval for the project to address impacts on MNES would be developed by the Commonwealth after the completion of the EIS process.

4 Adequacy of the EIS in addressing the TOR

This section of the assessment report discusses the adequacy of the EIS documents, taking into account key matters of concern identified in the EIS documents and particularly those of significant interest raised in submissions. The level of detail of the assessment is proportional to the significance of the potential impacts of the project, particularly on environmental values. Where possible, outstanding matters that need further assessment are identified, particularly those required by the proponent to meet state policy and legislative requirements.

Specifically, the following matters are addressed for each values section:

- a brief outline of the assessment methodology
- a brief outline of the environmental values identified
- statement of impacts as identified in the EIS documents
- adequacy of the avoidance, minimisation and management measures proposed
- assessment on how the proponent responded to the EIS submissions and if amendments addressed the comments adequately
- summary of the adequacy of the EIS chapters, including any outstanding issues identified during the EIS assessment process and any recommendations to address these issues.

4.1 Introduction

Chapter 1 of the EIS provided an adequate introduction to the proposed project, its objectives and scope. It discussed the legislation applicable to the proposed project and identified the necessary approvals and outlined the assessment and approval processes.

4.2 Project need and alternatives

The EIS adequately described the proposed project as an efficient coking coal extraction and processing operation of significant benefit to the local and state economy. Project need was discussed in EIS Chapter 1 while project alternatives and justification was provided in EIS Chapter 4.

The EIS stated that there are substantial undeveloped coking coal resources within the proposed project site. The project is proposed in order to efficiently extract these coal resources as coking coal is in high demand around the world. The EIS also estimated that the proposed project would provide substantial economic benefits to the region, Queensland and Australia; including employment and contributions to the Queensland and Australian government revenue through coal royalties (refer to section 4.16 of this assessment report).

The EIS further discussed key aspects of the project where alternatives were considered during project planning, such as:

- alternative resources
- alternative mining methods
- alternatives with respect to the location of the mine surface facilities
- alternatives with respect to the method of rejects disposal
- alternatives with respect to the location of the DREA
- alternatives with respect to mining beneath the Isaac River.

4.3 Project description

The EIS adequately described the location, scope and phases of the proposed project. No submissions on the EIS requested additional information. An outline of the proposed project has been provided in section 2 of this report.

4.4 Climate

Chapter 14 of the EIS described the local and regional climatic conditions in the vicinity of the proposed project area. Climate information was used in subsequent chapters of the EIS (particularly air and noise) to assist in making predictions about proposed project impacts.

The EIS adequately described the local climate and how the climate would affect the potential for environmental impacts and the management of operations at the site.

The climate of the area was described as sub-tropical with high variability in rainfall, temperature and evaporation. The region experienced drought, floods, heatwaves and frosts. In general, winter days are warm and nights are cool, while summer days are hot and nights are warm. The average daily temperature at Moranbah ranged from 10.7°C (winter) to 33.6°C (summer).

Average annual rainfall (615mm) occurs mainly in the wet season months between December and March from thunderstorms and tropical lows associated with cyclones. Average mean monthly rainfall ranges from 105mm in January to just 9mm in September. Average mean monthly evaporation is substantially higher than corresponding mean monthly rainfall rates.

The winds were predominantly from the north-east to the south-east and 50% of the time the wind speed was <2m/s. Moderate winds up to 5m/s occurred 42% of the time and high winds >5m/s only occurred 1% of the time.

4.5 Land

Chapter 4 of the EIS provided a high level overview of the key land uses in the project site while Chapter 5 of the EIS provided a more detailed account. EIS Chapter 4.4 described the geology and resources associated with the project site and outlined proposed resource utilisation. A detailed soils and land suitability assessment was included in Appendix D of the EIS. Rehabilitation was described in EIS Chapter 8. Chapter 17 of EIS contained a full description on the visual amenity assessment.

As part of the EIS submissions, the proponent provided a 'Report on Potential Disturbance of Vegetation due to Surface Subsidence Effects' (Response to Submissions; Appendix K).

The EIS adequately described those aspects of the project site related to the existing and proposed qualities and characteristics of the land. The following subsections address those qualities and characteristics outlined in the EIS in more detail.

4.5.1 Topography/geomorphology

The EIS adequately described the topography and geomorphology of the project site. The project site is characterised by about 17,550ha of gently undulating land, parts of which have been cleared for grazing activities and cultivation. Significant natural features include the Isaac River, Grosvenor Creek and Cherwell Creek. Vegetation was predominantly open woodlands and natural grasslands, in addition to introduced pasture grasses. Sensitive environmental areas within the project site include watercourses, including the Isaac River, Grosvenor Creek and Cherwell Creek; remnant riparian vegetation; and endangered vegetation communities including brigalow and natural grassland.

The main impacts on existing topography would include:

- construction of mine surface facilities and the coal handling and transport system
- construction of the DREA and overland rejects conveyor
- construction of mine entries including a box cut for the longwall mine and a separate box cut for the bord and pillar mine
- construction of water storages and water management infrastructure, including dams

- longwall mining resulting in up to 3.2m subsidence (southern part of the project area)
- ROM and product coal stockpiles, box cut overburden stockpile (maximum height of 20m and covering 50ha), and the DREA (maximum height of 50m and covering approximately 240 ha).

Proposed mitigation measures included:

- progressive rehabilitation of areas disturbed by subsidence and seismic activities, including targeted crack rehabilitation and drainage works to minimise disturbance to vegetation
- progressive rehabilitation of the DREA and box cut overburden emplacement area involving reshaping of the landform, capping and seeding to establish a self-sustaining native ecosystem
- decommissioning and removing project infrastructure at the end of mine life, including coal preparation plant and ROM coal handling areas, train loading infrastructure, water management infrastructure and haul roads.

4.5.2 Resource utilisation

The EIS adequately described how the project would recover the targeted coal resource (EIS Chapter 4.4). A summary of how the project intends to maximise the extraction of the coal resource follows.

The Moranbah South Project would be located on the north-western edge of the Bowen Basin in an area where two major coal-bearing formations subcrop:

- the Moranbah Coal Measures
- overlying Fort Cooper Coal Measures.

The stratigraphy of the project site, described in the Chapter 4.4 of the EIS and illustrated in EIS Figure 4-11, comprised Permian age coal measures overlain by Cainozoic deposits comprising unconsolidated Quaternary alluvium, poorly lithified Tertiary sediments and Tertiary basalts. The EIS stated that the highly inter-banded nature of the Fort Cooper Coal Measures has historically precluded it from mining interest. The Moranbah Coal Measures range in thickness from 250m to 300m and typically consist of thin to massive sandstones, siltstones, interlaminated siltstone and sandstone units, mudstones and a number of coal seams of significant thickness. The Goonyella Middle (GM) seam was stated to be the most prospective seam within the stratigraphy, correlating directly with the GM seam at Moranbah North Mine and the Harrow Creek seam at Peak Downs, and considered to be the lateral equivalent of the Aquila and Tieri seams at German Creek Mine.

The project would mine only the GM seam which the EIS stated is the only economic coal seam in the project site based on yield and market-acceptable product ash of 9.5%. The GM seam at the project site consists of four main coal plies separated by stone partings of varying thickness and composition. The proposed extraction height of the GM seam varies across the project site, with a maximum extraction height of 4.2m proposed consistent with the maximum average seam thickness. Resource recovery would be determined primarily by geotechnical considerations and coal quality. GM seam additional resources, computed in accordance with the Australasian Code for Reporting of Mineral Resources and Ore Reserves (JORC Code 2012), were reported as shown in Table 3.

As part the EIS review, DNRM considered the resource recovery proposal and determined that the proposed project would suitably extract the state's resources without unnecessarily sterilising any resources that could potentially be mined in the future.

Table 3 Goonyella Middle seam – additional resources within the proposed project site
(Source: EIS; Table 4-3)

Resource category	Minable tonnes in-situ (millions of tonnes)
Measured resource	349.6
Indicated resource	302.3
Inferred resource	50.8
Total additional resources in project site	702.7

The GM seam is located in the middle of the Moranbah Coal Measures stratigraphy at the project site. Seams below the GM seam would be unaffected by longwall mining. Seams above would be affected by subsidence but the proponent did not consider that the upper seams at Moranbah South would be sterilised by the mining of the GM seam.

4.5.3 Land use

The EIS adequately addressed the requirements of the TOR for land use. A summary of land uses within and surrounding the project was provided in EIS Chapter 5. Table 5-5 of the EIS summarised the potential impacts of the project on land use and identified the chapter of the EIS that addressed each issue.

Existing land use within the project site included cattle grazing, coal seam gas exploration, extractive industry, commercial and light industry, aviation, residential and recreation. Grazing is the primary land use within the project site, but there are areas where leucaena is grown as fodder for cattle.

Land uses surrounding the project site includes coal mining, grazing, residential, aviation, rail, commercial and light industry. Significant coal mining activities exist or are planned in surrounding areas. The residential areas of the town of Moranbah are located approximately 3km north of proposed mine surface facilities with commercial and industrial businesses located adjacent to the project site. The Moranbah airport is located to the west with the runway extending on to the project site.

The proponent stated that the project could be designed and managed to be compatible with continuation of the existing on-site and adjacent land uses. The proponent has aimed to design the project to avoid significant impacts on residential amenity in Moranbah. The project site would continue to be suitable for grazing during the life of the project although this would be temporarily affected by subsidence and rehabilitation. Management measures for subsidence related impacts to infrastructure within the project site, such as pipelines, powerlines, public roads, stock routes, and communications lines, would need to be developed in consultation with the owners of the infrastructure, in accordance with the *Mineral Resources Act 1989* and the *Coal Mining Safety and Health Act 1999*. The proponent stated that discussions are continuing with landowners, lessees and easement holders with the intent of allowing existing land uses within the site to continue subject to agreed changes or constraints.

Sections of three major roads—Moranbah Access Road, Winchester Road and the Peak Downs Highway—would be likely to be impacted by subsidence, as would the service station on the Peak Downs Highway. The proponent stated that discussions are continuing with the owners of this infrastructure, including TMR and the Isaac Regional Council (IRC), in relation to the potential impacts of subsidence, management measures and potential relocation. The Peak Downs Highway is proposed to be subsided by a single longwall panel subject to agreement with TMR. If agreement with TMR could not be reached, this panel would not be extracted. The Isaac river bridge is located outside the limit of measurable subsidence, but monitoring of the bridge may be required during active subsidence subject to agreement with TMR.

Stock routes U831 and M404 cross the project site. The EIS stated that stock route M404, which is aligned with the Peak Downs Highway, may be impacted by subsidence. Measures to manage potential subsidence impacts on stock route M404 are proposed to be addressed in an agreement with the proponent, DNRM and the IRC prior to the commencement of mining activities.

The Moranbah Airport and Isaac River bridge rest area are outside the limit of measurable subsidence and would not be affected by subsidence.

The proposed Isaac Plains South Project open cut mine site would overlap the eastern part of the proposed project site (referred to as the 'overlap area', refer to section 2.6 and Figure 3 for more information). In accordance with an agreement between the proponents of the two projects, the proposed project would only mine in the overlap area once the proposed Isaac Plains South Project mining is complete. The proposed Moranbah South Project would be responsible for repairing any damage caused by subsidence of the proposed Isaac Plains South Project's rehabilitated overburden emplacement areas, levee and stream diversion within the overlap area.

Infrastructure associated with Arrow Energy's coal seam gas exploration and development activities is located within the project site and development of the gas field may occur within the life of the proposed project. The EIS stated that agreements between the proponent and the holders of the

petroleum tenements would be developed that would address coexisting coal mining and coal seam gas extraction, including impacts due to mine subsidence.

Two quarries and two sand quarrying operations are located within the project site. The Quarrico quarry is not located within the limit of measurable subsidence, and would not be impacted by subsidence. Parts of the Moranbah South Quarry (MCG quarry) operation are located within the limit of measurable subsidence and may be impacted by location of the DREA, subsidence, and operational safety issues. Parts of the two sand quarrying operations along the Isaac River (SunWater Limited, and Hanson Construction Materials Pty Ltd) would be subject to subsidence. Prior to the grant of the mining lease for the project, the proponent would reach an agreement with the owners of the sand quarrying operations in relation to management measures for subsidence of the sand quarrying operations.

4.5.3.1 MCG quarry

The proposed project may adversely affect extractive activities within the state quarry reserve, for which DAFF is the trustee, particularly in regard to the proposed placement location for the DREA. The quarry reserve, which covers lot 23 on GV148 and lot 7 on CP906162, reserves and protects a very large hard rock quarry resource and is mapped as a key resource area for the State Planning Policy. This hard rock resource is considered to extend beyond the current boundaries of the key resource area. DAFF's preliminary estimates indicate that the hard rock quarry resource available within the reserve would be sufficient for at least 50 years of commercial exploitation.

The MCG quarry operated by MCG Quarries Pty Ltd (MCG), is located within a state quarry reserve. For the last two years the MCG quarry produced almost 1.9M tonnes of quarry material, which provided the state with \$2.84M in royalty revenue. This quarry services many coal mines in the Bowen Basin and other regional markets. The quarry produces a range of quarry products, particularly hard rock products, and also has a concrete batching plant. The quarry is being developed in a westerly direction at present and this would be followed by development in a northerly direction. The hard rock in the southern part of the quarry has been fully exploited and this part of the quarry is being progressively rehabilitated.

The proposed DREA location, which is directly on top of the current quarry operations or proposed future quarry operations, may risk sterilising a quantity of the available hard rock resource within the Quarry Reserve for future commercial exploitation, and may adversely affect the current and future operation of the quarry.

The proponent has noted the importance of the MCG quarry to the region and stated its intent for the MCG quarry to coexist with the proposed project. Chapters 2.2.3 and 5.7 of the EIS refer to the Queensland *Mineral Resources Act 1989* that provides that a mining lease cannot be granted until suitable consents or agreements are obtained with owners of land (or infrastructure) within the proposed mining lease. Under the *Mineral Resources Act 1989* the proponent would need to reach an agreement with the Queensland Government (as represented by DAFF) in relation to any effect on the MCG quarry, the rock resource and the management of the quarry. The proponent, DAFF and MCG continue to meet in order to progress details regarding co-existence. Any consents or agreements required would be finalised during the mining lease application phase.

The proponent has stated that there is flexibility in the staging of rejects emplacement, and staging could be adjusted to allow the project and quarry to coexist. There is also potential to use quarry voids for rejects disposal. The proponent would require further information on future operating plans for the quarry so that the DREA staging could be adjusted, as necessary, to reflect quarry operations and possible disposal of rejects into quarry voids. The location of the DREA infrastructure (e.g. conveyors) could be adjusted, as necessary, during the detailed design phase to minimise sterilisation of quarry resources and avoid placing constraints on the operation of the quarry.

According to the schedule provided in the EIS (Chapter 4 Figure 4-26), subsidence of the MCG quarry is not scheduled until at least project year 8. The proponent considered that the subsidence of the quarry resource and associated infrastructure would be manageable and has committed to working with DAFF and MCG to develop management measures for subsidence of quarry pits and quarry infrastructure. The proponent has committed to developing management measures for subsidence of the MCG quarry to ensure access to the quarry is maintained, sterilisation of the quarry resource is avoided or minimised, safety of quarry workers is maintained, and no significant impact on quarry operations occurs. A plan detailing the management of subsidence effects at the quarry would be developed in consultation with DAFF and MCG prior to subsidence of the quarry area. Any EA for the

project would also require a subsidence management plan.

DAFF outlined in the submission on the EIS that specific arrangements need to be agreed to ensure that the quarrying operations can continue while long-wall mining is being undertaken beneath the quarry and that any subsequent subsidence will not adversely affect the fixed and other infrastructure within and associated with the quarry and/or the subsequent safe operation of the quarry. The proponent responded that subsidence of the quarry resource and associated infrastructure would be manageable and that the proponent would continue to work with DAFF and MCG to develop management measures for subsidence of quarry pits and quarry infrastructure. The proponent outlined the following principles that will guide the development of management measures:

- access to the quarry is maintained
- any sterilisation of the quarry resource is avoided or minimised
- the safety of workers at the quarry is not jeopardised
- minimal impact on quarry operations.

A plan detailing the management of subsidence effects at the quarry would be developed in consultation with DAFF and MCG.

4.5.4 Soil types and land suitability

The EIS Chapter 8 adequately addressed the requirements of the TOR for soil types and the range of land suitability associated with the project. Seven soil mapping units were identified from the soils assessment and mapped in Figure 8 4 of the EIS. Further detail on each soil mapping unit was provided in the Soils and Land Suitability Report (EIS Appendix D).

All soil mapping units were found to be suitable for beef cattle grazing with units B1, B2, B2rp and A3 also suitable for rainfed broadacre cropping. Table 4 shows the land suitability of each soil management unit.

Table 4 Pre-mining land suitability and agricultural land class (Source: EIS; Table 8-1)

Soil mapping unit	Area ¹ (ha)	Description	Land suitability: cropping	Land suitability: grazing	Agricultural land class
A1	2051	Recent alluvial soils – texture contrast, stratified deep loam	5	4	C3
A2	4243	Texture contrast and generally sodic soils on relic alluvial plains	5	4	C3
A3	4299	Cracking clays in alluvium and colluvial footslopes	3	2	A*
C1	353	Generally non-sodic texture – contrast soils on colluvium	5	3	C2
C2	2407	Non-cracking clays and coarse textured soils	5	3	C2
B1	336	Dark crusting and cracking clays	3	2	A*
B2	1998	Dark cracking clays and surface	2	1	A*
B2rp	1700		3	1	A*

¹Disturbed areas (e.g. existing quarries, dams) would cover 108ha and were excluded from this table.

*Considered to be GQAL.

The major impacts of the project on soils and land suitability and proposed mitigation measures are summarised below.

Surface infrastructure – potential impacts and mitigation measures

Available topsoils would be stripped as part of the construction of the surface facilities and the proposed DREA. The topsoil depth measured within the footprint of the mine surface facilities varied between 0.3m and 0.5m. The soils assessment provided soil stripping depths for the project and confirmed that there would be sufficient topsoil resources available for proposed rehabilitation, as well as suitable capping resources for rehabilitation of the DREA. Topsoil would be stockpiled within the footprint of the mine surface facilities where possible, in order to limit the disturbance footprint of the project.

The mine surface facilities would be decommissioned and rehabilitated to their pre-mining land suitability, where possible, as part of mine closure. The mine box cuts and the box cut overburden emplacement area were not proposed to be restored to pre-mine land suitability. These areas would not be suitable for grazing because of the proposed slopes and would be considered to be class 5 (land) for grazing and cropping, and class D (agricultural land).

Subsidence – potential impacts and mitigation measures on surface effects

The total surface area within the limit of measurable subsidence resulting from the mine was estimated to be approximately 8555ha. Surface effects of subsidence would result in the development of a series of shallow troughs with gentle slopes in the relatively flat natural topography, with surface tension cracks expected to be similar to those evident at the Moranbah North Mine.

Proposed rehabilitation of surface tension cracks included surveys to locate cracks, ripping and ploughing small cracks using relatively small equipment (3m wide disturbance), stripping and respreading of topsoil where necessary, and follow up monitoring and revegetation if required. Ponding of water due to subsidence would be addressed by minor drainage earthworks to re-establish free drainage.

Subsidence would not alter the land suitability for grazing following rehabilitation (surface tension crack remediation and drainage earthworks) and subsided areas would be able to continue to be used for grazing post-mining. Land suitability for cropping would be unchanged by subsidence, following rehabilitation, except for soil mapping unit B2 that was predicted to change from class 2 to class 3 due to increased potential for water erosion.

Dry rejects emplacement area (DREA) – potential impacts and mitigation measures

The soil types within the proposed DREA (A3 and B2) were stated to be suitable and of adequate quantity for rehabilitation and capping of the DREA. The DREA would be rehabilitated as a native ecosystem with no grazing in order to protect the integrity of the capping layer and rehabilitation. The DREA would therefore have a land suitability of class 5 for cropping and grazing, and an agriculture land class of D.

Table 5 of this report summarises the predicted changes in land suitability and agricultural land class as a result of the mining activity and proposed rehabilitation.

Table 5 Pre- and post-mining land suitability and agricultural land class
(Source: EIS; Table 8-2)

Assessment category		Impact assessment		
		Pre-mine (ha)	Post-mine (ha)	Change in area (ha)
Land suitability class (rainfed broadacre cropping)	1	-	-	-
	2	2407	1144	-1263
	3	4989	5932	943
	4	-	-	-
	5	9993	10,312	319
Land suitability class (beef cattle grazing)	1	2743	2668	-75
	2	4652	4408	-244
	3	3699	3699	-
	4	6294	6294	-
	5	-	320	319
Agricultural land class	A	7396	7077	-319
	B	-	-	-
	C1	-	-	-
	C2	3699	3699	-
	C3	6294	6294	-
	D	-	320	319

4.5.5 Good quality agricultural land (GQAL)

The EIS adequately addressed the requirements of the TOR for good quality agricultural land. Overall, the area of land classified as good quality agricultural land (GQAL; agricultural land class) would be reduced by 319ha due to the construction of the mine box cuts, box cut overburden emplacement area and DREA. Subsidence would not change the land suitability for cropping, following rehabilitation, except for soil mapping unit B2 that was predicted to change from class 2 to class 3 due to increased potential for water erosion.

4.5.6 Strategic cropping land (SCL)

The EIS identified that the proposed project site contains areas of potential strategic cropping land (SCL) identified on the SCL trigger maps. The EIS stated that while the project site is suitable for beef cattle grazing it does have some soil mapping units suitable for rainfed broadacre cropping. A DNRM SCL validation process decision in March 2014 reduced the SCL area within the project site identified in the SCL trigger map to approximately 1140ha. It was concluded in the amended EIS that only minor areas of potential SCL would be located within the footprint of proposed mine surface infrastructure including the overland conveyor and possibly a small area at the proposed location of the explosives magazine.

The EIS concluded that the majority of SCL would not be permanently impacted by the project but

would be affected by subsidence effects including surface cracking and buckling, ponding of water, and associated rehabilitation works. The EIS stated that, where excessive land or soil degradation within SCL would be identified following subsidence and implementation of general rehabilitation measures, additional measures such as erosion control structures or varied crop tillage would be considered.

However, since submission of the EIS and amended EIS the *Strategic Cropping Land Act 2011* and associated State Planning Policy were repealed and replaced with the RPI Act on 13 June 2014 (refer to section 3.2.2.1 of this assessment report for further information). DNRM advised that all previous comments given during the EIS submission period relating to SCL were based on the then existing SCL framework and once the regional planning interest (RPI) framework commences, would be unlikely to be accurate. There are transitional provisions within the RPI framework for SCL validation and protection decision applications if made (containing the mandatory application requirements under the SCL Act) and not yet decided, withdrawn or lapsed at the time the RPI framework commenced. Advice relating to the RPI framework should, in the first instance, be directed to DSDIP; however, DNRM stated that it would participate as technical agency in any joint discussions with the proponent and DSDIP where required.

4.5.7 Land contamination

The EIS adequately addressed the requirements of the TOR for land contamination on the project site. The potential sources of land contamination and proposed mitigation measures are not significant.

A review of past and present potentially contaminating activities within the project site determined that:

- There are no properties within the project site that are listed on the contaminated land register.
- There are no known historical or existing contaminated sites within the project site.
- There are two properties within the project site that are listed on the environmental management register:
 - the Peak Downs Highway Service Station (notifiable activity 34 – service station)
 - Moranbah Airport (notifiable activity 29 – petroleum product or oil storage).
- A third property listed on the environmental management register (for notifiable activity – 29 petroleum product or oil storage) extends partly within the project site but the listing was presumed to be related to the adjacent Caval Ridge Mining Lease.

A number of notifiable activities were proposed in the EIS to be undertaken on the project site, including:

- notifiable activity 1 – abrasive blasting
- notifiable activity 7 – chemical storage
- notifiable activity 14 – engine reconditioning works
- notifiable activity 29 – petroleum product or oil storage.

The EIS stated that a complete list of notifiable activities, and the location of the activities, would be provided to EHP, in accordance with legislative requirements, during the EA application process.

The risk of land contamination as a result of project activities was proposed to be reduced through consideration of the design and construction of the facilities and post-mining rehabilitation, including:

- Hydrocarbon and chemical storage areas would be designed and constructed in accordance with AS1940.
- Handling of waste hydrocarbons and miscellaneous chemicals would be in accordance with standard operating procedures to minimise potential for spillage and leakage, and storage in separate sealed and bunded areas.
- Training would be provided to key staff in spill prevention and clean up, and oil spill cleanup kits would be placed at strategic locations.

- Workshop and truck wash-down area contaminants would be directed to an oil separator and sump for containment and subsequent treatment or appropriate disposal.
- Abrasive blasting would be screened or enclosed.
- Appropriate storage, handling and disposal of waste.
- Removal of hydrocarbon and chemical storage tanks and other infrastructure on decommissioning.
- Post-mine rehabilitation and site remediation.

4.5.8 Land disturbance

The EIS adequately addressed the requirements of the TOR for land disturbance associated with the project. The land disturbance impacts of the project and proposed mitigation measures are summarised below.

The mining activity would result in both temporary and permanent changes to the landscape, and the major potential impacts include:

- Clearing for seismic surveys as part of the ongoing exploration program for the project.
- Vegetation clearing and topsoil stripping and stockpiling in areas subject to construction of mine surface facilities, the coal handling and transport system, the DREA and rejects conveyor.
- Construction of mine entries including a box cut for the longwall mine and a separate box cut for the bord and pillar mine.
- Construction of water storages and water management infrastructure, including dams.
- Subsidence above longwall mining operations resulting in surface cracking and buckling, ponding of water, and associated rehabilitation.
- The final box cut overburden stockpile and the DREA.

The proposed mitigation measures outlined in the EIS included:

- Progressive rehabilitation of areas disturbed by subsidence and seismic activities, including targeted crack rehabilitation and drainage works to minimise disturbance to vegetation.
- Progressive rehabilitation of the DREA and box cut overburden stockpile involving reshaping of the landform, capping and seeding to establish a self-sustaining native ecosystem.
- Decommissioning and removing project infrastructure at the end of mine life, including coal preparation plant and ROM coal handling areas, train loading infrastructure, water management infrastructure and haul roads.

The box cuts at the underground mine entries were proposed to be left in place at the cessation of mining due to the large volume of material being removed.

The proposed rehabilitation strategy for land disturbed by the project is discussed in the following section.

4.5.9 Rehabilitation and decommissioning

The EIS Chapter 8 adequately addressed the requirements of the TOR for site rehabilitation. The rehabilitation strategy proposed for the project is discussed below.

4.5.9.1 Subsidence rehabilitation

The EIS outlined the following rehabilitation measures for general subsidence impacts:

- Survey of areas of potential tension cracking within six months of subsidence to locate cracks and assess rehabilitation requirements.
- Minor cracks: ripping or ploughing using a small dozer, grader or tractor and allowing vegetation to establish naturally consistent with the pre-disturbance vegetation communities.
- Large cracks: removal of topsoil, excavation and sealing with suitable material where necessary,

replacement of topsoil and allowing vegetation to establish naturally. The disturbance area for such rehabilitation was estimated to be typically 2–3m wide and up to 50m long.

- Grading of areas of surface buckling and allowing vegetation to establish naturally.
- Erosion and sediment controls where required.
- Control of stock access and grazing.
- Earthworks to re-establish free drainage in any areas subject to ponding.
- Pest animal and weed management.
- Monitoring to ensure that cracks were successfully rehabilitated and disturbed vegetation was regenerating.
- Additional measures where necessary in areas of strategic cropping land subject to subsidence.
- Specific measures to manage geomorphic effects on the channel of subsided watercourses if required.

Subsidence is addressed in more detail in section 4.6 of this assessment report.

4.5.9.2 Other rehabilitation measures

For other areas the EIS outlined the following rehabilitation measures:

- Progressive rehabilitation of areas disturbed by seismic surveys to the pre-disturbance vegetation through natural regeneration of vegetation, weed management and other measures if required.
- Rehabilitation of the box cut overburden stockpile and progressive rehabilitation of the DREA involving reshaping of the landform, addition of capping and topsoil layers, and seeding to establish a self-sustaining native ecosystem.
- Decommissioning and removing project infrastructure at the end of mine life, including coal preparation plant and ROM coal handling areas, train loading infrastructure, water management infrastructure and haul roads.
- Remediation of hydrocarbon contamination as necessary.
- Rehabilitation of decommissioned surface infrastructure areas by profiling, adding a topsoil layer to a minimum depth of 0.3m, ripping and seeding with a mixture of native grasses and trees with the aim of restoring the site to the required land use.

4.5.9.3 Rehabilitation of box cuts

The box cuts at the underground mine entries are proposed to be left in place at the cessation of mining due to the large volume of material being removed. Decommissioning and rehabilitation of the box cuts would involve grading the ramp to ensure a long-term stable egress for cattle and wildlife and constructing drainage and sediment and erosion control measures to minimise runoff into the voids. The portals of the underground mine access drifts would be permanently sealed at mine closure.

Negotiated agreements with existing land owners and land users may result in the need to implement additional rehabilitation measures.

4.5.9.4 Rehabilitation of the overlap area

Rehabilitation of subsidence impacts to post-mining landforms of the overlap area (as part of the Isaac Plains South Project) would be undertaken in accordance with an agreement between the proponents of the proposed project and the Isaac Plains South Project. The rehabilitation would involve regrading and/or ripping and reseeding tension cracks, regrading of contour drains to re-establish free drainage on the overburden emplacement area, and any necessary repairs to the Isaac Plains South flood protection levee to maintain flood immunity. Levee repairs may include repairing any structural damage to the levee due to subsidence, or increasing the height of the levee, in any subsided areas.

4.5.10 Landscape character and visual amenity

The EIS adequately addressed the requirements of the TOR for landscape character and visual amenity. The impacts of the project on landscape character and visual amenity and proposed mitigation measures are summarised below.

It was concluded in the EIS that the proposed project, as an underground operation, would not impact greatly on the visual amenity of the surrounding area. The views toward the proposed visible elements of the mine would be obscured by topography and vegetation and distance to visual receptors.

Several mitigation and management measures were proposed in the EIS:

- Minimise the clearing of vegetation on the project site, in particular around the surface facilities.
- Progressive rehabilitation of the final surfaces of the DREA with native vegetation.
- Utilise non-reflective materials and neutral tones in the cladding of infrastructure and the accommodation village buildings to blend with the surrounding environment.
- Design exterior lighting to minimise off-site impacts.
- In addition to the above, a conceptual landscaping plan for the accommodation village was completed, designed to ameliorate visual effects of the village on viewing locations surrounding the site. The landscape treatments proposed for the village would consist of two broad treatment types including woodland plantings and village edge plantings that together would contribute to the visual screening and integration of the accommodation village into the landscape.

4.5.11 Conclusions and recommendations

The land assessment in the EIS adequately addressed the requirements of the TOR. However, a few outstanding issues remain regarding the ongoing land use (especially in regard to the DREA location and the MCG quarry). For the purposes of developing a draft EA for the project the following information is needed on rehabilitation requirements:

- More detailed and measurable rehabilitation goals, rehabilitation objectives, indicators and completion criteria.
- Development of a final landform rehabilitation design, showing the different domains.
- The proposed vegetation species for each domain and coverage range.
- Breakdown of the landform design criteria for each domain with supporting evidence justifying the chosen landform designs.
- The geographic coordinates and a description of rehabilitation reference sites.
- Proposed maintenance, monitoring and reporting of rehabilitation as it is completed.
- Development of a rehabilitation management plan.

Recommendations

- *The proponent should continue discussions with DAFF and the MCG quarry owners on the details of coexistence. As part of this negotiation the proponent should investigate the use of the MCG quarry voids as a location for the disposal of dry rejects.*
- *The proponent should arrange, before the commencement of work for the project, any necessary Forestry Act 1959 authorisations (sales permit/s) that may be required.*
- *The proponent should liaise with DAFF to ensure that the location of the proposed project infrastructure on Lot 23 on Plan GV148 and Lot 7 on Plan CP906162, avoid sterilising and/or restricting the future utilisation and/or access to currently operational or known commercial deposits of State owned quarry material administered under the Forestry Act 1959.*
- *If the quarry voids are proposed for disposal of dry rejects, further consideration should to be given to the rehabilitation objective for the DREA and the availability of suitable capping material and topsoil.*
- *The proponent will need to assess strategic cropping areas under the provisions set out in the RPI Act.*
- *The proponent should continue to liaise with EHP in regards to rehabilitation criteria to be included in the draft EA.*

4.6 Subsidence

Mine subsidence issues associated with the project were described in Chapter 6 of the EIS. A detailed mine subsidence assessment was presented in the EIS Appendix A, Subsidence Report.

As part of the EIS submissions, the proponent provided a 'Report on Potential Disturbance of Vegetation due to Surface Subsidence Effects' (Response to Submissions; Appendix K), and a 'Peer Review Report on Subsurface Subsidence Cracking' (Response to Submissions; Appendix L).

The EIS adequately described all aspects of the project site related to subsidence. The following subsections address those characteristics outlined in the EIS in more detail.

4.6.1 Methodology

The Incremental Profile Method was used to model and predict subsidence, tilt and strain profiles for the project mine plan. The method as described in the EIS used an empirical model based on a large database of observed subsidence monitoring data from various mines in the Bowen Basin and across New South Wales. It involved the following three steps:

- Prediction of the incremental subsidence profiles over each longwall in each seam based on the local seam thicknesses, the incremental panel and pillar widths, the presence of adjacent previously mined panels and the local depths of cover.
- Addition of all the incremental subsidence profiles to form the total subsidence profiles over the series of longwalls. The prediction curves for the Moranbah South Project were calibrated using observed subsidence data from the nearby Moranbah North Mine that mines the same target seam in similar geology.

The EIS stated that the Incremental Profile Method has been found in most cases to give reasonable, conservative predictions of maximum subsidence, tilt and curvature. This method can produce subsidence predictions at any nominated point on the ground surface based on the proposed mine plan, as it takes into account variations in depth, seam thickness and seam dip, as well as the influence of multiple mining panels. The EIS further outlined that this method has been recognised and accepted by the NSW Government in its recent inquiry into the impacts of underground mining on the southern coalfields of NSW.

4.6.2 Subsidence predictions

The following predicted subsidence impacts were described in the EIS:

- Vertical subsidence:
 - No surface subsidence outside the project site boundary.
 - A total surface area affected by mine subsidence of approximately 8555ha (i.e. the area within the predicted limit of measurable subsidence).
 - Predicted maximum vertical subsidence of 3.2m. The maximum vertical subsidence would occur in the western part of the mining area where the depths of cover are the shallowest (Figure 4).
- Tilting:
 - The maximum post-mining surface slopes in these areas would be up to a maximum of 7%.
- Surface cracking and buckling:
 - Tension cracks would be to a width of up to 0.3m, and larger cracks may occur in isolated locations. Depending on the thickness of the near surface strata layers, the soil type, and the mining depth, surface cracking could extend to depths in the order of 5–10m.
 - Buckling of surface soil may occur due to compressive strain on the ground surface. Buckling would potentially occur near the centre of the longwall panels in the zone of maximum compressive strain. Buckling typically results in mounds of soil being produced in areas where transient tension cracks above the longwall have over-closed.
- Subsurface cracking:
 - The caved zone would be restricted to the Moranbah Coal Measures and the fractured zone would potentially extend to the base of the Fort Cooper Coal Measures, which overlie the Moranbah Coal Measures across the majority of the project site. The EIS concluded that it would be highly unlikely that connective cracking from the mining operations to the ground surface would occur following longwall extraction and subsidence. This was explained to be consistent with experience at Moranbah North Mine and supported by the 'Peer Review Report on Subsurface Subsidence Cracking' (Response to Submissions; Appendix L).

The reliability of the subsidence predictions were discussed in EIS Chapter 6.2.4 and the limitations of the model were described in EIS Appendix A, Subsidence Report. It was noted in the EIS that these limitations are considered unlikely to present a material difference to the outcomes or impacts predicted. In summary, the model is based on a large dataset of observed subsidence monitoring data from both Queensland and New South Wales, and was calibrated using the measured subsidence at previously extracted longwalls at the Moranbah North Mine, which has similar geology and topography. The predicted maximum vertical subsidence is approximately 76% of the total maximum extraction thickness. It was concluded in the EIS that in the unlikely event that the maximum vertical subsidence was 15% greater than predicted (i.e. maximum vertical subsidence of 3.2m), the impacts and mitigation would not be significantly different from those described in the EIS.

4.6.3 Subsidence impacts

The impacts of subsidence on the proposed mine infrastructure, existing transport infrastructure, utilities, natural environment and cultural heritage within the project area were described in the EIS and are summarised in Table 6.

The EIS stated that modifications to the underground mine plan and mining schedule may be necessary following more detailed geological exploration and underground mine planning. However, any revised mine plans would not extend beyond the conceptual underground mining area specified in the EIS. Any revised mine plans or schedules would therefore not have any significant additional impacts beyond those presented in this EIS. Consequently no additional mitigation or rehabilitation measures to those discussed in Table 6 would be required.

4.6.4 Mitigation measures

Chapter 6 (Subsidence) of the EIS did not provide a stand-alone discussion on the mitigation measures and management of potential subsidence. Instead proposed monitoring and mitigation measures (as summarised in Table 6) were described in the relevant EIS chapters (such as but not limited to land use, rehabilitation, transport, ecology and MNES) and hence are described separately here in the assessment report. Proposed rehabilitation measures for subsidence impacts were summarised in section 4.5.9.1 of the assessment report.

In summary, the EIS outlined that mine surface infrastructure would be located so that it would not be impacted by subsidence. No monitoring and mitigation measures were proposed to address impacts of subsidence on the roads and existing utilities. The EIS proposed that such subsidence impacts would be managed through agreements with the relevant infrastructure owners, prior to commencing any mining that would cause subsidence of the infrastructure in accordance with the relevant acts. For example, the proponent proposed in the EIS to manage potential subsidence of sections of the Moranbah Access Road, Winchester Road, and the Peak Downs Highway in-situ subject to approval by IRC for council-owned roads and TMR for state-controlled roads. The proposed longwall mining schedule (EIS Chapter 4 Project Description) for the Moranbah Access Road showed that it would be subsided in project year 7, while the Peak Downs Highway and Winchester Road would be subsided post-year 7. This is described in more detail in section 4.7 of this assessment report.

4.6.5 Major issues raised in submissions

Issues identified in regards to subsidence are discussed in the relevant sections (land, water, transport, waste, cultural heritage, ecology, and MNES) of this assessment report and will not be repeated here.

4.6.6 Conclusion and recommendations

Quantitative estimates of predicted subsidence on the project area (based on the mine plan outlined in the EIS) were provided in the EIS as required in the TOR. The model used to estimate subsidence predictions was calibrated using observed subsidence data from longwall mining at the nearby North Moranbah Project (which mine the same seams). It was stated in the EIS documents that subsidence as a result of longwall mining would impact on some transport infrastructure, utilities, landuse, the natural environment and cultural heritage within the project area that can be mitigated.

An assessment of the adequacy of the EIS documents in addressing the impacts of subsidence on infrastructure and natural and cultural values and the proposed mitigation measures is provided in relevant sections of this EIS assessment report.

Recommendation

The EA should include a requirement for a subsidence management plan detailing projected impacts, mitigation measures, monitoring and remediation works proposed.

Table 6 Summary of impacts of subsidence on proposed mine infrastructure, existing transport infrastructure, existing utilities, natural environment and cultural heritage within the project area (Source: EIS documents)

Value/infrastructure	Predicted impacts*	Proposed mitigation and monitoring measures
Mine infrastructure		
Proposed surface facilities and associated infrastructure	Proposed surface facilities and associated infrastructure would be located so that they would not be impacted by subsidence.	No mitigation or monitoring measures proposed in the EIS as infrastructure would be located so it would not be impacted by subsidence.
DREA	The location of the DREA has been designed to be constructed in stages, such that the placement of the reject materials would occur only on ground that would not subside, or ground that has already been subsided and rehabilitated. Reject materials would only be placed in a subsided area after any surface cracking has been repaired and at least 12 months after subsidence has occurred. The DREA catch dam would be located beyond the limit of measurable subsidence and will not be subjected to subsidence.	The DREA has been designed to be constructed in stages, such that the placement of the reject materials would occur only on ground that would not subside, or ground that has already been subsided and rehabilitated. Reject materials would only be placed in a subsided area after any surface cracking has been repaired and at least 12 months after subsidence has occurred. The DREA catch dam would be located beyond the limits of measurable subsidence and would not be subjected to subsidence.
Isaac Plains South Project		
Overlap area between the Isaac Plains South Project and the proposed project (Figure 3)	According to the agreement between the proponents of the two projects, Moranbah South would only mine in the overlap area once the Isaac Plains South Project had finished its mining operations. Consequently, the Moranbah South Project will give rise to subsidence of the decommissioned Isaac Plains South Project mine, including subsidence of its rehabilitated overburden emplacement areas, levee and stream diversion.	The Moranbah South Project would be responsible for repairing any damage caused by subsidence.
Utilities and other infrastructure		
Powerlines, pipelines and communication lines	The mine plan prepared by the proponent has been designed, where possible, to avoid subsidence of significant infrastructure. In particular, the mine plan has been designed so that the main headings (which do not subside) are beneath the easement which contains Powerlink's 132 kV powerline and SunWater's Eungella Water Pipeline. The majority of this easement would therefore not be subject to subsidence and only small sections of the powerline and water pipeline would be subsided. The communications lines (Telstra) are extending along the road corridors of Peak Downs Highway, Moranbah Access Road and	For infrastructure impacted by subsidence, the proponent would implement management measures for the infrastructure within the project site that may be affected by subsidence, such as pipelines, powerlines, public roads, stock routes, and communication lines. Management measures would be developed in consultation with the owners of the infrastructure, in accordance with the <i>Mineral Resources Act 1989</i> and the

Value/infrastructure	Predicted impacts*	Proposed mitigation and monitoring measures
	Winchester Road.	<i>Coal Mining Safety and Health Act 1999.</i>
Public roads and associated infrastructure Sections of Moranbah Access Road Winchester Road Peak Downs Highway Service station on the Peak Downs Highway	<p>The EIS outlined that some sections of the linear infrastructure may need to be temporarily or permanently relocated, and the proponent is in discussions with the owners of this infrastructure in relation to the potential impacts and management measures for future subsidence of this infrastructure. The proponent would continue to work with TMR and the IRC until this time in relation to the appropriate management measures for the subsidence of these roads.</p> <p>The Isaac River bridge will be located beyond subsidence impacts. Nevertheless, the proponent, as part of its broader discussions with TMR, would discuss any monitoring of the bridge that may be required during active subsidence. The Moranbah Airport and Isaac River bridge Rest Area would also be outside, therefore they would not be affected.</p>	
Stockroutes	The proponent has consulted with DNRM and the IRC in relation to the operation of the stock route in order to understand the potential project impacts and reach an agreement regarding the inclusion of the stock route within the proposed mining lease. Mitigation measures to manage potential subsidence impacts on the stock route would be addressed in this agreement.	
Private properties	The individual properties within the project site that would contain property improvements, such as structures (houses and sheds), farm dams, fencing etc. would be managed through land access arrangements with landowners.	
Coal seam gas operations		
Arrow Energy's coal seam gas exploration and development activities	The exact location of the infrastructure is not known at this stage and is likely to change over time as the gas operations progress. There is the potential for subsidence of infrastructure related to coal seam gas activities.	Co-development agreements between the proponent and the holders of the petroleum tenements are in the process of being developed. These agreements would include processes to resolve any issues associated with coexisting coal mining and coal seam gas extraction, including any impacts on gas extraction infrastructure due to mine subsidence.
Extractive industries		
Quarrico Quarry Operation	There are currently two quarry operations within the proposed project site. The Quarrico Quarry Operation would not be within the limits of	The proponent is in discussions with the owners of the MCG Quarry Operation and DNRM in relation to the

Value/infrastructure	Predicted impacts*	Proposed mitigation and monitoring measures
MCG Quarry Operation	<p>measurable subsidence area and would therefore not be impacted by subsidence from the Moranbah South Project.</p> <p>Parts of the MCG Quarry Operation would be located within the limits of measurable subsidence area.</p>	<p>potential impacts and management measures for future subsidence of the quarry area (refer to section 4.5.3.1 of this assessment report).</p>
Natural environment	<p>See relevant section of this assessment report for further information:</p> <ul style="list-style-type: none"> • Landuse and land suitability—section 4.5 • Terrestrial and aquatic ecology—section 4.18 • Surface water—section 4.10 • Groundwater— section 4.11 • Stygofauna— sections 4.18 and 4.19. 	
Cultural heritage	<p>See relevant section of this assessment report for details:</p> <ul style="list-style-type: none"> • Indigenous and non-Indigenous cultural heritage—section 4.14. 	

4.7 Transport

Project transport was discussed in EIS Chapter 20 Traffic and Transport. Issues addressed included road, rail, port and air traffic. A detailed road impact assessment was provided in Appendix O (Road Impact Assessment Report). A summary of the transport assessment is provided below.

4.7.1 Road

4.7.1.1 Methodology

The road network infrastructure surrounding the proposed project is well developed, servicing several coal mines and agricultural land uses. The proposed project site would be connected to Mackay via Moranbah Access Road and the Peak Downs Highway. Moranbah Access Road provides connectivity to Moranbah township. The regional and local road networks relevant to for the proposed project were identified in the EIS.

The EIS road impact assessment was undertaken in accordance with TMR's Guidelines for Assessment of Road Impacts of Development. The road impacts included those affecting the operation of external intersections, pavement loading and road safety. Traffic operation impacts were assessed up to the ten-year design horizon following commencement of mining operations. An inspection of the existing road network was undertaken together with data on existing road conditions sourced from TMR and IRC. Data collected included traffic volumes, crash rates, school bus routes, and planning for the future road network. The proponent provided information on the proposed project traffic generation and distribution.

Detailed analysis was undertaken using SIDRA Intersection—an industry recognised analysis tool for estimating the capacity and performance of intersections.

4.7.1.2 Existing network and expected traffic

The major roads to be used by traffic from the proposed project are the Peak Downs Highway, Moranbah Access Road and Winchester Road. All of these roads would traverse the proposed project site. The EIS described each road's design, vehicle allowances, and current and projected traffic volumes. The traffic growth rate on the highway and access road expected to range up to a cumulative 8% to 2020 and 4% to 2030. These adopted growth rates accounted for historic growth, forecast regional growth and other major projects in the area. The EIS assessment accounted for the cumulative impacts of projects such as the Isaac Plains South, Eagle Downs, Caval Ridge and Grosvenor Project.

The EIS detailed the origin, destination, vehicle type and morning and afternoon peak traffic movements expected for both construction and operation phases. The peak construction phase for this proposed project would likely require 15 vehicles per day (materials only). A number of over dimensional vehicle movements would be required especially during the construction phase.

4.7.1.3 Impacts

The EIS detailed the likely impacts on road intersections, pavement, access and public safety. In particular, the EIS examined the project's potential impact on intersections at the Peak Downs Highway/Moranbah Access Road intersection, Moranbah Access Road/accommodation village access road intersection, and Moranbah Access Road/mine surface facilities access road intersection. The EIS concluded, based on the road impact assessment undertaken in accordance with relevant guidelines, that no intersection upgrades were necessary.

Subsidence impacts

Sections of Moranbah Access Road, Winchester Road, and the Peak Downs Highway would be impacted by subsidence. Based on the proposed longwall mining schedule shown in EIS Chapter 4 (Project Description) the Moranbah Access Road would be subsided in project year 7, while the Peak Downs Highway and Winchester Road would be subsided after year 7.

Access to the project site

The proposed Moranbah Access Road and mine surface facilities access road would require an auxiliary left turn lane and a channelised right turn lane on the Moranbah Access Road. Safety for the assessed traffic volumes would also require enhanced management. The EIS stated that the SIDRA

analysis and the proposed form would meet industry standard performance thresholds. This road intersection and intersection lighting would be designed in accordance with government requirements (TMR's Road planning and design manual) including for example intersection lighting would be provided to assist drivers with identification and negotiation of the intersection.

Impacts on state-controlled roads

The EIS significance assessment stated that the likely maximum equivalent standard axles loading increases beyond existing (2011) levels for the Peak Downs Highway between Clermont and Nebo would be a 4% increase in equivalent standard axles (ESA) loadings during the construction phase and a 3.5% increase in ESA loadings during the operations phase. In general, traffic impacts on sections of state-controlled roads are significant where a project is likely to result in an increase of 5% or more beyond existing pavement loadings measured in equivalent standard axles.

Road safety and public infrastructure

The EIS presented crash data reflecting a higher rate (than is typical) of crashes on the Moranbah Access Road associated with recreational travel and not commuting traffic during mine shift changeovers. The crash data suggested that the increase in traffic associated with the proposed project, if managed properly, would not lead to increases in crash rates.

It was identified in the EIS that there is no public transport system in Moranbah. However, the EIS noted that a daily bus route services towns including Moranbah between Emerald and Mackay. The EIS stated that it would be unlikely that the Moranbah South Project would significantly impact this bus service. Two school bus routes use the Peak Downs Highway from Coppabella and Villafranca to access schools in Moranbah. School start and end times would not correspond with the start and end of mine shifts. The EIS stated that school bus routes would not be impacted significantly by the additional project traffic.

The limited pedestrian and cycling pathways in Moranbah urban area did not include designated pedestrian or cycle pathways along Moranbah Access Road toward the proposed project. The EIS stated that the project would not significantly impact this infrastructure.

4.7.1.4 Mitigation measures

Subsidence of road infrastructure

The EIS stated that any subsidence of road infrastructure would be managed by:

- Temporarily or permanently relocating the road. The proponent is in discussions with the owners of this infrastructure (IRC, TMR) to develop management measures for future subsidence of the roads. The EIS states that any road relocations would be the subject of environmental assessment of the proposed routes for government approval.
- Monitoring the subsidence impact and repairing roads in-situ if required. The proponent advised that minor regrading to repair cracking may be required. The EIS referred to examples in Queensland and NSW of successful in-situ management of subsidence of public roads project related road impacts.
- The proponent committed to work with TMR and the IRC to develop an approved management strategy for subsidence of the affected public roads. The EIS referred to the need for agreement such that if no approval is agreed then no mining of the relevant panel would proceed. In accordance with the *Mineral Resources Act 1989*, the proponent is required to have an agreement with the road owners prior to any mining that causes subsidence of the road.

Road safety and public transport

The crash data suggested that the increase in traffic associated with the proposed project, if managed properly, would not lead to increases in crash rates. Similarly the impact on public transport infrastructure is proposed to be mitigated with provision of a bus route to the site, pavement repairs as required and safety training programs. The proponent also committed to providing QPS with detailed schedules outlining the number, size and timing of wide load movements associated with the proposed project. As discussed in the EIS Social Impact Assessment Report (Appendix N), the proponent commits to engaging with the Mackay Whitsunday Road Accident Action Group and the relevant authorities, including QPS, on the enhancement of traffic rest areas located within the project

site.

The EIS outlined that road intersection and intersection lighting would be designed in accordance with the requirements of TMR's Road planning and design manual. Appropriate intersection lighting would be provided to assist drivers with identification and negotiation of the intersection.

The proponent would provide a bus service to transport personnel to and from Mackay and the accommodation village at the start/end of their block shift periods. The provision of a bus service would result in a reduction in the number of private vehicle trips between the two centres, and would therefore act as a safety strategy, as it would result in fewer personnel potentially driving fatigued on the Peak Downs Highway.

4.7.1.5 Major road issues raised in submissions

DAFF stated that any road works outside the mining tenement boundaries that may inhibit fish passage, or are non-mining related within the tenement boundaries (i.e. relocation of the Peak Downs Highway, Moranbah Access Road or Moranbah Airport), may require approval from DAFF for waterway barrier works. The proponent committed to obtaining all relevant fish passage approvals and amended the EIS accordingly.

DAFF, MCG Quarries, and Rogash & Uremba Pty Ltd requested that road access to the Quarrico Quarry and MCG Quarry is maintained for all phases of the proposed project. The proponent committed to constructing and operating the Moranbah South Project in ways that do not place restrictions on ongoing access to the quarries. The details of such a consent or arrangement would be subject of the ongoing discussions between the proponent, DAFF and MCG, and to be concluded during the MLA phase post-EIS. The EIS Road Impact Assessment Report (Appendix O) considered potential project impacts on the access road and concluded that the proposed project would not give rise to significant impacts on Moranbah Access Road. As detailed in Chapter 20 of the EIS, the proponent also committed to providing a bus service to transport workers from the project accommodation village to the mine surface facilities.

The Queensland Police Service (QPS) requested increased involvement in wide load planning, development of the traffic management plan for the construction and operation phases of the proposed project, and employee behaviour code. The proponent committed to continued liaison with the QPS on these matters. The proponent cited the Anglo American Workforce Code of Conduct as being applicable to any employee or contractor during shift operation and in circumstances where employees/contractors congregate in groups outside of shifts such as social events.

The Queensland Fire and Rescue Service (QFRS) proposed that a driver fatigue management plan should be implemented to assist in the education and management of workers driving whilst fatigued to their home bases after completion off their rostered shifts. The proponent has committed to implementing a range of driver safety actions and programs including journey management plans, buses to site, no car parks for cars at site, and bus stop secure car parks.

QPS, IRC and the Mackay Whitsunday Road Accident Action Group requested further information on the cumulative impact on traffic levels of other mining, energy and infrastructure projects in the Bowen Basin and not just those associated with the proposed project, e.g. road safety issues and movement of "wide loads" in the Bowen Basin, insufficient passing lanes and the lack of rest areas and toilets. The proponent stated that traffic assessments take cumulative traffic effects into account by applying growth factors to baseline traffic numbers. The growth factors were designed to take into account proposed developments in the region, including mining, energy and infrastructure projects. As stated in the EIS the proponent committed to providing detailed schedules outlining the number, size and timing of wide load movements associated with the proposed project. The EIS Social Impact Assessment Report (Appendix N) further committed to engaging with the relevant authorities and the Mackay Whitsunday Road Accident Action Group in relation to the enhancement of traffic rest areas located within the proposed project site. The referenced Bowen Galilee Basins non-resident population projections also identified that the non-resident workforce population of IRC expected to be within the traffic growth assessed within the EIS.

IRC and BHP Billiton Mitsubishi Alliance (BMA) requested commitments on maintaining local roads impacted by subsidence. The proponent committed to undertaking detailed technical work to further understand subsidence impacts on subsided roads and undertaking planning of mitigation measures. This work would be undertaken in consultation with the IRC, with the final management arrangements being to IRC's satisfaction. This would be required before any mining tenure could be granted. Any

road relocations on BMA's land or mining tenements, or located where that could impact BMA's operations, the proponent would consult with BMA in relation to any proposed relocations.

TMR and IRC requested further information and consultation on acceptable mitigation measures for subsidence arising from mining underneath the Peak Downs Highway, Winchester Road and Moranbah Access Road. The proponent stated that, although in-situ subsidence of the Peak Downs Highway was the preferred proposal, the mine schedule would be adjusted so that mining of the longwall panel located beneath the Peak Downs Highway would be delayed until agreement with TMR had been reached. If no agreement could be reached the longwall panel beneath the highway would not be extracted. EIS Chapter 6.3.2 was amended to reflect the above commitment.

TMR further detailed in its review of the EIS that approval of any construction activities and structures to be located in the state-controlled road corridor would be required under the *Transport Infrastructure Act 1994*, sections 33 and 50 – this would also refer to any conveyor overpass of the Peak Downs Highway. The proponent presented an initial conveyor design stated that all aspects of the highway overpass design are to be agreed with TMR. The EIS stated that designs for the Peak Downs Highway overpass would be in accordance with the requirements of the road authority.

TMR stated that for the Moranbah Access to Peak Downs Highway intersection it would not be acceptable to adopt the bring-forward approach to intersection capacity with no recommendations to ameliorate the impacts of project-generated traffic. It would also not be acceptable to assume a low level of private vehicle use for project workers. The proponent undertook a further intersection assessment on the recently upgraded intersection (see Appendix H of the Response to Submission). The assessment of the recently upgraded intersection found that it would be likely to exceed standard performance thresholds during January 2027 in the absence of project traffic (i.e. at background traffic levels), or alternatively during August 2026 with the addition of project construction traffic. The bring forward period associated with project traffic would be less than one year and would be therefore defined as insignificant in accordance with TMR's Guidelines for Assessment of Road Impacts of Development. The proponent has also committed to implementing a range of driver safety actions and programs including journey management plans, buses to site, no car parks for cars at site, and bus stop secure car parks. These commitments would discourage private vehicle use while in Moranbah or working at the project.

TMR requested additional information and updated Road Impact Assessment to demonstrate the basis of the ESA loading calculations and the results in Table 8.2 by breaking the heavy vehicle movement down into an Austroads Vehicle Classification and associated loaded and unloaded ESA/HV factor. The proponent amended the EIS Road Impact Assessment Report (RIA) (Appendix O) to include additional supporting information on the ESA loading calculations and results. Additional information was provided at EIS Appendix E Response to Submissions. This information demonstrated that the adopted ESA/HV factors provide for background traffic travelling with only a partial load and have a low loading impact on the pavement. The study assumed that project traffic would travel fully loaded and would have a high loading impact per vehicle on the pavement. The results of the pavement impact assessment (with conservative assumptions) showed insignificant pavement loading impact well in accordance with TMR's Guidelines for the Assessment of Road Impacts of Development.

TMR reviewed the proponent's Response to Submission and amended EIS. In response TMR stated that at that stage the proponent had not demonstrated to the TMR's satisfaction that the current operation of the Peak Downs Highway would be maintained during mining operations. Hence, TMR stated that no mining or subsidence is to occur under the Peak Downs Highway corridor and within 100m either side of the highway or structures. TMR further requested that the proponent be required to provide adequate engineering assessment to establish the extent (footprint) of underground mining, so that the subsidence effects are not reflected in the above areas. IRC stated similar concerns in their review of the amended EIS.

Also, TMR noted that, in the proponent's amended EIS (Part 6 of the EIS Addendum) it was stated that Peak Downs Highway, Moranbah Access Road and Winchester Road would be impacted by subsidence (up to 3.2m). These roads and their intersection with each other, including the existing service station, were also identified as potentially requiring relocation. TMR was concerned that very little detail regarding this relocation had been provided to TMR, including the likelihood and locations of relocation. Currently the side road intersections with the Peak Downs Highway have seagull intersection arrangements and acceleration lanes of substantial length. TMR stated that any changes to the road/intersection locations would need to be agreed by TMR, including all upgrades to TMR

standards and at no cost to the Department.

Another issue TMR had was that the proposed longwall panels that are shown to be perpendicular to Moranbah Access Road and Winchester Road (Figure 1; Figure 4). While TMR stated that these roads are not TMR administered roads, the intersection with Peak Downs Highway is administered by TMR. TMR stated that there was no mention made regarding the approach sight distance and pavement condition to be maintained during and following the completion of mining activity. TMR requested further information from the proponent confirming appropriate sight distance to intersections will be maintained.

- TMR was concerned that on the flow paths likely to be altered by subsidence of the longwall panels either side of the highway, especially along existing drainage structures, including the Isaac River bridge under the Peak Downs Highway. TMR requested that conveyance of water runoff would need to be maintained during and following completion of the mining activity.
- TMR stated that the proposed mining lease would cover the Peak Downs Highway, hence TMR consent and a compensation agreement would be required before the mining lease can be granted.
- TMR indicated that insufficient detail had been provided for the overland conveyor and service road proposed to cross the Peak Downs Highway and hence requested more detail, including geometric design, location, duration and proposed speed limit of both the overpass and the required construction side track to be provided in the road impact assessment/traffic management plans for approval by TMR. These works/structures would also require approval by TMR under the *Transport Infrastructure Act 1994*.
- TMR requested an updated road impact assessment confirming that there would be no pavement impacts on the state road network or operational impacts on state road intersections.
- TMR stated in its response that it is not in a position to fund any safety improvements that may be required, nor would it be likely that this funding could be made available to undertake the immediate works necessary to ensure the ongoing safety and efficiency of the state-controlled road network for the proposal to proceed with the construction phase. TMR requested that any temporary or permanent state road infrastructure should not be subject to subsidence. TMR further requested a 120km/h design speed in accordance with the relevant standards at no cost to TMR. Therefore, once further information is available on the final design of the project, the proponent is required to undertake a review of the road impact assessment and provide an updated assessment which clearly identifies any necessary safety improvement works, rehabilitation and maintenance costs to mitigate the impacts of project traffic, prior to undertaking any construction works. TMR recommended that the proponent continue to liaise with TMR on all matters concerning (refer to Appendix 1—Recommended conditions proposed by the Department of Transport and Main Roads):
 - Updated road impact assessment and road-use management plan.
 - Updated traffic management plan.
 - Undertaking road impact mitigation strategies and provision of new infrastructure.
 - Infrastructure agreements.
 - Rail-related conditions with Aurizon (formerly QR National; e.g. managing coal dust during transportation).

4.7.2 Rail

The EIS outlined that some infrastructure beyond the project site would be required for the proposed project, including a rail connection between the project site and the Blair Athol Rail Line. The off lease infrastructures were not assessed in this EIS but will be discussed briefly here as they are related to the proposed project.

The EIS stated that Aurizon is the sole provider of coal rail transport for the northern Bowen Basin, with the Goonyella Coal System currently servicing approximately 30 coal mines in the region. This rail system is a dedicated coal transport system and is not used for passenger services. Coal is transported along this system to coal terminals at Abbot Point, Hay Point, and Dalrymple Bay. The Blair Athol Branch of the Goonyella Coal System is the main rail line servicing coal mines from

Clermont to Moranbah.

The proposed rail extension (spur) from the project site would connect to the existing Blair Athol Branch Railway line for the transport of coal to port. A rail loop and train loading facilities would be constructed on the project site adjacent to the coal stockpiles. The rail spur would be constructed above the bord and pillar mine, and therefore would not be impacted by subsidence. The rail spur would cross Horse Creek, and a small rail bridge that would be constructed at this location. At its peak production capacity, the project would be serviced by an average of five coal trains per day, up to a peak of eight trains per day.

The EIS outlined that the environmental management, and the scheduling and control of trains, that utilise the Goonyella Coal System, would be the responsibility of Aurizon, the owners and operators of this section of track.

4.7.2.1 Major rail issues raised in submissions

DNRM raised concerns regarding coal dust during transit on railways and requested an explanation of the management of coal in transit and if current methods of 'laminating' coal in the wagons will be deployed from the start of operations. The proponent responded that any impacts beyond the project site are beyond the scope of the EIS and that Aurizon, as the owner of the rail infrastructure that would be utilised for this project, would be responsible for managing impacts associated with transport of coal.

In its submission, TMR stated that all mines having product coal transported on Aurizon's coal rail network would be required to have rail load-out facilities implementing procedures consistent with Aurizon's QR Network Coal Dust Management Plan (2010). IRC also raised concerns regarding dust from the rail load out facility and the rail corridor. The proponent responded that it would consult with Aurizon during the detailed design phase of the project to determine any additional dust mitigation requirements related to the transportation of coal. The proponent further committed to various dust control measures including for the train load out facilities.

Queensland Health (QH) requested that the proponent to consider appropriate positioning, design and engineering for activities of project that would generate low frequency noise in order to minimise low frequency noise impacts to nearby residents. This includes, but is not limited to the construction and operation of mine surface facilities, coal handling and processing plant, rail loop and train loading facilities. The proponent responded that the EIS contained an assessment of low frequency noise. The noise modelling concluded that the low frequency noise levels likely to be generated by the project would be within applicable noise criteria at all residential receptors.

IRC stated in its submission that the EIS did not fully describe the effects of the new rail spur link impacts on the flooding of horse creek and the overall impacts on Grosvenor Creek and that the new infrastructure would have no impact on the flooding profiles of either tributary, especially the Grosvenor Creek, as this waterway is directly related to habitable floor levels of residences. The proponent responded that it is committed to minimising the impacts from project activities on the hydrology of waterways. Detailed design of the proposed rail spur would ensure that the flood immunity of nearby residences would not be adversely impacted by the project.

Aurizon identified in its review of the amended EIS that the proponent has incorrectly stated that it would be Aurizon's responsibility for an EIS and for obtaining the necessary approvals for the proposed off-lease rail connection between Moranbah South Project site and Aurizon's Blair Athol Branch Line. As such Aurizon advised EHP that there is currently no rail connection agreement in place and therefore it is not Aurizon's current strategy to acquire land, nor would Aurizon be responsible for the EIS or approval, for connecting train infrastructure outside the existing rail corridor. Aurizon further advised EHP that, in the absence of any future arrangement to the contrary between Aurizon and the proponent, environmental assessment and approval for the rail infrastructure which is to be located off lease is the responsibility of the proponent.

4.7.3 Port traffic

The EIS indicated that coal from the project is proposed to be transported by rail to either the Abbot Point Coal Terminal located at the Port of Abbot Point, north-west of Bowen; the Dalrymple Bay Coal Terminal located at the Port of Hay Point, south of Mackay; or the proposed Dudgeon Point Coal Terminal planned for the Port of Hay Point.

There are plans to expand the capacity of the Port of Abbot Point with the construction of new coal terminals. Dudgeon Point would be a new coal terminal at the Port of Hay Point. The EIS stated that, once the proposed expansion projects are completed, each of these terminals would have adequate rail, storage and shipping capacity to handle the additional 14 Mtpa of product coal from the Moranbah South Project.

North Queensland Bulk Ports Corporation Limited (NQBP) is the port authority responsible for the Ports of Abbot Point and Hay Point. Environmental management at these ports would be the responsibility of the owners and operators of each terminal. However, the EIS also stated that the proponent's rail and port strategy may be revised over the life of the Moranbah South Project.

No submissions on the port issues were received during the EIS submission period.

4.7.4 Air traffic

The EIS stated that all air traffic in and out of Moranbah utilises the Moranbah Airport. The airport has a single north-south runway approximately 1.5km in length and 30m wide catering for up to 10 daily flights in and out of Moranbah. These flights are currently operated by QantasLink with seating for up to 74 passengers per flight. There are also a number of charter flights that utilise the airport.

The proponent proposed to use of charter flights to transport personnel before and after their rostered shifts from their places of residence outside of the Central Queensland region. The use of charter flights and commercial flights, where practical, will therefore not significantly impact on the current air services provided in Moranbah.

The EIS outlined that the main surface facilities for the project would be located to the east of the airport. The surface infrastructure in this area has been designed with regard to the Civil Aviation Safety Authority's height restrictions to ensure that the project would not impact detrimentally on arriving and departing aircrafts, or the operations of the airport.

4.7.4.1 Major issues raised in submissions

IRC raised concerns in regards to the location of the Moranbah Airport and noted that the proposed rail access would cross immediately north of the end of the runway, and requested information on elevations or other diagrams showing rail loading gauge in relation to landing and take-off paths; the likelihood and incidence of potential conflict; and details on the height clearances of rolling stock and all other infrastructure in the flight path of the airport. The proponent responded that it is aware of the considerable safety restrictions required to be placed on the construction of infrastructure within the vicinity of an airport and that the proponent consulted with the Civil Aviation Safety Authority and BMA (the owner of the airport) in order to understand the requirements in relation to Moranbah Airport. A number of meetings have been held with these authorities and the project planning has taken airport height restrictions into consideration for the design and dimensions of project infrastructure. This has included provisions for the project rail line and rolling stock.

4.7.5 Conclusions and recommendations – transport

The transport assessment was satisfactory and adequately addressed the requirements of the TOR. The EIS adequately described the existing road, rail, port and air infrastructure associated with the proposed project site and surrounds. The project's impacts on port and air infrastructure were adequately assessed and described.

On-site impacts of the project on road infrastructure as a result of subsidence from longwall mining, was predicted in the EIS. Site-specific mitigation and monitoring measures were described in the EIS to address how the proponent intends to manage impacts of subsidence on road infrastructure. EHP was satisfied that justification was provided by the proponent to comply with the TOR and demonstrated that:

- mitigation and monitoring measures are available (and have been used in other mines) that are conducive to the proponent's preferred option to manage the impacts of subsidence on infrastructure in-situ
- that the proponent had consulted with the relevant owners/lease owners of infrastructure regarding these impacts and proposed management options
- that if in-situ management of subsidence would not be deemed to be possible or agreed on by

relevant parties, then alternative options had been appropriately explored in the EIS and that worst case potential impacts of these options had been assessed.

In accordance with the *Mineral Resources Act 1989* and the *Coal Mining Safety and Health Act 1999* the proponent would be required to sign agreements with relevant infrastructure owners prior to conducting any mining that would cause subsidence of road infrastructure.

Recommendations

- *The proponent should address and implement all conditions and requirements outlined by TMR in Appendix 1 of this assessment report. The proponent should finalise the road impact assessment, the road-use management plan and traffic management plan in consultation with TMR prior to the commencement of project operations, including construction works.*
- *The proponent should continue to liaise with Aurizon for resolving the issue for the approval for the rail infrastructure and the dust and noise concerns raised in EIS submissions.*
- *The proponent should consult with DAFF for all waterway diversions, levee designs, culvert or bed level crossings, rock armouring, and any other works within a waterway, including dams, as defined under the Fisheries Act 1994 for both permanent and temporary works. The proponent should consider the following guidelines in the final designs:*
 - *Queensland Waterways for Waterway Barrier Works*
<http://dds.information.qld.gov.au/DDS/>
 - *Fisheries Guidelines for Fish Habitat Buffer Zones – FHG003*
http://www.daff.qld.gov.au/documents/Fisheries_Habitats/FHG003-Fish-Habitat-Guideline.pdf
 - *Waterway Barrier Works Development Approvals May 2012- FHMOP008*
http://www.daff.qld.gov.au/documents/Fisheries_Habitats/FHMOP008-May-2012-V2.pdf
 - *Culvert Crossings WWBW01 – Part 3*
http://www.daff.qld.gov.au/documents/Fisheries_Habitats/culvertcode- WWBW01.pdf
 - *Construction of minor dams or weirs WWBW01 – Part 1*
http://www.daff.qld.gov.au/documents/Fisheries_Habitats/minordam-code-jan-2013-final.pdf
 - *Temporary waterway barrier works WWBW02*
http://www.daff.qld.gov.au/documents/Fisheries_Habitats/temporary-code-WWBW02.pdf

4.8 Waste

Mine waste management was discussed in EIS Chapter 7. An excavated waste rock geochemical assessment was presented in Appendix C Geochemistry Report. Non-mineral waste management was discussed in Chapter 22.

The mine waste assessment includes descriptions of the management of coal rejects material and drift spoil. Also included was a discussion of the geochemical and geotechnical properties of the rejects material and drift spoil, as well as the design, construction, operation and rehabilitation of the proposed DREA. The discussion was supported by detailed technical reports namely the Rejects Emplacement Area Conceptual Design Report (EIS Appendix B) and the Geochemistry Report (EIS Appendix C).

The non-mineral waste assessment includes descriptions of non-mine waste including sewage, liquid waste and domestic waste as well as land contamination issues.

4.8.1 Methodology

The EIS stated that mine waste would arise from the washing of raw coal at the site coal preparation plant producing rejects and tailings material. These materials as well as drift spoil were geochemically assessed as part of the mine waste assessment. The geochemical assessment investigated the geochemical and physical characteristics of representative samples of rejects material and drift spoil, included a risk assessment of the likelihood and management of possible acid generation and leaching of soluble metals and salts.

The geochemical and physical testing included net acid producing potential, acid neutralising capacity, total sulphur, and static geochemical testing (32 samples). This test program involved use of the chromium reducible sulphur (Standards Australia AS4969.7-2008) method to determine the sulphide (pyritic) sulfur content of the samples. Fourteen composite samples were prepared based on lithology, drill hole, depth interval and geochemical characteristics. The composite samples were multi-element tested using both the solid and soluble fractions. Six composite samples of rejects material and drift spoil underwent kinetic leach column testing to assess the quality of leachate from the mine waste materials over time and the likely dynamic geochemistry of these materials.

The EIS described the legal and strategic framework for managing non-mineral wastes and land contamination in Queensland. The non-mineral waste assessment comprised a desktop study identifying potential waste streams associated with the project's construction, operations and decommissioning activities, likely impacts associated with waste streams, and management options for waste minimisation and disposal.

4.8.2 Waste characterisation and quantification

The EIS identified the following life of mine storage capacities for mine waste:

- the DREA – footprint approximately 240ha with maximum height of 50m with a storage capacity of 72Mm³
- drift spoil emplacement (box cut overburden emplacement area) – maximum height of 20m, footprint 50ha with a storage capacity of 4Mm³.

The EIS geochemical assessment found a low risk of environmental impacts from rejects material and drift spoil, based on the following results:

- Non-acid forming rejects material with excess acid buffering capacity, and a low potential for acid generation.
- Non-acid forming draft spoil with excess acid buffering capacity, low potential for acid generation. Less than 1% of all drift spoil material from the uneconomic coal seams would have potential for acid generation and would need to be appropriately managed.
- Surface runoff and seepage from rejects material and drift spoil would be likely to be pH neutral to alkaline (pH 7–9) with low levels of salinity following surface exposure.
- Low total metals and metalloids in rejects material and drift spoil were below criteria for soils.
- Trace metals/metalloids and major ions in runoff and seepage from rejects material and drift spoil were shown to be sparingly soluble.
- Dissolved metal/metalloid concentrations in runoff from rejects and drift spoil demonstrated were found to be within ANZECC (2000) and NEPC (1999) water quality guideline criteria. Exceptions were molybdenum and selenium concentrations which were elevated in some samples.
- Drift spoil would be likely to be alkaline and sodic. This material would be managed to address erosion and dispersion issues.

4.8.3 Mine waste management

The EIS stated that tailings would be dewatered and mixed with rejects and the combined dry rejects material would be emplaced in the DREA. The EIS noted that the proposed project would not produce wet tailings and would not require tailings dams. The location of the DREA is shown in Figure 1. Rejects material would be placed so as to limit dispersion and erosion using designed soil capping layer and drainage controls.

The design of the DREA accounted for the results of testing of the geotechnical properties of the rejects material as well as geotechnical testing of the foundation of the DREA, including permeability testing. The rejects would be granular and hence would appear and behave like gravel or crushed rock material and not like a fine soil, slurry or a paste. The rejects would therefore be expected to drain quickly.

The EIS outlined that surface runoff from the DREA and box cut overburden emplacement area and any seepage from the DREA would be monitored for compliance with water quality parameters

including water samples from the DREA catch dam and from runoff from the box cut overburden emplacement.

Drift spoil, the material from the excavation of the drifts and box cuts, would be emplaced in a box cut overburden emplacement area to the south of the mine surface facilities (Figure 2). Any drift spoil identified as potentially acid forming is proposed to be emplaced within the centre of the box cut overburden emplacement area and covered by benign material.

The EIS also described that the proposed surface water management strategies, including the construction of sediment dams and surface water drainage on-site, would manage any seepage from co-disposal storages and waste rock emplacements. Excavated stratigraphic waste units would be selectively handled to separate the individual lithological waste groups based on geochemical risk of each lithology. The higher risk, potentially dispersive lithological waste groups, such as the carbonaceous material, coaly material, mudstone and tailings, would be disposed in-pit and capped to minimise potential surface and groundwater contamination. Materials with higher geochemical risk would not be used as capping materials during progressive rehabilitation of waste emplacements. Ongoing waste rock characterisation would be undertaken during operations to further characterise the waste and amend the waste rock disposal strategy, as required.

The EIS included a detailed description of the proposed site preparation procedures which would include clearing of the DREA footprint, grubbing, removal of topsoil and subsoil material and preparations to provide a low permeability foundation and installation of water management structures and pipelines.

4.8.4 Non-mineral waste management

The EIS included a detailed list of wastes expected to be generated as part of mine construction and operational activities. This included the source, projected annual quantity and proposed management strategy for each waste. The main wastes anticipated to be generated by the proposed project include: green waste, scrap metal, waste oils, other hydrocarbons and miscellaneous chemicals and batteries and tyres. Environmental values to be protected when managing waste were also identified.

Wastes associated with mine construction activities and operational activities within the project site were presented in the EIS (Chapter 22 Table 22-1) together with the source, projected annual quantity and proposed management strategy for each waste.

Avoidance, mitigation and management of potential waste impacts from the proposed project would be achieved primarily through implementation of a waste management system. The waste management system would:

- meet the requirements of the waste management hierarchy under the *Waste Reduction and Recycling Act 2011* and other regulatory requirements
- provide for the identification of waste types
- commit to the use of licensed waste transport contractors
- outline a process for tracking of relevant regulated wastes.

The proponent committed to maintaining an inventory of all waste types and quantities produced by the proposed project and their applicable disposal method in accordance with *Waste Reduction and Recycling Act 2011* and Environmental Protection (Waste Management) Regulation 2000. The proponent would also submit annual National Pollution Inventory reports in accordance with the National pollutant inventory guide (SEWPaC 2012) and associated manuals, e.g. Emission estimation technique manual for mining (SEWPaC 2012), as required.

A list of measures to be undertaken during mine establishment, operations and decommissioning to minimise land contamination was provided in the EIS (Chapter 22). Wastes would be separated and stored for collection, transport, recycling, recovery or disposal as described in the waste inventory and collected, handled and stored so as to protect mine site staff, community health and prevent nuisance.

The recycling and re-use of waste materials would be the preferred option for the proposed project during both construction and operation. If waste cannot be recycled, it would be taken to the council landfill. Regulated waste would be removed and disposed of appropriately by a licensed waste contractor. The potential impacts of these waste streams generated by the project (if not appropriately

managed) would include:

- contamination of surface and/or groundwater and toxic effects to flora and fauna from inappropriately managed hydrocarbon wastes
- spontaneous combustion of buried tyres releasing greenhouse gas emissions, toxic emissions and visible smoke
- release of chemicals and/or heavy metals into the environment from improper storage or disposal of batteries
- increased incidence of disease-spreading vermin such as mice, rats, birds and insects attracted to food and organic wastes, creating health and amenity issues.

A waste management strategy would be developed for the life of the proposed project that would incorporate a suite of mitigation measures to manage and dispose of the project generated waste streams, including:

- recycling and/or disposal of hydrocarbon waste by licenced contractors at suitably authorised facilities
- recycling tyres through commercial contractors, or disposing of tyres according to best practice guidelines
- recycling paper, plastics, glass, aluminium and steel by placing recyclable materials in dedicated containers for collection by a licensed contractor
- collection and disposal of solvents, paints and chemical wastes by waste management contractors
- storing batteries on-site on pallets with drip trays within bunded, sealed and covered areas
- recycling of batteries to the supplier for recovery disposal, or disposal of batteries with general waste via a licensed contractor
- storing used oil/fuel filters in clearly labelled and bunded filter ponds for collection and recycling by a licensed contractor
- storing food and organic wastes in sealed containers for removal from site on a regular basis
- stockpiling and mulching green waste generated from clearing activities for reuse in rehabilitation activities
- storing removable waste in a central waste management area until it was removed from site
- draining oil/chemical drums of remaining product for storage in a dedicated bunded area for collection by a licensed contractor for recycling off-site
- using oil/water interceptors to separate water contaminated by oil as a result of any spill and pumping the separated water to sediment dams for re-use on-site for dust suppression and the oil to a storage area for removal by a licensed contractor
- remediating contaminated soil as a result of any significant spill on-site in a dedicated pit area, or collecting the contaminated soil for off-site remediation by a licensed contractor, if on-site remediation would be not practical
- storing tyres in small groups in a designated area with no grass or other flammable materials within a 10m radius.

4.8.5 Major issues raised in submissions

EHP requested further details on the assessment of the likely cumulative impacts on the receiving environment from potential runoff and seepage of leachate from the DREA with elevated concentrations of molybdenum and selenium. The proponent provided a detailed summary of the low risk of contaminated seepage occurring or of runoff being contaminated and mobilised. It included monitoring provisions for regular testing of water for potential contamination and adaptive management options should contamination be found.

DNRM requested further information on the potential for mine wastes to affect SCL and implications

for future decision applications affecting SCL. The proponent stated there would be no project infrastructure located on SCL and no wastes would impact SCL.

QH requested that the proponent manage any non-drinking water stores and supplies so as to preclude the potential for direct and indirect contact with humans, thereby minimising the potential for water borne disease transmission. QH also asked for a commitment for disposal of waste water via the sewerage system or in conformity to the South Australian Reclaimed Water Guidelines (Treated Effluent), 1999. The proponent responded that the proposed mine water management system would be a closed, nil-discharge system and as such security and containment measures would be put in place to protect the health and safety of mine staff and the general public, and to ensure that only authorised personnel were able to gain access to various areas of the mine. The proponent stated in response to QH's second query that the EIS committed to treating effluent from the on-site sewage treatment plant and septic tank waste for spraying to pasture or used to irrigate sporting fields or gardens. Sewage sludge would be collected by a licensed waste contractor and transported to a sewage treatment plant for treatment and disposal.

IRC, BMA and the Civil Aviation Safety Authority raised the issue of bird strikes at the Moranbah Airport and the potential for wastes and waste water to increase the bird population near the airport. The proponent noted that EIS stated that food wastes would be stored on-site in bins and regularly transported off site by a licensed waste contractor to a licensed landfill. The airport would be located adjacent to a large existing dam (associated with Quarrico Quarry) which provides year round bird habitat. The majority of the water storage dams would only contain water immediately after rainfall, with water from the majority of dams being pumped to a single water storage dam with no fringing vegetation.

4.8.6 Conclusions and recommendations

The EIS adequately addressed the waste identification and management requirements of the TOR. The management of coal rejects material and drift spoil from the proposed project was adequately described and the geochemical and geotechnical properties of the rejects material and drift spoil, as well as the design, construction, operation and rehabilitation of the proposed rejects DREA, adequately discussed.

Based on the environmental protection commitments outlined in the EIS, appropriate conditions for tailings disposal based on EHP's Model Mining Conditions Guidelines have been included in the proposed draft EA conditions in Appendix 2 of this report.

Requirements of the TOR in relation to non-mineral waste management were adequately addressed in the EIS. The overall commitment to apply and implement waste management principles in accordance with applicable legislation has been adequately demonstrated. The waste hierarchy has been appropriately identified and, generally adopted for identified waste streams, and reflected in general management measures. Specific waste management measures are proposed to be developed to ensure that the waste hierarchy would be effectively implemented during mine operations. The proposed project would contribute to additional waste being delivered to local landfills.

Recommendations

- *The proponent should liaise with IRC to negotiate the type and volume of waste likely to be delivered to the council landfill.*
- *When applying for the EA the proponent should provide further details and maps showing the design and location of the proposed sewage and waste management system in the context of all project infrastructure on-site including the location of any proposed sites to be used for irrigation.*

4.9 Mine water management

The mine water management system was presented in Chapter 13 of the EIS. Included was a description of the waters to be generated by the proposed Moranbah South Project and proposed strategies for the management of mine affected water. A water balance for the proposed project was presented in EIS Appendix K. Figure 5 in this assessment report shows the proposed mine water management system for the project. The system was designed to:

- maximise the reuse of mine affected water for water supply

- minimise the demand for external water supply
- minimise the risk of discharge of any poor quality water from the proposed project site.

4.9.1 Mine affected water

The geochemical assessment (EIS Appendix C) concluded that reject material (DREA surface) would be likely to be relatively benign and generate neutral to slightly alkaline, low salinity runoff. It was therefore concluded in the EIS that the likely soluble metals and salt content in any runoff waters would not impact the receiving environment. The DREA would be built in stages and would always drain to a designed catch dam for sediment control. The DREA drainage system would be designed for continued operation during and after subsidence from each longwall panel. DREA drainage control plans for each longwall panel would extend beneath the DREA footprint.

Runoff from project infrastructure areas (buildings, box cut, mine industrial area, coal preparation plant) may have elevated levels of suspended sediment, hydrocarbons and other contaminants. The EIS noted that these catchments would be isolated with diversion drains and bunding and runoff collected in catch drains flowing into sediment traps, oil separators (as necessary) and collected in catch dams for pumped transfer to the return water dam to supplement mine water supply.

The EIS stated that overland flow from subsided areas would not be contaminated, provided the proposed management measures for these areas were implemented, including the rehabilitation of surface tension cracks and erosion control works in subsided waterways.

The proposed raw water dam is proposed to become a buffer storage for raw water from an external pipeline supply. It would be designed as a turkey's nest dam with no contributing catchment and would not be used for mine affected water storage. The proposed return water dam would be designed to be the mine affected water storage. The return water dam would also be a 'turkey's nest' structure with no contributing catchment. The return water dam would store all mine affected water including transfers from the mine water dam, box cut dam, and the mine industrial area, DREA and coal preparation plant/coal stockpile catch dams. The EIS concluded that the return water dam would fulfil all mine affected water demands for the project; where supply is available.

The EIS stated that the preliminary hazard assessment for the proposed project storages, as well as the design of the proposed project storages, were made in accordance with the Manual for assessing hazard categories and hydraulic performance of dams (DERM, 2012). No significant or sensitive features, active working areas or important public facilities/utilities were found in this assessment to be present in the containment failure path. Proposed storages would be unlikely to contain water exhibiting elevated metals, metalloids, organics or other contaminants, as listed within the manual. A salt balance for the mine water storages (EIS Appendix K Water Balance Report) indicated that the conductivity of stored water in the water management dams would be unlikely to exceed 4,000 μ S/cm (threshold value as per manual). The proposed storages are considered to be 'low' hazard category structures and not 'regulated structures' under the EP Act.

The EIS stated that further detailed hazard category assessments would be conducted at the detailed design stage before finalising the EA and prior to construction to confirm whether any of the mine water dams may be regulated dams so that design storage allowances and mandatory reporting levels can be determined for mine water dams in accordance with the manual requirements for "significant" hazard category dams. This would ensure that the mine water management system would comply with the regulated dam requirements in the event that any of the storages are assessed as hazardous at the detailed design stage.

The location of collection drains for the mine industrial area catch dam and the coal preparation plant/coal stockpile catch dam are shown in Figure 6. Runoff from the box cuts containing the portals to the longwall and bord and pillar mining areas would be collected in sumps near the portals and transferred to the box cut dam.

4.9.2 Water storages

The following water storages and capacities were proposed in the EIS for the mine water management system (as shown on Figure 6):

- raw water dam – 350ML
- mine water dam – 150ML

- coal preparation plant and coal stockpile catch dam – 350ML
- mine industrial area catch dam – 40ML
- box cut dam – 35ML
- return water dam – 800ML
- DREA catch dam – 800ML.

It was concluded in the EIS assessment that the mine water management system would run an annual deficit with make up raw water imports by pipeline. The mine water management system would not result in the need for discharges of mine affected water to waterways. Median project total water demands would be likely to be constant (at approximately 4600ML/a) with evaporation losses from dams a relatively minor 130–160ML/a consideration. The inflow from runoff and direct rainfall combined was found to contribute between 250–530ML/a.

The 123 year period used in the modelling of mine affected water storages showed that the maximum storage volume required was 1736ML. The combined storage capacity of the proposed mine water management system would be 2175ML. Therefore the EIS concluded there would be sufficient storage capacity for mine affected water during the full range of historical rainfall sequences over the life of the proposed project.

4.9.3 Water balance

The EIS modelling used GOLDSIM software, which is widely used for modelling both natural and industrial water management systems. The model relied on historical rainfall data for a 123 year period (1889 to 2012). Catchment yield was modelled using the Australian water balance model watershed model calibrated to the recorded daily flows at the Phillips Creek stream gauge (Station Reference 130409A). Runoff coefficients were set at 4.2% for natural undisturbed catchments up to 28% for hardstand areas.

The proposed project would receive water from the following sources (total inflows were estimated in the EIS to be approximately 4800ML/yr):

- external raw water (pipeline(s) to be specified supplying over 3000ML/yr on average)
- groundwater from underground mine inflows and coal seam gas drainage
- rainfall and runoff
- moisture entrained in the raw coal.

The proposed project would generate the following waters:

- underground mine pit water (up to 690ML/yr excess) including:
 - groundwater inflow to the underground workings
 - excess water recycled from underground operations
- coal seam gas drainage water (up to 50ML/yr) with an estimated average electrical conductivity value of 8500 μ S/cm.
- runoff from disturbed areas including:
 - DREA
 - mine industrial area
 - coal preparation plant area and associated coal stockpiles
 - box cut areas.

Water demands and losses for the project were identified in the EIS as follows:

- underground mine activities requiring 1710ML/a of raw water
- vehicle washdown requiring:
 - 94ML/a raw water for underground spray bars

- 43ML/a mine affected water for general washdown
- coal preparation plant water supply of up to 2376ML/a preferentially sourced from mine affected water supplies. Raw water would be used where no mine affected water is available
- potable water requirements comprising 373ML/a raw water treated at 60% efficiency to provide 224ML/a potable water for longwall, and domestic demands
- dust suppression for coal stockpiles and conveyor transfers requiring 211ML/a of mine affected water.

The maximum modelled salinity of mine-affected water within any proposed storage was predicted to be 3355 μ S/cm in the return water dam. The maximum modelled salinity of water in all other dams was predicted to be <3000 μ S/cm. Modelling of the proposed water management system showed a significant water deficit with a low probability of discharge of excess mine affected water.

The EIS concluded that rainfall runoff volumes would be dependent on the contained catchment areas and climatic factors (including rainfall and evaporation). Contained catchment areas would generally remain constant once constructed with the exception of the DREA as its catchment area would vary as the DREA during construction. However, the staged development of the DREA was included in the EIS water balance analysis in order to capture the variation in runoff contribution over the life of the mine.

Rainfall runoff captured as mine affected water from all contributing catchment areas has been modelled based on daily rainfall data.

The proponent has secured a raw water allocation of 1600ML/a from SunWater for the proposed project. This water would be sourced from the Eungella Dam, via the Eungella Water Pipeline. Raw water would be used to supply demands of the underground mine, the water treatment plant, vehicle washdown and make-up demand for the coal preparation plant.

The mine water system is predicted to have a water deficit throughout the proposed operations. Modelling in the EIS used showed that the median annual raw water requirement would range from approximately 2550–4400 ML/a over the life of the mine. In contrast, the maximum annual raw water requirement to meet fully operational demand would be approximately 4650ML/a.

The EIS concluded that, in addition to the 1600 ML/a allocation secured for the project, an additional external raw water supply of approximately 950–2800ML/a would be required to meet the median annual requirement for raw water. To meet the maximum operational demand, it was estimated in the EIS that an additional 3050ML/a would be required from an additional external source.

The EIS also stated that the proponent is currently considering the following potential sources of additional water supply for the project:

- construction of a dedicated pipeline from SunWater's existing water supply facilities at either the Eungella Dam or the Burdekin Falls Dam
- partnership in a multi-user pipeline currently being investigated as part of a redevelopment of SunWater's Eungella Water Pipeline Southern Extension
- from other mining and CSG operations in the region.

4.9.4 Mine water discharges

The EIS modelling of the proposed water management system indicated that would be a significant water deficit and a low probability of discharge of excess mine-affected water. As the AEP of discharge was found to be less than 0.008, the probability of discharge of mine-affected water is less than once in 123 years based on modelling of all historical rainfall sequences over the last 123 years, including all extreme wet periods.

Although the EIS identified a water deficit with a low probability of discharge of excess mine affected water, it did state that in the unlikely event that discharge of excess mine affected water would be required during an extreme rainfall event, this would be conducted in accordance with EA conditions relating to the discharge of mine affected water. These conditions are designed to prevent any adverse cumulative impacts on downstream water quality. Proposed EA conditions are found in this assessment report in Schedule F in Appendix 2.

4.9.5 Water monitoring

Water management system monitoring outlined in the EIS for the proposed project would include quarterly monitoring of water quality in mine water dams including the DREA catch dam, the coal preparation plant/coal stockpile catch dam, the mine industrial area dam, the box cut dam, the mine water dam and the return water dam. The monitoring program would include monitoring of a comprehensive suite of water quality parameters, including metals; pH and EC. Refer to recommended draft EA conditions in Schedule F in Appendix 2.

The EIS further outlined that the site water balance including water transfers, consumption and dam storage volumes would be monitored in accordance with the site water management plan. The site water balance would be reviewed regularly and would trigger modifications to the water management system, where necessary, to ensure the proper functioning of the system.

According to the EIS sediment control structures would be managed in accordance with the erosion and sediment control plan which would include an inspection plan for sediment control structures to ensure they are maintained and remain effective.

4.9.6 Major issues raised in submissions

The Department of the Environment, DAFF, and EHP requested further details about likely impacts from an emergency water release from the dams and the likely impacts on water quality and MNES downstream. Clarification of EIS commitments, in regards to monitoring of water quality upstream and downstream of potential discharge points, were also requested. The proponent responded with amendments to the EIS to provide additional details on the monitoring and discharge of mine affected water and the unlikely need for discharge. The proponent also outlined that this information would also be consistent with the requirements of the model EA conditions for mine affected water management.

The Department of the Environment stated that any Australian Government approval conditions would be likely to require development of a surface water management plan with a monitoring program including upstream, downstream and source monitoring of relevant contaminants. Information on this would be used as part of the overall assessment and inform any conditions which may apply to the project. However, surface water plans required by Queensland agencies (EP Act and *Water Act 2000*) may address the Australian Government requirements.

EHP required further information on mine water management system dam designs, including a hazard assessment report prepared by a suitably qualified and experienced person for the six dams proposed for storing mine affected water. The proponent committed to providing an updated report as part of the development of the final dam design for EA conditions. All storages were modelled to be low hazard category structures in terms of stored contaminants. Chapter 13.6 and Chapter 25.3.6 of the EIS were amended to include the following statement: "Modelling of the proposed water management system indicates that there would be a significant water deficit and that there would be a low probability of discharge of excess mine affected water. The predicated annual exceedance probability (AEP) of discharge would be less than 0.008."

In another comment, EHP requested that monitoring and recording of the AHD water levels together with the volumes of water in each storage should be undertaken for the six storages in the integrated water management system. This monitoring and recording should be done on a quarterly basis at the same time as the water quality monitoring of those storages. The proponent responded with appropriate changes to the EIS.

In regards to the risks of controlled and uncontrolled water releases during extreme rainfall events EHP considered that insufficient information had been provided as to when uncontrolled, or controlled, releases may occur from the site and hence requested further information. The proponent responded that the capacity of storages within the mine water management system was designed to ensure discharges of mine affected water would not be required. The modelling conducted for the EIS indicated that if the mine had operated at any time within the last 123 years it would not have needed to discharge any mine affected water. Hence, the proponent concluded that discharges of mine affected water would be unlikely. However, in accordance with EHP's stated preference, provision for mine water discharges was proposed only as a contingency measure.

IRC requested further information on the contamination of water due to mine water release and the cumulative effects of release. The proponent provided amendments to Chapter 25.3.6 of the EIS with

further details on the monitoring and discharge of mine affected water consistent with the requirements of the model EA conditions for mine affected water discharge. The overall risk of the proposed project contributing to cumulative water quality impacts would be 'very low' in accordance with the risk assessment matrix presented in Chapters 13.6 and 24.7.3 of the EIS as well as Chapter 13 of the EIS Executive Summary. These sections were amended to provide an improved summary of this semi-quantitative risk assessment.

IRC also requested further information on how a drying climate with increasing rainfall variability in the locality would undermine the site water balance calculations and projections. The proponent outlined how the 123 year rainfall record was used in the very conservative water balance modelling for the site. IRC also voiced concerns regarding the lack of information on water balance and water supply allocations, as well as the lack of sustainable solution for the projects water needs to ensure long-term project viability. These comments have been forwarded to the proponent.

DNRM supported the need for a mine water management plan and recommended that the proponent contact the department prior to the construction of any works that may interfere with the flow of water.

Queensland Health stated that any waste water from the proposed project should not pollute any ground water or creeks, streams or rivers, used for drinking, agricultural, pastoral or recreational purposes. The proponent outlined how mine water would be contained and reused and runoff from mine infrastructure areas would be collected in catch drains and diverted to on-site dams and reused as mine water supply.

MCG Quarries requested further information on the water management system especially in relation to how the quarry water management system would be affected by the DREA. The proponent stated that the mine water management system for the proposed project would be designed to fully contain runoff from active DREA areas with nil discharge.

4.9.7 Conclusions and recommendations

The TOR in relation to mine affected water systems was adequately addressed by the EIS. Strategies for the management of mine affected water were described and a water balance model for the proposed project presented to demonstrate sufficient consideration had been given to the long-term management of water for the proposed project. An assessment of the project's potential impacts and proposed mitigation strategies to address the impact of the project on surface and groundwater values were addressed in section 4.10 (Surface water resources) and section 4.11 (Groundwater resources) of this assessment report.

Recommendations

- *EHP requires further information on mine affected water release limits and the receiving environment; on mine affected water release during flow events and receiving waters contaminant trigger levels for inclusion in Tables F2–F6, recommended draft EA conditions, Schedule F; Appendix 2). These must be based on a suitable background monitoring program and provided prior to mining activities commencing.*
- *The future arrangement between the MCG and the proponent regarding the DREA management would need to include alignment on water management issues.*

4.10 Surface water resources

Chapter 12 of the EIS described the surface water values potentially affected by the proposed project. An operational water balance was presented in EIS Chapter 13 (Mine Water Management). Appendix J Surface Water Report of the EIS provided flood assessments while Appendix K provided detailed water balance information.

The proposed project site would be located within the upper Isaac River catchment and would be traversed by the Isaac River. The Isaac River was identified as a significant regional watercourse discharging into the Mackenzie River, a major tributary of the Fitzroy River, approximately 90km downstream of the proposed project site. The area of the Isaac River catchment was estimated to be approximately 22,000km², and the area of the Isaac River sub-catchment to the downstream boundary of the proposed project site approximately 4075km². The EIS stated that there were numerous coal mining operations located within the Isaac River catchment both upstream and downstream of the proposed project site. The dominant land uses in the Isaac River catchment

downstream of the proposed project site were cattle grazing, and irrigated and dry land cropping. Following is a summary of the surface water assessment for the proposed project, as well as the major issues raised during the review of the EIS, relevant proponent responses, and recommendations for operational approvals.

4.10.1 Methodology

The EIS provided assessments of the surface water and geomorphic features of the site as well as the proposed impacts of subsidence on watercourses. This was done using water flow and quality data, field observations and the development of hydrologic and hydraulic models for the site. The following methods were used:

- **Flooding:** Presentation of the existing and post-mining flow paths, flood discharges, flood extents, depths and levels for the 2, 50, 100, 1000 year average recurrence interval (ARI) events and the probable maximum flood (PMF) design flood events. The 2 and 50 year ARI events were used to assess the impacts of mine subsidence on surface drainage flow conditions including stream power, flow velocity and shear stress. The 100 year ARI, 1000 year ARI and PMF events were used to identify the impacts of flooding on mine infrastructure and off-site land use. An XP-RAFTS hydrological model estimated design flood discharges in the Isaac River and its tributaries. A TUFLOW two-dimensional hydraulic model estimated the 2, 50, 100, and 1000 year ARI and PMF design flood levels, depths, velocities and extents along the Isaac River and its tributaries. The TUFLOW hydraulic model was used to assess the impact of likely mine subsidence and proposed mine infrastructure on flood behaviour.
- **Geomorphology:** Site data, digital elevation model (from LiDAR surveys) and HEC-RAS hydraulic modelling described the existing geomorphic condition of watercourses and drainage features. This identified the current condition of the streams including bank vegetation, bed form (sediment characteristics) and existing locations and types of bed or bank erosion, as well as channel characteristics including bed slope, hydraulic gradient, channel widths and depths.
- **Mine subsidence:** The hydraulic model estimated subsidence impact locations on the watercourses and drainage features. Assessments presented included stream velocity, bed shear stress and stream power. Modelling assumed that the stream channel and overbank areas would subside as predicted (see EIS Appendix A Subsidence Report) with no infilling or erosion of the channel bed or banks. Based on observed outcomes for previous subsidence activities under the Isaac River, Isaac River flows were predicted to rapidly fill any subsidence depressions in the river bed to pre-subsidence levels. At each potential impact location, the hydraulic and geomorphic characteristics of the channel were used to predict the potential impact and determine proposed mitigation measures.
- **Water quality:** Monitoring data for flows in the Isaac River collected at locations upstream, and within the Moranbah South disturbance area for the period February 2010 to March 2012 were presented in the EIS. Monitoring locations included sites on the Isaac River upstream and downstream of the Moranbah North Mine, Grosvenor Creek (upstream of the proposed project site) and the Isaac River bridge (within the proposed project site). The range and average water quality measured from these sites was summarised and compared with the relevant water quality objectives (WQOs).

4.10.2 Identified surface water values

The proposed project site lies within Basin No. 130 (the Fitzroy Basin) as gazetted under Schedule 1 of the Environmental Protection (Water) Policy 2009: Isaac River sub-basin environmental values and water quality objectives (September, 2011) (EPP Water). Under Schedule 1 of this policy, a plan has been issued that provides environmental values and WQOs relevant to sites and waters in this basin. This EPP Water Plan provides for these environmental values and WQOs.

Under the EPP Water Plan, the project site lies within the Upper Isaac catchment and is drained by the following sub-catchments: the Isaac western upland tributaries; and the Isaac and lower Connors River main channel. Environmental values relevant to the proposed project are listed in the EPP Water Plan and include aquatic ecosystems, agricultural supply (farm, stock and irrigation), human consumption, recreation and cultural and spiritual value. The EPP Water Plan further indicates that aquaculture is not applicable for the main channel sub-catchment. All aquatic ecosystems in the

Upper Isaac catchment are considered moderately disturbed for management purposes under the EPP Water plan.

Environmental values for the existing surface water environment in the vicinity of the proposed project site were derived from the Environmental Protection (Water) Policy 2009 and subordinate plans and assessed through both geomorphic field observations and water quality analysis. The existing surface water environment was determined to be moderately disturbed by human activities (including agriculture and industry) with naturally high sediment loads. Geomorphic conditions within the Isaac River reflected the high sediment loads with the bed of the Isaac River channel having deep sand deposits. Sand point bars, vegetated benches and well vegetated sand islands were observed within the Isaac River channel, as well as the lower reach of Cherwell Creek.

4.10.2.1 Water quality

Average concentrations of ammonia, turbidity, and suspended solids exceeded the WQOs for a moderately disturbed aquatic ecosystem at all monitoring locations, and average concentrations of oxidised nitrogen exceeded this WQO at three monitoring locations. Concentrations for both suspended solids and turbidity were above the WQOs. Average salinity (as electrical conductivity) exceeded the low-flow aquatic ecosystem WQO at four of the five monitoring locations, and exceeded the WQO for human consumption at three monitoring locations. Given the high turbidity and salinity levels in the Isaac River and Grosvenor Creek, the surface waters are not usually suitable for human consumption without prior treatment. Sulphate concentrations exceeded the aquatic ecosystem WQO but not the WQO for human use. Although the maximum recorded levels of aluminium exceeded WQOs for stock at three locations, the average levels of aluminium were found to be well below the WQO. All mean values were within applicable WQOs for agricultural use.

Elevated median concentrations of ammonia and its breakdown products were considered to be possibly due to agricultural inputs to the catchment. Elevated levels of suspended sediments and turbidity were considered to reflect the naturally high sediment loads in the surface water system with localised industrial inputs. Elevated median sulphate concentrations were recorded around upstream mining operations but were not widespread within the surface water system.

4.10.3 Potential surface water impacts

The EIS identified several potential impacts on surface water. These are discussed in more detail below.

4.10.3.1 Subsidence impacts on water flows

The EIS identified the main impact on surface water as subsidence from underground longwall mining. This would result in changes to flood flow paths, flood inundation areas and flow velocities, physical changes to drainage lines (channel bed and bank stability) as well as ponding of runoff in subsidence depressions.

4.10.3.2 Flood impacts

The flood afflux was determined in the EIS by subtracting the pre-mine flood levels from the post-mine levels. The flood impacts and mitigation measures were shown in detail in Chapter 12 of the EIS including:

- Minor reductions in peak 2 year ARI flood levels would occur across and downstream of the mine subsidence zones along Cherwell Creek and the Isaac River due to the lowering of the channel bed levels in subsided areas.
- A significant reduction in 2 year ARI flows along Conrock Gully, the Unnamed Gully and JB Gully (draining into Cherwell Creek) due to ponding within the mine subsidence zones. Along the Unnamed Gully north-west of the DREA, mine subsidence would create a new flow path northward into an adjoining gully that drains into the Isaac River. Predicted peak 50 year and 100 year ARI flood levels for pre- and post-mining were not significantly different.
- Minor reductions in flood levels would occur across the mine subsidence zones and a minor increase (0.02m for the 100 year ARI event) would occur in the Isaac River downstream of the Conrock Gully confluence. Overbank flooding would increase along Cherwell Creek for the 50 year ARI event, particularly along the subsidence zones created by longwall panel 406 and longwall panel 407 across Winchester Road. The flow across the subsidence zones would be

minor for a 50 year ARI flood.

- The flood immunity of the Winchester Road bridge over Cherwell Creek would be significantly reduced (assuming the bridge subsided in the same manner as the ground surface). Modelling showed that flood levels in this location would reduce by similar levels to the predicted subsidence depths. Any accumulation of sediment within the subsidence zone could reduce the capacity of the bridge waterway.
- All mine infrastructure that would remain post-mining would be located outside the extent of the probable maximum flood except the DREA which would be impacted by relatively minor overland flows in the Unnamed Gully. The DREA would be above the 1000 year ARI flood level. Predicted peak flood levels along the Conrock Gully diversion and the Isaac River in the vicinity of the proposed Isaac Plains South project for pre- and post-mining were not significantly different.

4.10.3.3 Geomorphic impacts

Subsidence troughs may create panel catchments on the floodplain due to localised alteration of surface drainage paths. This may lead to the ponding of water in localised shallow surface depressions. The EIS stated that the project site would require post-subsidence management to re-establish free drainage and avoid ponding of water for more than two days in any one area, unless the area was a wetland prior to mining.

The EIS further stated that the mine subsidence troughs formed in the Isaac River bed would subsequently fill with transported sediment during subsequent flood flow events. Based on the Isaac River Cumulative Impact Study (2008) and recent experience at the nearby Moranbah North Mine the river sediment discharge rates would fill the subsidence zones within two years.

The subsidence of the Isaac River would lead to some increase in bed scour as flood velocities would increase where the river drained into the subsidence zones. An increase in sediment deposition was predicted across the subsidence troughs where flood velocities would decrease. Given the high sediment loads in the Isaac River and experience with managing subsidence at Moranbah North Mine, it was predicted that the mine subsidence troughs in the river bed would fill with transported sediment during subsequent flood flow events. Based on the Isaac River Cumulative Impact Study (2008), the current sediment discharge rates would fill the subsidence zones within one to two years. It was predicted in the EIS that bed levels in the Isaac River would be restored after one or two significant flow events. The risk of bank erosion occurring would be likely to diminish as the subsided river bed filled with transported sediment during flood events.

Post-subsidence flood events in Grosvenor Creek, Cherwell Creek and the Conrock Gully diversion would not result in significant erosion, except for subsidence of longwall panel 309 under Cherwell Creek. Mitigation works were proposed in the EIS to manage potential erosion with details to be included in a subsidence management plan.

The Peak Downs Highway bridge is located where likely minor increases in peak velocity would lead to predicted minor lowering of the bed. The bed levels in the subsided areas would return to pre-subsidence levels after one to two significant flow events. No impacts on the Peak Downs Highway bridge were expected.

4.10.3.4 Mine affected water discharge

The proposed water management system predicted a mine water deficit with low probability of discharge of excess mine affected water. Excess mine affected water from extreme rainfall event was proposed to be discharged from the DREA catch dam and coal preparation plant/coal stockpile catch dam (Figure 5, Figure 6). Refer to section 4.9 (Mine water management) of this assessment report for more information.

4.10.3.5 Cumulative Impacts

The EIS proposed that the key impact of the project on surface water would be subsidence of the Isaac River, its tributaries and floodplain as a result of underground longwall mining. Chapter 12 of the EIS referred to a 2008 study funded by Anglo American Metallurgical Coal and BHP Billiton Mitsubishi Alliance, the Isaac River Cumulative Impact Assessment of Mine Developments (CIA), that assessed 110km of the Isaac River from Burton Gorge Dam to Deverill for the type and extent of impacts due to existing and proposed mining including longwall mining, diversions and levee banks. The study concluded that there would be adequate sand already in the channel capable of infilling the total

number of subsidence voids to be created by all of the existing and proposed projects. Any potential for instability of the river bed due to individual river subsidence events was therefore expected to be limited to the short term period prior to the re-establishment of pre-subsidence bed levels following river flow events. The subsidence of the Isaac River proposed was stated to be similar to that assessed in the CIA and as such, the findings of the CIA were considered directly applicable.

The EIS concluded that discharges to surface water would be unlikely based on modelling of the proposed water management system and stated that conditions of any EA would address the cumulative impacts of discharges from multiple mines in the catchment.

4.10.4 Proposed mitigation measures

4.10.4.1 Water demand

The proposed water management system was designed to be a nil-discharge system maximising the reuse of mine affected water and minimising the risk of discharge of mine affected water. The EIS stated that the proposed project water demands would remain relatively stable (at approximately 4600ML/a) over the life of the mine. The proposed project would operate with a significant water deficit (median range 2550–4400ML/a). This water deficit would be met through the existing SunWater allocation of 1600ML secured for the project (from Eungella Dam) with additional mine water supply to be sourced from external providers. The system would have a mine affected water storage capacity of 2175ML.

The EIS concluded that, based on modelling using 123 years of historical rainfall records, there would be sufficient capacity within the mine water system to contain the maximum storm water inventory of 1736ML and storages would have sufficient capacity to contain mine affected water generated by the proposed project including during periods of extreme rainfall.

4.10.4.2 Water and salt balance

A salt balance for the mine water storages found that the salinity of stored water in mine water management dams would be unlikely to exceed the salinity threshold of 4000 μ S/cm as per the 'Regulated dams' manual.

The cumulative risk assessment water balance indicated that the proposed project would be a 'very low' risk category in terms of frequency and volume of likely discharge. The project location would also be a 'low-very low' risk category in terms of receiving water salinity.

The proponent has committed to regularly reviewing the site water balance, including water transfers, consumption and dam storage volumes as set out in a site water management plan; as would be required by conditions of an EA for the project.

4.10.4.3 Discharge management

The EIS stated that it would be unlikely that discharges of mine affected water would be required even during extreme rainfall events (AEP 0.008). Any discharge would be conducted in accordance with EA conditions relating to the discharge of mine affected water designed to prevent adverse cumulative impacts on downstream water quality and environmental values. Recommended draft EA conditions are at Appendix 2 of this report.

If necessary, controlled discharges would occur from the site water management infrastructure into the Isaac River when river flow is suitable. The geochemical assessment of overburden indicated that there would be a low risk of acidic and a low to medium risk of saline drainage from the DREA and that any run-off or leachate from waste emplacements into sediment dams would be relatively free from contamination. The run-off calculations from disturbed areas showed that operational storage capacity would be adequate for the containment of run-off from catchment areas during storm events up to the 1-in-20-year AEP. Overflows from sediment dams would be a relatively infrequent occurrence and the capacity of these dams was stated to provide sufficient residence time to settle out sediment so that the discharge water quality would be unlikely to exceed guideline values and would not pose a high risk of harm to the downstream environment.

4.10.4.4 Flood management

The watercourses and drainage features crossing the proposed project site were assessed to determine the existing and post-mining flow paths, flood discharges, flood extents, depths and levels for the 2, 50, 100, and 1000 year ARI and PMF design flood events.

A predicted reduction in 2 year ARI flows along Conrock Gully, the Unnamed Gully and JB Gully (draining into Cherwell Creek) due to ponding within the mine subsidence zones would be mitigated by the installation of minor remedial drainage works to re-establish free drainage.

Any impacts on the Winchester Road bridge due to accumulation of sediment within the subsidence zone and subsequent reduced capacity of the waterway would be managed in accordance with the requirements of the Isaac Regional Council.

The EIS stated that all mine infrastructure that would remain post-mining would be located outside the extent of the PMF except for the DREA. The DREA would be impacted by relatively minor overland flows in the Unnamed Gully. The DREA would be above the 1000 year ARI flood level.

4.10.4.5 Waterway diversions and management of impacts on waterways

No waterway diversions, levees or waterway barrier works would be required within the mining lease for the proposed project. Mining related project activities within the project's proposed mining lease would not require a development permit under the *Sustainable Planning Act 2009* for. Any approval for waterway barrier works required for off lease infrastructure would be obtained as part of a separate approvals process following the EIS process.

Lateral bank erosion could increase on the outside bend of creeks and rivers immediately upstream of subsidence impacts. The EIS stated that this would be repaired and revegetated until such time as the watercourse bed returned to pre-existing levels. The subsidence management plan would detail the monitoring and adaptive management actions to be applied.

Pre-emptive mitigation works were proposed to protect the high bank of Cherwell Creek following subsidence of longwall panel 309. Proposed mitigation works would likely include a permeable groyne field to slow flows sufficiently to allow sediment to accumulate against the bank and the detailed design of the mitigation works would be included in the subsidence management plan.

EIS Chapter 9 Figure 9.4 showed the location of proposed project infrastructure relative to watercourses and significant drainage features. Potential impacts on fish passage were summarised in Chapter 9.6.5 of the EIS, with further detail provided in the EIS Aquatic Flora and Fauna Report (Appendix G). Chapter 12.4.3 of the EIS outlined minor changes to surface water flow velocities in a small number of ephemeral waterways and stated that these changes were unlikely to impact fish movement. No significant impacts to fish passage were therefore anticipated as a result of the proposed project.

Where construction work would be required in or adjacent to watercourses, the amended EIS listed the following measures:

- Construction only in the dry season when flows have ceased within the watercourses.
- Sediment control works in accordance with an erosion and sediment control plan.
- Any necessary rehabilitation of riparian areas to be undertaken using native flora species.
- A pre-clearing inspection will prior to construction of powerlines across watercourses to determine which tree species could be retained.
- Consultation with DAFF, as necessary, if works could impact fish habitat or fish passage.
- Detailed design to have regard to relevant guidelines and codes.

4.10.4.6 Water monitoring

The EIS provided commitments to a comprehensive monitoring program for flow, erosion and sediment mobilisation, and water quality to support management of surface water impacts. Monitoring of subsidence impacts on watercourses was proposed to be detailed in a subsidence management plan. Recommended draft EA conditions in Appendix 2 would require the proponent to implement suitable monitoring programs.

Water management plan

The EIS included a commitment to develop a site water management plan which would detail measures to prevent contamination of downstream water resources, monitor the site water balance, and maintain water supply for the project. Table 25-15 of the amended EIS provided a summary of water resource management objectives, performance criteria, measures and monitoring including the following measures to manage potential impacts to surface waters:

- Location of the majority of surface infrastructure away from watercourses or aquatic habitat.
- Construction in or adjacent to watercourses during the dry season.
- Sediment control in accordance with an erosion and sediment control plan.
- Mine affected water collected in dedicated water storages.
- Preferential use of mine affected water to meet operational demands where quality permits.
- Rehabilitation of riparian areas using native flora species.
- Pre-clearing inspection prior to construction of powerlines across watercourses.
- Development and implementation of a subsidence management plan providing for rehabilitation works in response to monitoring, including management of potential increased erosion of land and watercourse banks, and minor earthworks to re-establish free drainage of ponded areas.
- Monitoring and reporting of site water balance, water releases, storage water quality, sediment control measures, and subsidence impacts in accordance with relevant management plans and conditions of the EA.

4.10.5 Major issues raised in submissions

In response to advice on the EIS from EHP, the Department of the Environment, DNRM and IRC, the following EIS chapters were amended to include further information on environmental management of activities in waterways on the proposed project site: chapters 9.7.2, 25.3.6, 9.2.1 (EIS MNES Report) Appendix Q, chapter 9.2.1.2 and Appendix E Terrestrial Flora and Fauna Report. The further information and commitments included descriptions of environmental controls that would be placed on construction activities in watercourses.

DSITIA advised that the EIS did not include water quality guidelines for all of the environmental values (including aquatic ecosystems) in order to identify the most stringent WQO for each parameter, as needed to develop the discharge limits and trigger values conditions in the project EA. The proponent responded in the SEIS with a revised table of water quality guidelines for all environmental values. DSITIA determined the table of water quality guidelines was adequate for the purpose of developing water management conditions for the project EA.

EHP advised that the proponent should outline the potential competing requirements of other mines within the area for the external raw water sources required as well as the likely approval pathways for the construction and operation of the three nominated external raw water options (i.e. a pipeline from SunWater's Eungella or Burdekin Falls dams, and a multi-user pipeline as part of SunWater's Eungella Water Pipeline Southern Extension) and the potential for options to use mine affected water from nearby mines as a raw water source. The proponent provided further information on raw water source options for up to 2800ML/yr including dedicated and multiuse pipelines from all three sources outlined in the EIS. The proponent also stated that the assessment of options would be the responsibility of the water supply entities.

EHP also requested further information on what the proponent classified as 'extreme rainfall conditions' in relation to the EIS determination of very low risk of uncontrolled discharge events. The proponent provided further background material and stated that the predicted AEP of discharge was less than 0.008.

In response to advice on the EIS from DAFF, Chapter 9.6.5 was amended to clarify that no significant impacts on fish passage were predicted as a result of the proposed project. The majority of proposed waterway crossings would be located in existing easements or areas subject to existing disturbance. The proposed powerline crossings of the Isaac River and Grosvenor Creek were not expected to impact fish passage, given that powerlines span waterways thus avoiding the need for development within waterway channels. Works within a watercourse would be subject to relevant provisions of the

Water Act 2000.

DAFF stated that any off site watercourse road crossings would need to comply with the Code for self-assessable development - minor waterway barrier works - Part 3 culvert crossings (April 2013). The EIS contained a map of watercourses (and significant drainage lines) based on review of available mapping data (including the spatial data layer Queensland Waterways for Waterway Barrier Works), as well as accurate LiDAR and field survey work. A map showing the location of DAFF mapped waterways was included in Chapter 9 of the amended EIS.

The Department of the Environment requested further details on the likely impact of any new drainage flow path on DREA runoff and any mitigation measures required to avoid alkaline DREA runoff using the new flow path, bypassing the catch dam and impacting on MNES. The proponent responded with a summary of specific management measures including temporary and/or permanent earthworks to relocate or re-establish diversion or collection drains. The re-establishment of drains would include the excavation and sealing of any subsidence cracks that could allow DREA runoff to bypass the drains.

4.10.6 Conclusions and recommendations

The surface water assessment in the EIS adequately addressed the requirements of the TOR. The existing surface water values were described in the EIS and amended EIS. Potential impacts of subsidence on flood behaviour and flow velocities, geomorphic features, erosion, and floodplain drainage were assessed for the Isaac River and its tributaries, and the project site. Appropriate conditions have been included in the recommended draft EA conditions in Appendix 2 of this assessment report which would require the proponent to maintain the functioning and flows of Isaac River and its tributaries after subsidence.

The potential impacts of controlled and uncontrolled water releases on the environmental values of the receiving system were adequately addressed. The EIS conservatively assessed storage dam sizes and containment performance under the significant hazard category requirements of the 'Regulated dams' manual with the final hazard category assessment to be completed during detailed engineering design and prior to the construction of any dams. EHP is satisfied that the application of model mining conditions in the EA, particularly for subsidence management, waste water discharges and regulated structures, would provide adequate protection of downstream environmental values.

Recommendations

- *The proponent will need to consult with DNRM regarding approvals required prior to the take of water, including water permits to take surface water or groundwater and/or water licence for dewatering groundwater.*
- *Further information on mine affected water release limits and release contaminant trigger investigation levels and potential contaminants are necessary (recommended draft EA condition, Tables F2, F3; Appendix 2). This information must be based on a suitable background monitoring program (over at least two years, ideally three years) that must be provided to EHP prior to mining activities commencing, to minimise the risks of discharges that impact upon environmental values of receiving waters.*
- *The proponent must develop and implement a receiving environment monitoring program (REMP) to monitor, identify and describe any adverse impacts to surface water environmental values (recommended draft EA condition F20; Appendix 2).*

4.11 Groundwater resources

EIS Chapter 11 described the groundwater resources and the potential impacts of the proposed project on groundwater values. A groundwater technical report and background monitoring results were provided in Appendix I of the EIS. A long-term water balance was included in Appendix K of the EIS. Following EIS submissions the proponent also provided a Peer Review Report on Subsurface Subsidence Cracking in the Response to Submissions; Appendix L, which included detailed explanation of the assessment methods, supporting data and implications for the assessment of groundwater impacts.

A summary of the groundwater assessment and major issues raised in submissions on the EIS is provided below.

4.11.1 Methodology

The assessment of potential impacts on groundwater levels, mine inflow and groundwater quality included gathering and analysing information on the groundwater regime using groundwater, geotechnical and environmental reports from the proposed project site and surrounding mines. Additional data was sourced from exploration bore data, hydrogeological data held on the DNRM groundwater database for existing water bores, a census of farm bores in the area to confirm bore locations their usage and water quality, and through installing dedicated monitoring bores and vibrating wire piezometers for measuring groundwater levels, quality and hydraulic parameters. Fourteen PVC monitoring bores and four vibrating wire piezometers were installed in the major geological units of the project site (shown on EIS Figure 11-1).

The groundwater information obtained was used to develop a conceptual groundwater model including a 3D numerical groundwater flow model (MODFLOW SURFACT) to simulate the existing conditions of the groundwater regime and provide predicted potential impacts of the proposed mining activities. The model included hydrogeology, the proposed underground mining operations and associated subsidence fracturing of subsurface strata. The model also included nearby mines and approved mining projects, including the Caval Ridge Project, Peak Downs Mine, Eagle Downs Project, Isaac Plains South Project, Grosvenor Project, Isaac Plains Mine and Moranbah North Mine.

Predictive modelling assessed the scale and extent of mining impacts on groundwater levels throughout the proposed stages of mine operations and post-closure. The likely groundwater impacts and mitigation and management strategies in the event of potential adverse impacts were identified and a groundwater monitoring plan proposed.

4.11.2 Identified groundwater values

The regional hydrogeology within the vicinity of the project site broadly was determined to consist of three water-bearing strata:

- shallow and thin Quaternary alluvium associated with the Isaac River and Grosvenor Creek
- Tertiary basalts and sediments occupying palaeo-river channels
- Permian sediments including the coal seams of the Permian Moranbah Coal Measures and the Fort Cooper Coal Measures.

Quaternary

A thin surficial cover of alluvial and colluvial sediments has been deposited across the majority of the project site. This cover generally comprised less than 25m of poorly consolidated clays, silts, sands and gravels deposited during the Quaternary (and late Tertiary) period. Alluvial sediments are closely associated with the present-day floodplains of the Isaac River and its tributary Grosvenor Creek. The alluvial sediments represented a shallow low-yielding water-bearing stratum. Groundwater yielded from the alluvium was too low to measure, and were estimated in the field as being less than 0.1L/s.

The Quaternary alluvium monitoring showed EC values of 2230–7770 μ S/cm. The EIS concluded that the water quality in the Quaternary alluvium would be unsuitable for human consumption based on exceedances of aesthetic and health guidelines and is marginal for use as stock water supply due to elevated total dissolved solids and aluminium concentration in some samples.

Tertiary

Tertiary basalts comprised a composite stratigraphic unit of massive and vesicular lava, tuff and ash flows up to 90m thick. Groundwater yields in the Tertiary materials were highly variable (0.2–5.6L/s) reflecting the nature of the groundwater occurrence within the basalts and basal sands. The hydraulic conductivities measured in the basalt within the project site (2.6×10^{-1} to 6.5m/day) were generally consistent with those measured from the basalt within nearby mines and project sites, such as Moranbah North Mine and the Caval Ridge Project.

Groundwater within the Tertiary materials showed high variability in water quality across the project site. EC values ranged between 1450 μ S/cm and 13,400 μ S/cm indicating slightly brackish to saline groundwater within the basalt. The water quality of the Tertiary basalt and sediments would be unsuitable for human consumption based on exceedances of aesthetic and health guidelines. The majority of bores that were sampled yielded water that was of suitable quality for use as stock water supply.

Permian

Air-lift yields measured from 80 open exploration holes that intersected the Moranbah Coal Measures within the project site averaged a yield of 1.2L/s (ranging from 0.1–11.1L/s). The higher yields were associated with the coal seams where extensive fracturing was present.

The EC of groundwater within the Permian coal measures showed a range of 1970–4260 μ S/cm for the Fort Cooper Coal Measures, and 7710–9460 μ S/cm for the Moranbah Coal Measures. Groundwater within the Fort Cooper Coal Measures could be classified as slightly brackish to brackish. In contrast, groundwater within the Moranbah Coal Measures was saline. The water quality of the Permian coal measures was unsuitable for human consumption based on exceedances of aesthetic and health guidelines. The water quality in the majority of bores that were sampled was unsuitable for use as stock water supply.

Groundwater use

There was limited use of groundwater from the Permian coal measures within and surrounding the project site boundary. Within the radius of influence of the project there was a single bore (located outside the project site) in the Permian coal measures. This bore reached the Back Creek Group (below the Moranbah Coal Measures) and therefore was not predicted to be impacted by the proposed project.

4.11.3 Potential groundwater impacts

Key impacts on the groundwater regime identified in the EIS that may arise from underground mining included direct impacts on the Moranbah Coal Measures from extraction of the target coal seams and subsurface cracking in areas that have been subject to subsidence due to longwall mining. Key impacts as described in the EIS are summarised in the following sections.

4.11.3.1 Groundwater inflow

Groundwater inflow to the mining operations would occur from the coal seams and from overlying strata where fracturing was predicted to occur above mined longwall panels. EIS modelling predicted that inflow volumes would gradually increase up to 19L/s (1655m³/day) towards the end of longwall mining in project years 26–29. The modelled inflows then declined from 19L/s at the end of longwall mining to 10L/s (832m³/day) during bord and pillar mining to project year 46, when mining would cease.

4.11.3.2 Groundwater drawdown

Mining and gas drainage activities associated with the proposed project would depressurise the GM coal seam, lowering the potentiometric surface of groundwater associated with this coal seam and creating a locally steep hydraulic gradient around the longwall panels and bord and pillar mine area. The radius of influence was predicted to extend approximately 4–5km from the mine footprint to the north, east and south. The radius of influence to the west would be limited by the Peak Downs Mine, the Caval Ridge Project and the subcrop of the GM coal seam. Depressurisation to the east of the proposed project would be limited by the presence of the Isaac Thrust Fault.

Depressurisation and significant adverse impacts on groundwater resources were stated to be unlikely because the Permian coal measures and the individual coal seams have been depressurised by existing mining projects and CSG operations ahead of the development of the proposed project. The Permian coal measures also yielded brackish to saline groundwater and the more permeable coal seams were often too deep for private bores.

The Tertiary basalts and sediments were considered unlikely to be adversely impacted because the extent of depressurisation would likely be limited to the project site boundary, the likely 3m reduction in the potentiometric groundwater surface resulting from depressurisation of the Tertiary basalts and sediments was considered to be minor given the 50m saturated thickness of these water-bearing strata, and there was no existing use of this brackish groundwater from the Tertiary basalts and sediments within and surrounding the project site.

The EIS predicted a maximum of 2.3m lowering of the Quaternary alluvium groundwater due to shallow bord and pillar mining (western area). Runoff and flow events were considered likely to be significant recharge sources to the shallow Quaternary alluvium and likely to negate the predicted dewatering impact. No net change in the storage or distribution of groundwater within the alluvium

was predicted.

4.11.3.3 Groundwater dependent ecosystems and stygofauna

The riparian vegetation associated with the Isaac River and Grosvenor Creek alluvium was classified as a groundwater dependent ecosystem for the purposes of the EIS. Underground mining would drawdown the alluvium temporarily. No significant long-term impact on groundwater levels in the alluvium was predicted and no consequent impact on the riparian vegetation or groundwater quality was considered likely.

The EIS stygofauna assessment found oligochaete species (i.e. worms of the subclass Oligochaeta) in the alluvium groundwater and considered these to be stygofauna although possibly relating to surface water species. As the proposed project was not predicted to significantly impact the alluvium groundwater, no adverse impacts on surface water fauna or stygofauna in the alluvium were predicted. One specimen of a sub-order of stygofauna was collected from a shallow monitoring bore within the basalt. Drawdown of the basalt in this area (approximately 2m) was predicted but considered minor relative to the approximately 60m of saturated thickness of basalt in the location and unlikely to impact on stygofauna. No stygofauna were found in coal measures for the proposed Moranbah South Project, or for the adjacent Grosvenor Project.

4.11.3.4 Subsurface cracking

The EIS Subsidence Report (Appendix A) provided an assessment of the extent of subsurface cracking likely to result from subsidence. The EIS Groundwater Report (Appendix I) considered potential impacts on groundwater that could result from subsurface cracking and the amended EIS contained a Peer Review Report on Subsurface Subsidence Cracking' in the Response to Submissions; Appendix L.

Subsurface cracking and fracturing would occur in the strata overlying the area from which coal had been extracted (i.e. the goaf). The caved zone and fractured zone above the goaf were predicted to be restricted in extent due to the Moranbah Coal Measures and the Fort Cooper Coal Measures respectively. The Fort Cooper Coal Measures comprise a thick (up to 100m) interbedded sequence of tuffaceous claystones, siltstones and coals and provide a barrier that would prevent subsurface cracking from propagating to the ground surface. The EIS concluded that it would be unlikely that there would be any connective cracking from the mining operations to the ground surface following longwall extraction and subsidence. Monitoring at the nearby operating underground Moranbah North Mine and 'Peer Review Report on Subsurface Subsidence Cracking' (Appendix L of the Response to Submissions) confirmed this conclusion.

4.11.3.5 Water quality

Potential likely sources of groundwater contamination were identified as seepage from the DREA and the storage of hydrocarbons from workshops. Hydrocarbon storage management would be in accordance with best practice measures and according with AS 1940:2004. The DREA would be built as a low permeability and low seepage storage based on geochemical characterisation studies of the reject material as well as the underlying clay hardstand. The EIS found that the pH of the surface runoff and seepage from coal reject material would range between pH 7 and pH 9 (neutral to alkaline) with low salinity levels. The EIS concluded that DREA seepage would be unlikely and any seepage would not be of a volume or sufficiently contaminated to impact on the existing alluvial or Tertiary groundwater.

4.11.3.6 Cumulative impacts

The EIS concluded that the combined impact of the surrounding mines would impact groundwater values significantly more than the Moranbah South Project. Most of these mines are, or would be, mining the same GM coal seam in the Moranbah Coal Measures. To the north, depressurisation of the GM seam is currently occurring due to the operations of Moranbah North Mine and CSG development. To the south, the depressurisation zone of the GM seam from the proposed project was predicted to join the depressurisation zone caused by the proposed Eagle Downs Project.

Significant depressurisation of the alluvial and Tertiary water-bearing strata was predicted due to the proximity of large open cut operations including the future Caval Ridge Project and current Peak Downs Mine. Mining of Tertiary materials by these open cut operations was predicted to cause significant local dewatering.

4.11.3.7 Post-closure

Predictive modelling simulating groundwater recovery post-mining the EIS indicated that the proposed project site would behave as a sink until groundwater levels recovered post-mining and underground mine areas filled with brackish to saline groundwater. After recovery of groundwater levels, flow directions would be very similar to pre-mining groundwater flows. Post mining groundwater quality in each aquifer was predicted to show no change from the quality recorded for the EIS.

The EIS simulation showed water levels in the alluvium and Tertiary basalts and sediments would take between 500 and 650 years to recover to 80% of their simulated pre-mining water levels. However, stream flow or flood events within the alluvium were considered likely to rapidly recharge the alluvium and Tertiary basalts and sediments and increase the rate of post-mining water level recovery.

The potentiometric groundwater surface associated with the GM coal seam was expected to recover to 80% of the pre-mining levels very quickly due to the elastic storage that occurs in the confined conditions existing at depth in the coal seams. After the elastic storage response was exhausted, the groundwater levels would stabilise and recover in line with the long-term net recharge rates.

4.11.4 Proposed mitigation measures

The EIS stated that groundwater inflow to the longwall panels and bord and pillar mine area would be managed as part of the proposed mine water management system. Hydrocarbon storage would be managed in accordance with best practice to prevent the contamination of shallow groundwater systems.

The EIS further presented a suite of monitoring programs to be conducted during the life of the project. These included:

- **Groundwater monitoring program:** The groundwater monitoring program, which was established as part of EIS groundwater investigations, would continue to record groundwater levels from existing monitoring bores and vibrating wire piezometers. The EIS concluded that this would enable natural water level fluctuations (such as responses to rainfall and river/creek flows) to be distinguished from potential water level impacts due to depressurisation resulting from underground mining.
- **Groundwater quality sampling:** Groundwater of existing monitoring bores would be sampled and analysed in order to collect longer term baseline data of groundwater quality, and in order to detect any changes in groundwater quality during and post-mining.

In order to set the groundwater quality trigger values and groundwater level monitoring EHP requires a sampling program of at least 24 months to account for seasonal variations. After this period, a review of the data would be undertaken to set site specific trigger and limit values until the sampling program that accounts for seasonal variation has been completed; and the groundwater quality trigger values supplied by the proponent in the Addendum EIS, which were based on 12 months of monitoring data, will be sufficient. Refer to the recommended draft EA conditions (Tables E2 and E3, Schedule E; Appendix 2).

4.11.5 Major issues raised in submissions

The Department of the Environment, DNRM and EHP requested additional supporting information on the likely vertical hydraulic conductivity due to uncertainty in the analysis of modelled inflow to the underground operations. The proponent further outlined information on the likely vertical hydraulic conductivity within local sedimentary units and referred to the values having been applied to the numerical model so as to achieve the best model calibration result as verified by model sensitivity analyses.

The Department of the Environment, DNRM and EHP requested additional information on the assumptions and modelling used to determine the extent of the fractured zone (upper limit stated as the base of the Fort Cooper Coal Measures). The proponent provided additional explanatory material showing that continuous fracturing would not propagate upward through the Fort Cooper Coal Measures. Figure 5 of the EIS Groundwater Report (Appendix I) showed that the Fort Cooper Coal Measures are present over the majority of the longwall mining area. Hydraulically connected fracturing and any potential groundwater impacts would therefore be limited to the underlying

Moranbah Coal Measures across the majority of the longwall mining area. There would be at least 145m of cover above the target coal seam. The proponent further explained that based on experience at the Moranbah North Mine, discontinuous fracturing may extend to the base of these materials. The peer review report provided as part of the amended EIS (Appendix L) further confirmed the EIS assessment to the likely upper extent of continuous cracking and associated vertical groundwater connectivity.

The Department of the Environment questioned the main cause of water loss from the groundwater aquifers and how flood events would contribute to recharge in the area. The proponent explained that the key potential impacts to the groundwater regime of the alluvium and basalt water bearing units would be due to subsurface cracking in areas that had been subject to longwall mining. Hydrographs of river flow discharge and groundwater level in alluvial bore MB05 supported the conclusion that surface water flow provides recharge to the highly permeable alluvium. Tertiary basalt and basal sediments would be recharged through infiltration of direct rainfall where the basalt outcrops or subcrops beneath weathered cover.

The Department of the Environment, DNRM and EHP requested additional information on the connectivity between aquifers pre- and post-mining, including alluvial, Tertiary basalt and Permian aquifers. The proponent provided a conceptual pre- and post-mining groundwater flow diagram for the area identifying water sources and sinks and amended the EIS accordingly to include the following: "The 3D numerical model included changes to model parameters to simulate the effects of subsurface subsidence fracturing. Figure 11-6 shows the post-mining conceptual groundwater model showing the extents of subsurface fracturing and post-mining hydrogeology."

EHP and DNRM requested further detail on groundwater monitoring, bore locations and water quality trigger values for the purposes of development of any draft EA. The proponent provided additional information in the amended EIS on the proposed groundwater monitoring program including bore locations and frequencies, groundwater level trigger thresholds, and interim quality trigger values based on a 12-month sampling dataset.

DNRM requested additional information about the distribution of the basal sand and any particular impact this may have on inflow volumes. The proponent stated that exploration drilling had demonstrated that the basal sediments are limited in extent and discontinuous beneath the Tertiary basalt. EIS Chapter 4.4.4 stated that the Tertiary basalt flows directly over Permian coal measures or are separated from them by the discrete occurrences of basal sediments which are discrete, thin and highly localised lenses of sediment. While these deposits may be permeable and locally saturated, the available water storage volume is limited by the sediment thickness and localised distribution. Based upon the properties and distribution of these sediments, the numerical groundwater model did not represent the basal sediments as a separate layer but included the Tertiary basalt and basal sediments as a single unit. Inflows to the underground longwall mine as a result of subsidence fracturing from the longwall mine interacting with the basal sediments was predicted to produce short-term high inflow rates that would not be sustainable due to the limited storage capacity of these deposits. The proponent stated that experience at Moranbah North Mine demonstrated that discontinuous fracturing caused by the same mining methods in the same deposits have not yielded any major inflows from the basal sediments.

DNRM requested additional information on the effect of model boundaries on the predicted groundwater flow gradient and how this might be improved in any future model update. The proponent stated that the eastern model boundary alignment represents a faulted boundary whereby significant vertical offset is highly likely to occur, inhibiting groundwater flow in the coal seam. While model boundary conditions would influence model calibration, the model boundary conditions applied in the EIS Appendix I Groundwater Report were considered representative and justified. The proponent proposed to update the groundwater model using monitoring data in the event of a significant change in the project or where monitoring showed unexpected impacts. DNRM recommended that the groundwater model boundaries be reviewed, and that all representative monitoring data from all bore be used, when the model is updated. DNRM also considered that in any future review of the model it would be advantageous to review the appropriateness of the model boundaries and DNRM would like to see a commitment by the proponent along these lines, or a condition to ensure that it will occur.

DNRM stated that shallow alluvial groundwater may support vegetation and aquatic groundwater dependent ecosystems as baseflow does not have to be sustained or permanent to be ecologically relevant. The proponent responded with the following addition to Chapter 3.6.1 of the EIS Stygofauna Report Appendix H "The ephemeral nature of the Isaac River and its tributaries suggests that

groundwater is unlikely to provide any significant and sustained baseflow contribution to these surface water features within the project site. Despite this, it is possible that the shallow, alluvial groundwater may support groundwater dependent ecosystems.”

DNRM requested seasonal sampling for stygofauna in the bores sampled for the EIS in August 2012 and in the new monitoring bores MB04, MB05 and MB06 to confirm the conclusion that no significant stygofaunal values would be impacted by the proposed project. The new information would confirm if there are likely impacts on stygofauna. In response, the proponent noted that the TOR only required a desktop assessment and pilot study to be undertaken to assess the potential for stygofauna to be present, and that the EIS concluded that there would be no significant impact on stygofauna or stygofaunal habitat based on the assessment of potential impacts on groundwater rather than the presence or absence of stygofauna. The proponent asserted that further stygofauna sampling over an additional season was not warranted and would not alter the conclusions of the impact assessment. However, in its review of the proponent’s response, DNRM replied that sampling of stygofauna in geological formations other than the alluvium, was carried out in newly constructed bores and hence stygofauna did not have the chance to repopulate. DNRM recommended that prior to project commencement, the proponent should carry out stygofaunal sampling in bores sampled in August 2012, and in the new monitoring bores MB04, MB05 and MB06 in a different season from winter (August) as per WA EPA guidelines, to confirm the conclusion that no significant stygofaunal values would be impacted by the proposed project.

The IESC submitted several comments regarding groundwater management and modelling. These are discussed in detail in section 4.19 (MNES – Issues raised by the IESC) of this assessment report.

4.11.6 Conclusions and recommendations

The existing groundwater resources were described in the EIS and the potential impacts of the proposed project (in terms of both the quantity and quality of the groundwater) on aquifers, existing users and adjacent environmental values were adequately assessed and addressed the requirements of the TOR. Based on the environmental protection commitments in the EIS, recommended draft EA conditions to protect groundwater values have been included in Appendix 2.

The take of groundwater for dewatering of the mine will require a licence under the *Water Act 2000*.

Recommendations

- *DNRM advised that the appropriateness of the groundwater model boundaries, as used for the EIS, should be reviewed when the groundwater model is reviewed.*
- *The proponent will need to consult with DNRM regarding approvals required prior to the take of water, including water permits to take surface water or groundwater and/or water licence for dewatering groundwater.*
- *DNRM recommended that prior to project commencement, the proponent should carry out stygofaunal sampling in bores sampled in August 2012, and in the new monitoring bores MB04, MB05 and MB06 in a different season from winter (August) as per WA EPA guidelines, to confirm the conclusion that no significant stygofaunal values would be impacted by the proposed project.*
- *For the purpose of finalising groundwater EA conditions, EHP requires trigger and limit values for groundwater water quality and level based on a sampling program of at least 24 months in order to account for seasonal variations and to obtain site-specific data. This data must be provided to EHP three months prior to any mining activities commencing or at the completion of the sampling program, whichever is sooner.*

4.12 Air quality

Air quality was discussed in Chapter 15 and a technical assessment was provided in Appendix L of the EIS. The proponent’s Response to Submissions addressed several air quality issues and included more detailed monitoring results in Appendix D Air Quality Results. A summary of the air quality assessment follows.

4.12.1 Prediction methodology

The EIS considered dust to be the most important air pollutant from coal mining. Elevated dust deposition rates can cause reduced public amenity through soiling of clothes and living areas.

The air impact assessment combined detailed information from mining activities, local and regional meteorology and existing air quality to estimate the potential effect of project activities on ambient dust levels. Estimated dust levels were then compared with the applicable air quality objectives to confirm whether any potential adverse impacts on health or amenity may occur. Any potential for air quality impacts upon surrounding land uses (e.g. grazing) were considered to be transient and limited in effect. Health and amenity were identified in the EIS as the most sensitive environmental values and compliance with standards for health and amenity would confirm that no impacts on other less sensitive environmental values (e.g. grazing) would occur as part of the proposed project.

The air quality assessment included the key project activities that could contribute to dust generation, such as:

- wind erosion of coal stockpiles, DREA and other exposed areas
- transportation of rejects materials
- stacking and reclaiming of stockpiles
- transfer of material between conveyors
- dust emissions from train loading
- dust emissions from the coal sizing plant.

4.12.1.1 Dispersion modelling

The modelling assessment for used the following to model the potential air impacts on sensitive receptors:

- full review of background air quality data
- estimates of dust emission rates for the proposed project
- use of a dispersion modelling to estimate dust levels in the vicinity of the project site
- proposed dust controls.

The air quality objectives have been developed from the Queensland Government's Environmental Protection Policy (Air) 2008 (EPP Air) and Odour Impact Assessment from Developments.

The proposed dust controls were taken into account in predicting the likely dust levels at sensitive receptors. Background levels were also accounted for. The modelling assessment was undertaken using the United States Environmental Protection Agency's (USEPA) Integrated Source Complex (ISC3) model (USEPA, 1995).

Odour emissions from the ventilation shaft were modelled with Ausplume Version 6.0 (EPA Victoria, 1999) to predict ground-level concentrations of odour. The odour emissions used in the model were based on the results of odour sampling at the Moranbah North Mine and measured against EPA's Odour Guideline (2004). The EIS stated that odour emissions from the Moranbah North Mine would provide an accurate estimate of the expected emissions from the proposed project because of its close proximity and similar geology.

4.12.2 Identified air environmental values

The EIS identified 16 sensitive receptors in proximity to the proposed project site; including nearest residences or commercial facilities, as well as accommodation villages used to house mine and industrial workers in the region.

Of these 16 receptors, sensitive receptor R14 would be the temporary Caval Ridge Accommodation Village which was completed in 2012 to house a portion of the construction workforce associated with the Caval Ridge Project. It was outlined in the EIS that Caval Ridge Project is planned to commence in 2013, therefore the village would be decommissioned and the site rehabilitated during 2014. As operations at Moranbah South would not be scheduled to commence until 2017, it was concluded in

the EIS that R14 would not be a sensitive receptor during the operational phase of the Moranbah South Project. Construction activities at Moranbah South are scheduled to commence in 2014, the same year as the village is scheduled to be decommissioned; therefore the EIS identified that R14 may be a sensitive receptor for a few months during the initial construction phase of the Moranbah South Project.

The EIS further identified the following key air emissions generated by the proposed activities on the project site, such as particulate matter (i.e. dust; in particular PM_{2.5} and PM₁₀ size ranges); odour; and the total mass of particles (total suspended particulate matter (TSP); 30–50µm in aerodynamic diameter). Minor emissions of other substances, such as volatile organic compounds, trace metals or oxides of nitrogen, carbon or sulphur would also be generated by the project, mainly due to mine vehicle exhausts. The EIS concluded that the project would not; however, emit these pollutants in sufficient levels to result in any measurable adverse air quality impacts at sensitive receptors. Greenhouse gas emissions were also discussed in the EIS.

The EIS outlined that PM_{2.5} has been assessed in the air quality study because it is a requirement of the TOR. However, the EIS identified that PM_{2.5} would not be a key pollutant for coal mining projects given that the key source of PM_{2.5} is vehicle exhaust emissions.

The EIS identified the following potential sources of dust in the region:

- natural features of the environment such as pollens, grass seeds and smoke from bushfires;
- grazing activities
- use of unsealed roads
- existing mines and gas extraction operations
- quarries
- urban activities
- neighbouring mines (Caval Ridge Project Isaac, Plains South Project, Grosvenor Project, Eagle Downs Project, Peak Downs Mine).

The existing airshed is generally comprised of uses such as urban (north north-west), industrial (mining) and agricultural (grazing). Local terrain is relatively flat with no significant topographical landscape features that would affect air dispersion patterns. The existing background air quality based on existing air quality data (refer to section 4.12.1.1) was found to be well within the Queensland Government's ambient air quality objectives (Table 7).

Table 7 Existing background air quality (Source EIS; Tables 15-2 and 15-3)

Parameter/air pollutant	Background level concentration	Air quality objectives
PM _{2.5} (24 hour)	4.3µg/m ³	25µg/m ^{3*}
PM _{2.5} (annual)	3.6µg/m ³	8µg/m ^{3*}
PM ₁₀ (24 hour)	26.8µg/m ³	50µg/m ^{3*}
TSP (annual)	27.5µg/m ³	90µg/m ^{3*}
Dust deposition (annual)	71mg/m ² /day	120mg/m ² /day ¹
Odour (1 hour – 99.5 th percentile).	-	2.5 odour units ²

* Objectives under the EPP (Air)

¹ Objectives under EM944 Model Mining Conditions

² Objectives under EPA's Odour Guidelines (EPA 2004).

4.12.3 Potential air impacts

The EIS stated that control of dust emissions was a key consideration in the design of the proposed project due to the proximity of the Moranbah township. Extensive dispersion modelling was conducted during the design stages of the proposed project to ensure that dust generating activities were placed well away from residential areas. The project design ensured that emissions would be minimised.

Particulate matter would be the primary source of air pollutant generated by the proposed project. The types of particulate matter assessed for the proposed project included PM_{2.5}, PM₁₀ and total suspended particulates. The main potential sources of particulate matter in the airshed are from other mining operations and agricultural activities. Minor emissions of volatile organic compounds, trace metals, oxides of nitrogen, carbon and sulphur would result from vehicle and engine exhausts.

The main dust producing activities proposed for the site would include coal handling and stockpiling, DREA and unsealed roads. Odour sources include ventilation shafts. The prevailing winds were found to come mostly from the north-east to south-east direction. The predominant wind speeds were <2m/sec (>50% of the time) with strong winds (>5m/sec) occurring 1.4% of the time.

The EIS considered dust to be the most important potential air pollutant from coal mining. Table 6 presents the predicted annual average dust deposition concentrations and Figure 7 shows the predicted dust deposition contours based on the annual average ground-level concentrations, including background levels. The EIS modelling showed that the predicted levels would be low and well below the Queensland Government's ambient air quality objectives.

Similarly, predicted levels of PM_{2.5}, PM₁₀ and odour were also found to be low (including an allowance for background levels) and well within the relevant air quality objective at all sensitive receptors:

- **PM_{2.5}:** The predicted maximum 24-hour PM_{2.5} concentrations ranged from 5–6.4µg/m³ while the annual average ground-level PM_{2.5} concentrations ranged from 3.7–3.9µg/m³.
- **PM₁₀:** The predicted maximum 24-hour ground-level concentrations of PM₁₀ ranged from 27.8–36.2µg/m³.
- **Odour:** Predicted ground level concentrations were <2.5 odour units.

The EIS concluded that all of the identified potential air pollutants were found to be low and, even including an allowance for background levels. Predicted ground level concentrations were all within the relevant air quality objectives at all sensitive receptors. By meeting the air quality objectives in the EPP Air (which are designed for health and amenity), it was argued that it would also protect against problems associated with visible dust because, at levels equivalent to the EPP Air objectives, dust is essentially not visible. The project would also not constitute a hazard for operation of the Moranbah Airport, or to motorists on public roads in or near the project site.

Modelling for odour emission impacts from the ventilation shafts (the likely main odour source) showed no ground level concentrations above the EHP guideline of 2.5 odour units at any sensitive receptor. The proponent has also committed to investigating odour should there be complaints received.

**Table 8 Predicted TSP and dust deposition rates, including background levels
(Source EIS; Table 15-5)**

Receptor ID	Receptor	Annual average	
		TSP ($\mu\text{g}/\text{m}^3$)	Dust deposition rate ($\text{mg}/\text{m}^2/\text{day}$)
R1	Moranbah, Archer Drive	28.2	71.6
R2	Moranbah, Tallon Street Sportsfields	28.5	71.8
R3	Moranbah, Jackson Avenue	28.6	71.9
R4	Moranbah, Langford Court	28.5	71.8
R5	Wotonga Homestead	27.6	71.0
R6	Northern PDA Land	28.2	71.7
R7	Southern PDA Land	28.5	72.1
R8	MAC Accommodation Village	28.4	71.9
R9	Residence on Moranbah Railway Station Road	28	71.4
R10	Residence Adjacent to Moranbah Railway Station Road	28	71.4
R11	Wongybill Property	28	71.5
R12	Residence on Eastern End of Longpocket Road	28.1	71.5
R13	Residence on Western End of Longpocket Road	27.9	71.4
R14	Temporary Caval Ridge Accommodation Village	28.1	71.6
R15	Kalari Transport	29.4	74
R16	Moranbah Airport	29.9	75.2
Compared to background level		27.5	71
Compared to air quality objectives		90	120

4.12.4 Cumulative impacts with existing and proposed mines

The background dust levels reported above included natural sources of dust, as well as dust emissions from existing anthropogenic sources in the area, including existing quarries and mines. Coal mines such as Peak Downs Mine, Isaac Plains Mine, Moranbah North Mine and Goonyella Mine have been operating for a number of years and their dust emissions are captured in the measured background levels.

However, there are a number of projects that are approved, or well progressed in the approval process, that have not yet been constructed and so have not yet been captured in the measured

background dust levels. Hence, the EIS cumulative impact assessment considered the potential cumulative effects of future projects, together with the Moranbah South Project and existing ambient background dust levels. The following projects have been included in the modelling of cumulative impacts on top of the existing data:

- Caval Ridge Project
- Isaac Plains South Project
- Grosvenor Project
- Eagle Downs Project.

It was concluded in the EIS that the Grosvenor Project and Eagle Downs Project, because of their low dust emissions and location, would be unlikely to result in cumulative impacts with the Moranbah South Project at Moranbah township. Underground coal mines typically have much lower emissions of dust compared to open-cut mines because excavation, overburden handling and transfer, and stockpiling of overburden material is not required. The Grosvenor Project and Eagle Downs Project would therefore be expected to have relatively low impacts on air quality in their surrounding areas compared to the open cut coal mines. This was confirmed by the dust assessments that were included in the published EIS documents for these projects.

The Caval Ridge Project is a proposed open-cut mine located approximately 5km south of Moranbah and directly to the west of the Moranbah South Project. Its proposed production rate would be approximately 8Mtpa of product coal. The Isaac Plains South Project would involve the proposed expansion of the existing Isaac Plains open-cut mine in an area located approximately 7km south-east of Moranbah, on land that partially overlaps the Moranbah South project site. Its production rate would be approximately 1.2Mtpa of product coal.

It was concluded in the EIS that, given the location of the Caval Ridge and Isaac Plains South projects, and their relatively high dust emission rates (as open cut mines), there would be a potential for these projects to give rise to cumulative dust impacts on Moranbah, when considered together with the Moranbah South Project. However, the EIS also detailed that any contribution from the Moranbah South Project to cumulative dust emissions would be minor when compared with these open cut mining projects. This is discussed in more detail below.

4.12.4.1 Predicted cumulative dust emissions

The EIS found that the predicted emissions from the proposed project would be less than 4% of the emissions expected from Caval Ridge Project and less than 7% of the emissions expected from the Integrated Isaac Plains Project (which includes the Isaac Plains South Project, as well as the Isaac Plains Mine).

Table 9 provides a summary of the estimated annual dust emissions from the Moranbah South Project, Caval Ridge Project and the Isaac Plains South Project and contains data from published EIS documents.

Table 9 Existing background air quality (Source EIS; Table 15-6)

Project	TSP (kg/annum)	PM ₁₀ (kg/annum)	PM _{2.5} (kg/annum)*
Moranbah South Project	309,368	125,198	17,976
Caval Ridge Project ¹	8,530,609	3,317,057	497,559
Integrated Isaac Plains Project ²	6,182,429	1,901,819	285,273

¹URS 2009 Caval Ridge Air Quality Assessment: Supplementary Report

²Noise Mapping Australia Pty Ltd, 2007 Integrated Isaac Plains Project: Noise, Vibration and Air Quality Assessment

*Calculated by Katestone Environmental Pty Ltd for the Caval Ridge Project and the Integrated Isaac Plains Project, assuming 15% conversion from PM₁₀ to PM_{2.5}

The EIS hence concluded that the proposed Moranbah South Project would make only a minor contribution to any cumulative dust impact with either Caval Ridge or Isaac Plains South. However, the EIS also stated that the proponent is willing to work cooperatively with other project proponents to ensure that cumulative dust levels would not give rise to significant impacts on sensitive receptors. In particular, Anglo American would continue to be an active participant in the Moranbah Cumulative Impacts Group, and a dust monitoring program would be established for the project. This group was originally convened by the IRC to address cumulative dust impacts in Moranbah.

4.12.5 Proposed mitigation measures

The EIS proposed the following key dust impact mitigation measures to control and manage dust emissions, and minimise the potential impacts:

- Large separation distances between the DREA and both the township of Moranbah and the airport.
- Watering of coal stockpiles to minimise dust emissions.
- Conveyors, rather than haul trucks, to transport rejects to the DREA.
- Enclosure of the coal sizing plant with a roof and on at least three sides to minimise emissions.
- All transport of coal from the underground mine to the stockpiles, processing facility and further on to the train loading station would be via conveyors, with at least a roof enclosure.
- Transfers would occur in enclosed chutes to minimise emissions.
- Emissions from stackers would be reduced with the use of a variable height luffing stacker (i.e. a stacker where the height of the boom is adjusted to meet the surface of the stockpile). Luffing of the boom minimises dust by reducing the distance that the coal needs to fall to the top of the stockpile.
- Inactive disturbed areas (e.g. the box cut overburden emplacement area and completed sections of the DREA) would be rehabilitated as soon as possible.
- Haul roads within the DREA would be watered to minimise dust emissions.
- Veneering would be applied after coal is loaded onto trains.

The EIS stated that these proposed management measures would align with best practice techniques implemented at other Australian coal mines, and the modelling described in preceding sections has included these dust controls and shown that they would be effective in controlling dust emissions and avoiding adverse impacts.

The proponent would also consult with Aurizon during the detailed design phase of the project to determine any additional dust mitigation requirements related to the transportation of coal. These may include measures such as:

- Rail load-out facilities and rail loading procedures consistent with those outlined in Aurizon (2010) Network Coal Dust Management Plan.
- Testing of product coal to establish its characteristics with regard to dust generation.
- Control of surface coal moisture content of supplied coal.
- Load profiling and veneering of loaded coal wagons.

Monitoring of dust is a commitment by the proponent involving annual monitoring reports, agreed monitoring sites, parameters measured including PM₁₀, dust deposition and weather data already collected at the airport. An annual dust monitoring report would be prepared and provided to the Isaac Regional Council.

4.12.6 Major air issues raised in submissions

The Bureau of Meteorology advised that the automatic weather station located at Moranbah Airport provides crucial information that supports safe aviation operations at the aerodrome. The proponent committed to maintaining the requirements of Specification 2013.1 – ‘Guidelines for the Siting and Exposure of Meteorological Instruments and Observing Facilities’ for the instrumentation at Moranbah

Airport.

EHP highlighted the sensitive receptors on or near the site and the importance of maintaining the relevant environmental values for each. The proponent has committed to ongoing monitoring for air quality indicators and the intention that there would not be any sensitive receptors within the mining lease that are not owned by the proponent or the subject of an appropriate agreement with the landowner. It should be noted that, notwithstanding any agreements between the proponent and any occupants of sensitive receptors on the mining lease, that EA conditions are required to be met at all sensitive receptors. Investigation and compliance action; however, is triggered by complaints.

EHP requested an assessment of 24-hour average PM₁₀ impacts based on the maximum modelled PM₁₀ ground-level concentrations. As part of the response to submissions the proponent provided Appendix D showing predicted values for the project in isolation and with ambient background. The results demonstrated that the maximum and 6th highest 24-hour average ground-level concentrations of PM₁₀ predicted at the sensitive receptors due to the project in isolation comply with the EPP Air objective for PM₁₀; and the maximum and 6th highest 24-hour average ground-level concentrations of PM₁₀ predicted at the sensitive receptors due to the project and ambient background (based on monitoring data) comply with the EPP Air objective for PM₁₀.

EHP also questioned the lack of an assessment of nuisance dust fall deposition impacts based on a maximum monthly deposition rate of 120mg/m²/day. As part of the response to submissions the proponent provided Appendix D showing annual average and monthly maximum dust deposition rates predictions with ambient background (based on monitoring data). The data complied with the recommended guideline of 120 mg/m²/day at all sensitive receptors.

DNRM and TMR requested an improved explanation of the management of coal in transit and if current methods of 'laminating' coal in the wagons would be employed from the start of operations. The proponent and Aurizon are responsible for the air impacts associated with transport of coal and would consult on the final coal transport design. The proponent has committed in the EIS to veneering (laminating) of coal after the coal is loaded onto trains.

DNRM, IRC and MCG requested further information on how dust from the DREA and or raw coal stockpiles would be controlled. The proponent outlined measures identified in the EIS to control dust from the DREA, such as conveyor used to transport rejects, progressive rehabilitation of completed sections and watering haul roads within the DREA. Dust impact mitigation measures in relation to the stockpiles would include watering of stockpiles, transport of coal to the stockpiles utilising covered conveyors, transfers in enclosed chutes, and deposition using variable height luffing stackers.

TMR's submission on the EIS raised concerns that the EIS had not described measures to mitigate dust generation during rail-haul of coal to the export port. TMR stated that it is a requirement for all mines transporting coal on the Aurizon coal network to implement measures contained in the Aurizon National Coal Dust Management Plan (CDMP, 2010). The response to submissions and amended EIS included a commitment by the proponent to consult with Aurizon to determine any additional requirements at the rail load-out facility including the use of coal wagon veneering systems, coal testing, measuring moisture content of product coal and consistency with CDMP 2010.

Several submissions, including the IRC submission, referred to cumulative impacts for dust. The proponent responded that the EIS did not predict that the proposed project would contribute significantly to cumulative impacts for dust. Operating (Peak Downs) and approved projects (Caval Ridge, Integrated Isaac Plains Project) were predicted to contribute significantly more dust than the fully underground Moranbah South Project. The proponent has also committed to ongoing monitoring and support in the Moranbah Cumulative Impacts Group with other proponents and the Isaac Regional Council. A complaints handling protocol would also to be maintained. However, in the review of the proponent's submission IRC replied that the proponent and the amended EIS still did not provide sufficient information regard to the cumulative effects of dust which requires a strategic change and different role for EHP as the state regulator. The council suggested a collaborative approach (clear reference Anglo's comments on dust modelling at SEIS presentation) through Moranbah Cumulative Impacts Group where it is more likely to get some meaningful collaboration and local empowerment rather than asking the regulator to carry out the work.

The Department of Education, Training and Employment (DETE) and QH were concerned regarding the air quality impacts on residents and local schools and requested regular air testing with the results to be shared with DETE. Furthermore, QH requested a complaints system for investigation and managing dust and odour nuisance compliance and potential health impacts. The proponent

responded that the EIS concluded that the proposed project would not impact on air quality at any sensitive receptors in Moranbah, including schools, and that EHP would be responsible for the regulation of air quality and the conditioning of regular monitoring and reporting. The EIS was also amended to include a commitment to a complaints handling protocol. Furthermore, IRC was questioning the proponent's response that it is difficult to model cumulative impacts and instead requested other modelling that would be able to forecast a more reliable expected dust deposition in the area for the Moranbah township and the proposed accommodation village. The proponent supported in its response the IRC's request for EHP to undertake an air quality modelling program to identify cumulative effects of dust. In its original response to this issue, the proponent also committed to participating in a cumulative dust modelling exercise and sharing the modelling data that has been prepared for the Moranbah South Project, and also the Grosvenor Project to the north of Moranbah. This involvement would be subject to the involvement of proponents of other relevant projects (such as the Isaac Plains South and Caval Ridge Projects). IRC responded that the response received to date indicated no commitment by the proponent to seek the assistance of the EHP to facilitate integrated air quality modelling to identify the cumulative effects of dust on the urban township of Moranbah through the established Moranbah Cumulative Impacts Group framework.

EHP requested further information on how the achievement of air quality objectives will be audited for the project. The proponent stated in its response that the EIS was amended to include information on air quality auditing. Furthermore, the proponent would continue its involvement in the Moranbah Cumulative Impacts Group; a forum that meets quarterly for the purpose of addressing cumulative impacts in Moranbah, particularly dust impacts. It includes representatives from mining companies and the community. As such, the proponent (Anglo American) regularly reports dust monitoring results from its Moranbah operations at this forum.

4.12.7 Greenhouse gas

Chapter 15 of the EIS included a summary of predicted greenhouse gas emissions and Appendix L included technical information about how the assessment was undertaken. It was concluded in the EIS that greenhouse gas emissions would vary significantly over the life of the project, given that the project includes a number of stages, with the ROM production rate varying between 2 and 18 Mtpa. The total emissions were estimated to be 1.0Mt CO₂-e per year over the life of the proposed project.

The EIS further stated that the proponent would buy emissions permits under the Commonwealth government's carbon pricing mechanism for the greenhouse gas emissions from the project. Furthermore, Anglo American is a participating organisation for the Energy Efficiency Opportunities program, as set out in the *Energy Efficiency Opportunities Act 2006*, and will report on the project, as necessary.

In addition to these legislative requirements, the EIS stated that Anglo American has its own internal energy efficiency targets outlined under various corporate policies. In order to gain internal corporate approval, the project would have to demonstrate an ability to achieve these targets. Hence, the project would address all mandatory energy efficiency performance standards, where applicable.

4.12.7.1 Major issues raised in submissions

One private submission raised greenhouse related issues in a submission predominantly relating to the use of the mined coal. The proponent responded that such issues are beyond the scope of the EIS as set out in the TOR. Unsuccessful legal challenges to Sonoma/Isaac Plains and Wandoan confirmed the scope of resource project EIS and the assessment of greenhouse gas emissions and impacts associated with these emissions. The submitter was not satisfied with the proponent's response and reiterated their concerns that climate change impacts had not been fully addressed in this EIS. In response, the proponent stated that it would comply with greenhouse gas legislation as it applies to the project and approvals process. While it was acknowledged in the EIS that the greenhouse gas emissions from the proposed project could have an adverse impact on the normal global carbon cycle, current government policy does not require the proponent to further deal with or offset its emissions.

4.12.8 Conclusions and recommendations

The air quality assessment adequately meets the information requirements of the TOR. The EIS adequately described the existing air environment and airshed that may be affected by the construction and operation of the Moranbah South Project. The EIS documents adequately addressed the TOR in relation to estimating potential GHG emissions associated with processes involved in the extraction of coal for the proposed project.

Based on the environmental protection commitments outlined in the EIS and EHP's Model Mining Conditions Guidelines (EHP, 2012), recommended draft EA conditions for air quality are outlined in Schedule B of Appendix 2.

The following recommendations provide direction on the key air quality issues raised and the proponent's commitments.

Recommendations

- *It is recommended that the proponent liaise with TMR and Aurizon during the negotiation of rail access agreements to ensure that appropriate mitigation measures are implemented to manage coal dust emissions and minimise the loss of coal from rail wagons.*
- *The proponent must prepare a monitoring program for the site which outlines measurable performance criteria for achieving air quality objectives and a monitoring program to measure how control strategies perform against the performance criteria (refer to draft EA conditions in Schedule B; Appendix 2 of this EIS assessment report).*

4.13 Noise and vibration

EIS Chapter 16 (Noise and vibration) and Appendix M (Noise Report) described the existing local acoustic environment; identified sensitive receptors potentially affected by noise and vibration emissions from the proposed project; established relevant noise and vibration criteria; predicted the noise and vibration levels likely to be experienced by sensitive receptors from the project; and provided mitigation measures for receptors where predicted noise and vibration levels are likely to exceed relevant criteria. A summary of the noise assessment is provided below.

4.13.1 Prediction methodology

The EIS stated that environmental expected noise levels produced by the proposed project were calculated by using RTA Technology's Environmental Noise Model (ENM) software. ENM is a general purpose noise modelling package that combines terrain and noise source information with other input parameters such as weather conditions to predict noise levels at specific receptor locations or as contours over a specified receptor area.

The following variables have been included in the modelling to assess the effects of the generated noise from the proposed project on sensitive receptors:

- identification of the existing environment : background and ambient noise levels measured from three monitoring locations from 11–24 June 2012 during day, evening and night
- comparisons of previous background noise data (e.g. Grosvenor Project EIS; Caval Ridge Project EIS).
- mining noise levels that would be produced by equipment operating as part of the project were determined from noise measurements taken at other operating mines.

The following criteria were included in the assessment:

- atmospheric conditions
- mining noise
- sleep disturbance
- road and traffic noise (including increased truck and car movements on Moranbah Access Road and Peak Downs Highway)
- low frequency noise

- blasting.

The predicted noise levels were calculated for construction noise impacts and for operational noise impacts covering the years with the highest production rate.

The noise objectives and goals at the site boundary were drawn from Queensland Government policy and guidelines including the Environmental Protection (Noise) Policy 1997 and 1998; Queensland EPA 2004 Planning for Noise Control Guidelines; Queensland EPA (2006) Noise And Vibration from Blasting Guideline; and Queensland EPA (2004) Draft Ecoaccess Guideline for the Assessment of Low Frequency Noise.

The adopted noise limits outlined in the EIS were as follows:

- sleep disturbance:
 - 47L_{Amax} for windows wide open
 - 52L_{Amax} assuming windows partly closed
 - 62L_{Amax} with windows fully closed
- low frequency noise:
 - 50dB_L (inside a dwelling with the windows and doors closed)
 - 60dB_L (outside a dwelling)
- blasting – overpressure:
 - 115dB_L peak for 9 out of any 10 consecutive blasts, with an absolute limit of 120dB_L peak for all blasts
- blasting – ground vibration limits:
 - 5mm/s peak particle velocity for 9 out of 10 consecutive blasts, with an absolute limit of 10mm/s peak particle velocity
- road noise:
 - 63L_{A10,18hr} for Moranbah Access Road (daytime)
 - 68L_{A10,18hr} for the Peak Downs Highway (daytime)
- rail noise:
 - 65L_{Aeq,24hr} (average) and 87L_{Amax} (maximum).

4.13.2 Identified acoustic environmental values

The EIS described the local area of the proposed project as predominantly associated with rural land uses, industry and residential properties. The existing acoustic environment was generally well populated. Local terrain was relatively flat 230m above sea level with few topographical landscape features that would affect noise dispersion patterns. Significant sources of noise emissions identified near the proposed project were coal and gas projects. Sixteen sensitive receptors were identified, comprising residential villages, commercial facilities and offices. The existing acoustic environment was found in the EIS to comprise of road traffic, mining, other industry and fauna (e.g. insects and birds).

4.13.3 Potential noise impacts

It was concluded in the noise assessment that acceptable environmental noise levels at all noise sensitive receptors under all regularly occurring meteorological conditions. A summary of noise level results at each sensitive receptor are shown in Table 10, along with the intrusive noise criteria ('specific levels') and planning noise levels identified in the EIS.

In conclusion, the following noise impacts were identified in the EIS:

- **Sleep disturbance** – short sharp noises would include vehicle reverse alarms, material handling mine surface facilities and compressed air operated starter motors on mining vehicles. The

loudest anticipated noise source was estimated at 125L_{Amax} (material handling) which would momentarily increase the project sound power level from 128L_{Aeq} to 130L_{Amax}, resulting in a predicted 35L_{Amax} at the closest residential receptor. This would be within the sleep disturbance criteria; with at least 5dBA below the sleep disturbance criteria for all residential receptors for transient noises.

- **Blasting** – small blasts (less than 100kg charge) would be required in the underground operations. Ground vibration level were predicated to be up to 2.3mm/s at the runway and up to 1.3mm/s at the terminal building, well below the conservative residential criterion of 5mm/s. The EIS further found that the runway would not be sensitive to overpressure while the terminal building would receive an overpressure level of up to 112dB (compared to the residential criterion of 115dB).
- **Construction activities** –earthmoving vehicles during construction were predicted to produce noise levels with a sound power level of 128dBA at any sensitive receptor (assuming all machines operate continuously at full power). Construction of the accommodation village would involve earthmoving and other activities not undertaken during the evening or night.
- **Road and rail** – these sources were modelled for worst case scenarios (weather, frequency) and were shown to be within the recommended noise levels at all sensitive receptors. Noise levels from the operation of the rail line within the project site indicate that train movements would have an average noise level of 51L_{Aeq,24hr} and 54L_{Aeq,24hr} during a peak day (both at a distance of 50m from the track). The maximum passing noise level of 78L_{Amax} is predicted for both scenarios. Predicted noise levels are below the 65L_{Aeq,24hr} and 87L_{Amax} criteria at a distance of 50m from the railway line.
- **Low frequency noise** – low frequency noise levels would remain below the EIS criterion of 60dBL at all residences (measured outside of the dwellings). Low frequency noise levels may slightly exceed the residential criterion at R15 (Kalari Transport Services) and R16 (Moranbah Airport). The EIS concluded that both are industrial developments with frequent aircraft or truck movements and therefore not sensitive to low frequency noise.

Table 10 Predicted project noise levels, criteria and planning levels; L_{Aeq}
(Source EIS; Table 16-4)

Receptor ID	Predicted noise levels (L _{Aeq})				Noise criteria (L _{Aeq})					
	Neutral	Prevailing			Specific levels			Planning levels		
		All	Day	Evening	Night	Day	Evening	Night	Day	Evening
R1	21	27	22	30	45	41	36	55	50	45
R2	22	29	29	32	-	-	-	40	40	40
R3	24	29	25	33	45	41	36	55	50	45
R4	26	29	27	35	45	41	36	55	50	45
R5	18	18	19	26	38	36	30	60	55	50
R6	19	26	22	30	45	41	36	60	55	50
R7	23	31	28	34	45	41	36	60	55	50
R8	23	31	29	34	45	41	36	60	55	50
R9	20	28	27	31	38	36	35	60	55	50

Receptor ID	Predicted noise levels (L _{Aeq})				Noise criteria (L _{Aeq})					
	Neutral	Prevailing			Specific levels			Planning levels		
	All	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
R10	21	28	28	31	38	36	35	60	55	50
R11	22	29	29	33	38	36	35	60	55	50
¹ R12	23	30	30	33	38	36	35	60	55	50
¹ R13	23	30	30	33	38	36	35	60	55	50
² R14	26	32	36	36	45	41	38	65	60	55
R15	33	42	43	46	-	-	-	60	60	60
R16	38	48	49	51	-	-	-	60	60	60

¹Receptor was predicted to be affected from the Caval Ridge Project

²R14 would be decommissioned in 2014 and consequently would not be present during the operational phase of the Moranbah South Project.

4.13.4 Cumulative noise impacts with existing and proposed mines

There were a number of other sources of noise identified in the EIS within the vicinity of the project site which would contribute to cumulative noise impacts, namely the Caval Ridge Project, Isaac Plains South Project and Grosvenor Project. Other major industrial developments such as the existing Moranbah North Mine and approved Eagle Downs underground project were found to be too far from assessed receivers to produce audible noise or to have any influence on cumulative noise levels at any assessed receptor near the project. Smaller industrial developments in the vicinity of the project, such as Kalari Transport Services, would produce limited environmental noise and would not significantly contribute to cumulative noise levels at any sensitive residential receptor.

Cumulative noise levels were calculated based on existing noise data from the abovementioned sources and the EIS concluded that the predicted cumulative noise levels were below planning noise levels at all sensitive receptors; ranging from 33–54L_{Aeq} for night prevailing weather conditions. The cumulative noise levels calculated for all 16 sensitive receptors are presented in Table 11.

The EIS concluded that cumulative noise levels would be below the planning noise levels at all receptors. No cumulative noise impacts were therefore predicted in the EIS at any of the 16 identified sensitive receptors.

**Table 11 Cumulative noise levels, night prevailing weather conditions; L_{Aeq}
(Source EIS; Table 16-5)**

Receptor ID	Moranbah South	Grosvenor	Caval Ridge	Isaac Plains South	Cumulative noise level	Night planning level
R1	30	29	25	<20	33	45
R2	32	28	26	<20	34	40
R3	33	27	26	20	35	45
R4	35	27	27	22	36	45
R5	26	<20	<20	35	36	50
R6	30	29	28	20	34	50
R7	34	27	33	20	37	50
R8	34	27	33	20	37	50
R9	31	26	33	<20	36	50
R10	31	26	34	<20	36	50
R11	33	25	35	<20	37	50
R12	33	24	39	<20	40	50
R13	33	24	39	<20	40	50
R14	The EIS stated that R14 would be decommissioned and removed before the Moranbah South Project begins operating					55
R15	46	22	50	21	51	60
R16	51	22	50	21	54	60

4.13.5 Proposed mitigation measures

The EIS stated that all potential noise and vibration sources modelled for worst case scenarios were shown to be within the recommended noise levels at all sensitive receptors. Furthermore, it was concluded in the EIS that cumulative noise levels would be below the planning noise levels at all receptors and as such no cumulative noise impacts were therefore predicted in the EIS at any of the 16 identified sensitive receptors.

The following mitigation measures were proposed in the EIS:

- A complaints handling procedure would be developed, similar to that used at other mines managed by Anglo American Metallurgical Coal. This complaints handling procedure would include providing a considered response to any noise related complaints, an investigation into the complaint, and adoption of any noise control measures identified as necessary during the investigation.
- The proposed project would further avoid undertaking earthmoving activities associated with the construction of the accommodation village between 6pm to 7am
- The proponent would develop a blast management plan for the project, including measures to control flyrock and details of any required notifications of blasting.

4.13.6 Major issues raised in submissions

EHP commented that details on a noise monitoring program for the construction and operation phases should be developed for the purposes of any draft EA conditions. The proponent responded that project would not give rise to any exceedances of noise criteria at any sensitive receptors and that implementation of an ongoing noise monitoring program is not a requirement of the model EA conditions for mining projects and noise issues are generally dealt with through complaints-based monitoring. The proponent further stated that the noise predictions for the project do not justify any deviation from this standard approach to noise monitoring.

EHP further requested information on progress with compensation agreements with sensitive receptors which was addressed by the proponent in stating that there would not be any sensitive receptors within the mining lease that are not owned by the proponent or the subject of an appropriate agreement with the landowner. It should be noted that, notwithstanding any agreements between the proponent and any occupants of sensitive receptors on the mining lease, that EA conditions are required to be met at all sensitive receptors. Investigation and compliance action; however, is triggered by complaints.

QH raised concerns regarding cumulative noise issues and also suggested hours of earthmoving activities and construction work should be limited to times outside 6pm to 7am and that the proponent should minimise low frequency noise. The proponent responded that any EA that would be issued for the project would include environmental performance requirements for noise and vibration for the life of the mine. Furthermore, the EIS modelled potentially impacting noise and vibration sources, including cumulative noise impacts which showed that cumulative noise levels would be below the planning noise levels at all project sensitive receptors, and therefore no impacts to these receptors were predicted.

IRC noted that sensitive receptor R14 (Caval Ridge Accommodation Village) would likely be a more permanent facility and may clash with construction activity noise and dust impacts from the proposed project. The proponent responded that the noise and dust impacts would be managed to the nominated criteria.

Rogash & Uremba Pty Ltd pointed to the proposed accommodation village for the proposed project and possible impingement on quarry operations due to noise and other impacts from the quarry. The proponent is currently in discussions with the proponent of the quarry operation in relation to any necessary consent for granting of a mining tenure and the detailed design of the accommodation village taking account of noise, dust and blasting from the Quarrico quarry.

BMA (airport owners) and the proponent are in discussion about noise impacts from the airport on the proposed Moranbah South Project accommodation village.

4.13.7 Conclusions and recommendations

The noise assessment concluded that predicted noise levels would be below the Queensland Government's noise criteria at all sensitive residential receptors. The EIS adequately addressed the noise requirements of the TOR. Legislation, policies and guidelines relevant for identifying values, mitigating and managing noise and vibration impacts on environmental values were adequately described in the EIS. The proposed draft noise EA conditions for the project (Schedule D; Appendix 2) are considered adequate to manage the potential noise impacts of the proposed project.

The following recommendations provide direction on the key noise issues raised and the proponent commitments made.

Recommendations

- *It is recommended that the proponent continue to liaise with the operators of the quarries on the site on the detailed design of the accommodation village taking account of noise, dust and blasting.*
- *It is recommended that the proponent continue to liaise with BMA about noise impacts from the airport on the proposed Moranbah South Project accommodation village.*
- *Any noise monitoring program developed for the site should outline measureable performance criteria for achieving noise objectives and criteria for measuring how control strategies perform against the performance criteria.*

4.14 Cultural heritage

Indigenous and non-indigenous cultural heritage was presented in EIS Chapter 21 and Appendix P. The assessment of Indigenous and non-indigenous cultural heritage is summarised below.

4.14.1 Methodology and identified values – Indigenous cultural heritage

The *Aboriginal Cultural Heritage Act 2003* requires anyone who carries out a land-use activity to exercise a duty of care. Land users must take all reasonable and practicable measures to ensure their activity does not harm Aboriginal or Torres Strait Islander cultural heritage. The cultural heritage duty of care can be met by acting under an approved cultural heritage management plan. However, a cultural heritage management plan is not required for projects that have existing agreements with the Aboriginal parties, prior to the commencement of the *Aboriginal Cultural Heritage Act 2003*.

The desktop review undertaken as part of the EIS assessment found no declarations in relation to Aboriginal heritage made under Commonwealth legislation for the project site and no sites were listed on Commonwealth heritage lists. However, the Barada Barna People were identified as the Aboriginal party for the proposed project in accordance with the *Aboriginal Cultural Heritage Act 2003*. Anglo American Metallurgical Coal Pty Ltd (Anglo American) signed a cultural heritage management agreement (CHMA) with the Barada Barna predecessor, Barada Barna Kabalbara & Yetimarla in December 2003 for all tenements controlled by Anglo American within their claim area, including the project site. The CHMA is considered to be an existing agreement under the *Aboriginal Cultural Heritage Act 2003*; hence Indigenous heritage on the proposed project area would be managed in accordance with this agreement. The EIS concluded that all artefacts of significance would be managed in accordance with the cultural heritage management plan.

4.14.2 Methodology and identified values – non-Indigenous cultural heritage

The EPBC Act is the principal legislation for matters of international and national non-Indigenous cultural heritage significance. Another piece of Commonwealth legislation, the *Australian Heritage Council Act 2003* provides for the establishment of the Australian Heritage Council. Actions which are likely to significantly impact on matters of international or national significance are prohibited without approval from the Australian Heritage Council and the Australian Government Department of the Environment. The *Queensland Heritage Act 1992* provides for the conservation of Queensland's cultural heritage and is administered by EHP.

A non-Indigenous historical cultural heritage assessment, consisting of desktop review and field inspections, was undertaken as part of the EIS assessment. The desktop review identified heritage themes of the region and predicted the locations and types of items of cultural heritage significance potentially located on the project site. This was followed by consultation with landowners and local residents and field inspections.

Twelve sites with potential heritage significance were identified in the desktop review. The field inspection assessed these 12 potential sites for cultural heritage values based on the Burra Charter, in order to determine if any site had local, state or national significance. General searches were also undertaken on the proposed project area.

The field investigation found 11 of the 12 previously identified sites. No other non-indigenous cultural heritage sites were identified. Of these 11 sites, four were assessed as having the potential to be of local heritage significance, namely:

- Site 1 – Redbank crossing, grave and occupation-site
- Site 2 – Grosvenor Creek crossing
- Site 3 – occupation and yard site
- Site 4 – original Grosvenor Downs Homestead.

Sites 1 and 3 met one or more of the thresholds for local heritage significance (although not for national significance), as they demonstrated evidence of sheep grazing activities, which is rare in the district and is important for demonstrating the evolution of the pastoral industry. It was identified in the EIS that local landholders and the community have a strong association with the gravesite located on-site 1.

The assessment of significance indicated that sites 2 and 4 did not meet the criteria for local, state or national significance. Nevertheless, they were determined to be nearing the threshold for local significance and were included in the impact assessment.

4.14.3 Potential impacts

The EIS described the potential to impact sites of cultural heritage significance through clearing for the construction of the mine surface facilities and subsidence impacts due to longwall mining. No impacts were identified from bord and pillar mining. The EIS stated that subsidence following longwall mining may lead to ground strains that would damage structures, and that cultural heritage sites may be disturbed by subsidence cracking and the work undertaken to repair subsidence cracks.

The EIS assessment identified that site 1 (Redbank crossing, grave and occupation-site) would not be located in close proximity to any mine surface facilities and consequently would not be disturbed by clearing. The Redbank Crossing, the wells, scrap metal and other artefacts found on-site 1 were beyond the limit of mining and would not be subject to subsidence. However, the gravesite was located within an area that is predicted to experience 20mm of vertical subsidence. The assessment concluded though that the gravesite is on the limit of measureable subsidence, which means that subsidence in this area is predicted to be so minor that it would not be detectable beyond the range of natural ground movements. As the gravesite did not contain any structures, such as a stone headstone, that could be impacted by subsidence, no impacts due to subsidence were predicted in the EIS and no management or monitoring measures would be required.

Site 3 (occupation and yard site) was found to be well beyond the limit of subsidence and would not be located in close proximity to mine surface facilities. No impacts on this site were therefore predicted in the EIS and no management or monitoring measures were therefore outlined.

Sites 2 and 4 would be located beyond the footprint of proposed mine surface facilities and consequently would not be disturbed by the construction of infrastructure. They were both located above the proposed bord and pillar mining area and as this type of mining does not give rise to surface impacts, no impacts were predicted in the EIS.

4.14.4 Proposed mitigation measures

The EIS predicted that the four sites would not be impacted by the proposed project activities. However, inadvertent damage to these sites would be avoided through the implementation of a permit to disturb process during construction and operation of the mine. The permit to disturb process would involve identifying significant features that should be avoided when any disturbance (e.g. clearing or earthworks) is planned.

The EIS identified several procedures to mitigate potential impacts in the unlikely event that previously unrecorded sites of non-Indigenous cultural heritage significance would be located during ground disturbance:

- **Staff briefing:** The general manager and all staff or contractors of the proponent who would be responsible for undertaking initial clearance and ground breaking activities would be informed of their obligations under the *Queensland Heritage Act 1992* to report to the EHP any archaeological items that may constitute an important source of information about an aspect of Queensland's history. As a cautionary approach, a find strategy would be employed if any potential heritage items are identified.
- **Find strategy:** In the event that any staff or contractors of the proponent suspect that they have uncovered an archaeological object that may constitute an important source of information about an aspect of Queensland's history, the following measures would apply:
 - Disturbance of any areas immediately surrounding the find would cease immediately.
 - If it is considered that the find is at risk of being inadvertently damaged by construction activities, a temporary fence would be erected around the find.
 - EHP would be notified.
 - A suitably qualified archaeologist would be engaged to inspect the find and determine its significance.
 - Should the find be of state significance, appropriate mitigation strategies would be

developed in consultation with EHP officers.

- **Archaeological standards:** In the event that archaeological monitoring or excavations would be required as a result of implementing the find strategy, the standards outlined in EHP's Draft Guidelines for Carrying Out an Archaeological Investigation (2010) would be applied (or any version of the EHP guidelines that may supersede this document).
- **Management of gravesites:** A management plan for gravesites at site 1 and site 4 would be prepared prior to the commencement of construction activities. The management plan would be developed in consultation with relevant landowners, to ensure that gravesites are preserved and protected from any project related impacts.

4.14.5 Major issues raised in submissions

The IRC stated that the EIS did not provide sufficient detail on a strategy for management of cultural management of rural cemetery sites. IRC requested that the EIS include a preferred model for managing rural cemetery sites which describes the cultural acceptance. The proponent stated that although the gravesites at site 1 and 4 were not predicted to be impacted by proposed project activities, a management plan for these gravesites would be prepared prior to the commencement of construction activities. The management plan would be developed in consultation with relevant landowners, to ensure that gravesites would be preserved and protected from proposed project related impacts.

4.14.6 Conclusions and recommendations

The EIS was found to adequately address both Indigenous and non-Indigenous cultural heritage issues and adequately met the requirements of the TOR.

4.15 Social

A social impact assessment of the proposed project was summarised in EIS Chapter 18. A social impact management plan (SIMP) was provided in Appendix N. The social impact assessment addressed the socio-economic impacts associated with the construction, operation and decommissioning of the proposed project. Also assessed were the social impacts of the introduction of the project workforce.

Following is a summary of the potential social impacts and proposed mitigation measures as well as the major issues identified during the EIS process.

4.15.1 Methodology

The methodology for the social impact assessment included the following key components:

- identification of the study area
- profiling the socio-economic environment of the study area based on a review of existing information/data and consultation with relevant stakeholders
- identification and assessment of potential socio-economic impacts
- development of appropriate management commitments to address socio-economic impacts and to maximise community benefits.

A variety of desktop and consultative sources were used to profile the communities of the local and regional study area including:

- literature review
- quantitative data collection and analysis
- consultation.

The EIS stated that consultation with relevant stakeholders was an essential part of the social impact assessment in order to gather information on community perceptions, to better understand the current social setting, to assist in the prediction of potential social impacts and to understand the stakeholder's key issues of concern.

Potential project socio-economic impacts were categorised into seven thematic areas: community demographics; housing and accommodation; social infrastructure; community liveability; economic vitality; labour market and training; and mine closure. The characteristics of each potential socio-economic impact were then analysed with reference to nine indicators, such as the desirability, timing, duration, likelihood, reversibility, and geographical extent of the impact.

4.15.2 Identified social values and potential social impacts

4.15.2.1 Overview

The primary area of influence identified was the town of Moranbah due to the proposed project workforce accommodation arrangements, the associated demand generated by the project workforce for housing, services and facilities, and the supply chain opportunities. The local study area for the project was defined as the Isaac local government area (LGA) with a focus on the urban centre of Moranbah. The regional study area was defined as the Mackay, Isaac and Whitsunday Region as preliminary workforce planning for the project suggested that approximately 60% of the workforce would likely reside in this region.

The EIS stated that the proposed project would have the potential for positive social changes including increased employment, economic growth and resident population. Negative potential impacts would include a further increase of the non-resident workforce, increased demand for social services and risks of loss of community identity. A description and assessment of the impacts and management commitments was provided in a stand-alone SIMP.

Moranbah is located in the centre of a large expansion of the Queensland mining industry—with nine existing mining operations and three mines under construction within an approximate 25km radius of Moranbah.

4.15.2.2 Demographics, housing and social infrastructure

The full time equivalent population of Moranbah is predicted to increase by approximately 60% between 2011 and 2015, doubling the number of non-resident workers.

Two key issues identified in the EIS were housing availability and housing affordability. The EIS stated that the housing market conditions in Moranbah reflected the impact of local mining activities as well as broader Australian and Queensland trends in housing prices and residential rents.

The EIS described the regional centre of Mackay as providing a diverse range of services and facilities including specialised services not readily found in the smaller communities of the Mackay, Isaac and Whitsunday Region, such as Moranbah. Moranbah was described as a well-served community which catered for the basic needs of residents and surrounding rural communities.

The EIS stated that there is a wide range of social infrastructure available in Moranbah. It was identified that the increased business costs and competition for labour had limited the availability of health, retail and training services. The fluctuating population base, associated with drive in/drive out and fly in/fly out employment conditions, has led to a loss of social infrastructure and opportunities, which increased the existing issues and provided disincentive to prospective new residents. A number of the local service and facility operators were experiencing high levels of demand and corresponding difficulties in supply of the service.

The EIS also reported a division in the town between mining staff and mine contractors; especially in the last three to four years where an increasing number of long-term residents and families left town and the number of non-resident workers increased. The EIS concluded that there was a declining strength of social networks and sense of community in Moranbah.

The EIS identified residents perceiving a decline in personal safety and security in Moranbah due to a range of factors including, but not limited to, the increased number of non-resident workforce and the prevalence of long shift arrangements. The analysis of trends in reported offences in Moranbah between 2007 and 2012 showed no statistical correlation to these perceptions.

4.15.2.3 Labour force, training and economy

The EIS stated that there were 650 businesses in Moranbah, including financial, retail, medical and restaurants and catering. The EIS concluded that it is likely that growth in the town population has been matched by a declining propensity to spend locally on discretionary expenditure items, with residents reporting that they are frequently shopping online.

The EIS reported a number of small businesses located in Moranbah and servicing the wider community were experiencing growth constraints due to high commercial rents in town, limited labour markets and higher housing costs. Service providers also reported difficulties in recruiting labour (especially local, long-term and skilled staff) due to a lack of affordable accommodation and increased competition from local mining industries that are able to offer significantly higher wages than the service industry.

Income levels in Moranbah were significantly higher compared to national and state equivalent incomes.

4.15.2.4 Project workforce and accommodation

Two construction phases were identified for the proposed project:

Construction phase 1 – construction of surface facilities and the two longwalls. The average annual construction workforce would be 574 full time equivalent workers for construction phase 1 which would commence in project year 1.

Construction phase 2 – a second and smaller construction phase involving the construction of bord and pillar components. The average annual construction workforce would be 253 full time equivalent workers for the construction phase 2 which would commence in project year 20.

The workforce for the operations phase would gradually ramp up in parallel with the completion of construction phase 1. From project years 6–20, both longwalls would operate simultaneously (referred to as the dual longwall operations phase). The workforce was expected to remain stable during this period with 1314 persons (consisting of 1039 employees and 275 contractors).

The EIS stated that the workforce would consist of approximately:

- 25% resident workers – employees who would reside permanently in Moranbah and commute on a daily basis between their residence and the project site
- 75% non-resident workers – employees who would drive in/drive out or fly in/fly out of the project site and live in Moranbah temporarily while rostered on. The majority of these employees would likely be based outside of Moranbah but within the Mackay, Isaac and Whitsunday Region reflecting labour supply issues currently present in that region.
- 20 resident contractors and 255 non-resident contractors.

According to the EIS the construction workforce would be accommodated in an on-site accommodation village to be located at the northern end of the proposed project site—with the initial construction workforce to be accommodated in third party provided accommodation until the on-site accommodation village is complete. Accommodation options identified for the operation phase workforce consisted of:

- on-site accommodation village for the non-resident workforce
- residential housing in Moranbah provided by the proponent
- proponent support to employees who choose to purchase their own property.

4.15.2.5 Mine closure

The EIS provided information on the potential social impacts of the mine closure in the SIMP in Appendix N. Decommissioning of the first longwall is proposed for project year 25 with the second longwall decommissioned in project years 31 and 32. The peak decommissioning workforce would consist of 144 persons in project year 31 and a further decommissioning workforce of approximately 79 and 50 persons would be required for final decommissioning in project years 46 and 47.

The following key impacts associated with the mine closure were identified:

- Reduction in non-resident population in Moranbah – which would result in a positive socio-economic impact.
- Reduction in permanent population in Moranbah – which would result in a negative socio-economic impact.
- Reduced demand on housing and accommodation in Moranbah – which would result in a negative socio-economic impact.

- Reduction in opportunities to support the community – which would result in a negative socio-economic impact.

The SIMP stated that given the life of the project, it would be likely that the population and housing dynamics of the community would change significantly by the time that mine closure impacts occur. There would be a high likelihood of the reduction in opportunities to support the community.

4.15.3 Proposed mitigation measures

The strategies identified in the EIS to manage potential adverse impacts and enhance positive impacts were informed through consultation conducted with key government regulators and service providers, such as the IRC and the broader Moranbah community.

The proponent developed in the SIMP a range of action plans in order to manage and monitor potential socio-economic impacts associated with the proposed project. These are summarised below.

- **Action plan 1 – Project workforce accommodation:** Attract and retain suitable labour for the project, whilst making a positive contribution to community vitality and minimising potential impacts on housing availability and affordability in Moranbah.
- **Action plan 2 – Project workforce management:** Support labour force up skilling in the mining and non-mining sectors of the Isaac LGA, and in particular in Moranbah; and support employment retention and career development for vulnerable sectors (including people with disabilities, Indigenous people, etc.) across the Mackay, Isaac and Whitsunday Region.
- **Action plan 3 – Local and regional business development:** Support capacity and capability increases in local and regional business; and enable access for local businesses to supply chain opportunities that arise from the presence of Anglo American projects and operations in the Mackay, Isaac and Whitsunday Region.
- **Action plan 4 – Social infrastructure accessibility:** Contribute to the continuing development of Moranbah as a sustainable, safe and healthy community by proactively managing any increase in demand on community services and facilities from project related workforces and their families. The provision of essential social infrastructure is primarily the responsibility of the state government.
- **Action plan 5 – Community and employee health and wellbeing:** Support the development of a happy and healthy workforce and Moranbah community.
- **Action plan 6 – Community liveability:** Support a welcoming, safe and secure environment for the project workforce, residents and non-residents of Moranbah.

In addition the proponent outlined in the EIS that there are a number of existing corporate tools (policies, guidelines and strategies) established to manage socio-economic issues associated with its current operations in the Bowen Basin. Socio-economic impacts associated with the proposed project would be managed through a combination of these existing corporate tools and the commitments defined in the action plans outlined above.

This would include a mine closure toolbox that was developed by the proponent as part of the Anglo American Socio-Economic Assessment Toolbox (SEAT), in order to expand the focus of mine closure planning from financial provisioning for rehabilitation and physical closure to planning for sustainability beyond mine closure and leaving a positive legacy. This would include specific actions for consideration in mine closure planning. The SIMP outlined that the requirements of the mine closure toolbox would be addressed through the Anglo American SEAT process as project operations progress. It was further proposed that the implementation of the SEAT study would occur at least every three years to inform updates to the social management plan.

4.15.4 Major issues raised in submissions

The Department of Aboriginal and Torres Strait Islander and Multicultural Affairs (DATSIMA) requested development of specific strategies to support increased Indigenous training, employment and business procurement opportunities. DATSIMA also requested that a project Workforce Diversity Policy and the Met Coal Indigenous Workforce Diversity Action Plan should be attached to the SIMP. The proponent responded that it is currently developing a reconciliation action plan (RAP) in line with

Reconciliation Australia's RAP program. The RAP is anticipated to be released publicly in early 2014 following approval by Reconciliation Australia. The final RAP would broadly address the suggested strategies identified by DATSIMA. Specific strategies to be addressed in the RAP would include the establishment of minimum targets for Indigenous people and the establishment of an Indigenous mentoring program. A copy of the proponent's RAP would be forwarded to DATSIMA following public release. The proponent's RAP replaced the Met Coal Indigenous Workforce Diversity Action Plan referred to in the EIS and several sections of the EIS were amended to reflect this change. The SIMP was amended to include consultation with the Traditional Owners in relation to potential employment and procurement opportunities associated with site rehabilitation. EHP understands that the Anglo American RAP was subsequently completed and submitted to Reconciliation Australia in May 2014.

DATSIMA further outlined that given that it would be difficult to find local Indigenous job seekers, DATSIMA requested specific reference to seeking fly in/fly out and bus in/bus out opportunities for Indigenous peoples and specific targets for each phase of the mine. The proponent responded that it is an equal opportunities employer and that applications for project positions would be accepted from any person who meets the applicable application criteria and demonstrates a cultural fit with the organisation. The proposed bus in/bus out opportunities from Mackay would hence assist in encouraging Indigenous applicants from the available pool of Indigenous labour in the Mackay region. Furthermore, in implementing the RAP the proponent would seek to establish minimum employment targets for Indigenous people as well as internal targets for local procurement and workforce diversity, both of which incorporate opportunities for Indigenous and non-Indigenous people. The proponent is currently working with Spotless and Workpac to identify further opportunities for Indigenous participation in a number of Anglo American projects, including the Moranbah South Project. The proponent committed to engage further with DATSIMA in relation to strategies to increase Indigenous access to project related employment opportunities as project planning progresses.

The Queensland Ambulance Service (QAS) requested further information on management strategies to address the consequences of limited accommodation availability and affordability, the impact for local residents including emergency service personnel in securing suitable accommodation at a reasonable cost. Furthermore, QAS requested commitments that the proposed project would assist the local community, low income earners and critical workers with residential housing availability and affordability factors, should the project result in a significant increase in the construction workforce. In its reply, the proponent stated although the slow-down in the mining industry during 2013 resulted in a decline on house rental and purchase prices in Moranbah and an increase of available accommodation, the proponent plans to build, lease or otherwise acquire at least 150 units of accommodation in Moranbah for the operations phase of the project. In addition the proponent proposed to construct an on-site accommodation village with sufficient capacity to accommodate the construction workforce and the operations phase non-resident workforce. The anticipated peak in the construction workforce would be fully accommodated in the on-site accommodation village. Affordable housing initiatives may be eligible for funding under the Anglo American Moranbah 2020 Fund if need exists.

QAS requested to be consulted in relation to provision of a paramedic service on the site. This paramedic would work closely with your health team to ensure loss time is reduced where possible. The proponent committed to engage a paramedic on-site and would request expressions of interest from relevant service providers in the near future. The proponent stated that after reviewing these expressions of interests, a vendor would be chosen based on a range of selection criteria, including the level of service provided and the cost. QAS can be considered during this process.

DHPW recommended that the monitoring framework outlined in the social impact management plan should include an additional performance goal about monitoring the local housing market over the life of the project. As a response, the proponent amended its framework to include a target relating to the monitoring of the housing market in Moranbah.

DSDIP informed the proponent that the 'Local Industry Policy' (LIP) outlined in the EIS no longer applies to private sector resources and energy projects and that reference should be given to Queensland Resources and Energy Sector 'code of practice for local content'. The proponent hence removed these references and replaced it with a reference to the Queensland Resources and Energy Sector 'Code of practice for local content' instead.

DSDIP informed the proponent that the Queensland Government introduced in July 2013 a new social impact assessment guideline superseding the earlier guidelines, and offering the option to not prepare a SIMP, but instead to follow the new guideline. DSDIP indicated that the Moranbah South SIMP

should acknowledge this change, and nominate its choice. The proponent responded that the EIS was prepared in accordance with the requirements of the EP Act and that the project's social impact assessment and SIMP were prepared and placed on public exhibition prior to the release of the new guideline. Hence, the content of the social impact assessment and SIMP follow the structure and requirements outlined in the TOR for this project. However, the proponent also stated that the social impact assessment and SIMP are considered to be compliant with the core social impact assessment principles documented in section 3 and Appendix 3 of the new social impact assessment guideline. In a review of the proponent's response to DSDIP's comments, DSDIP reiterated again that in line with social impact assessment guidelines, the proponent should report social impacts to stakeholders and EHP annually during construction and the first two years of operation, whichever is greater.

QAS and DE TE requested in their submissions to be involved in ongoing consultation. The proponent responded that QAS and DE TE were already listed as stakeholders in the SIMP and that their issues/topics were noted.

DE TE further informed the proponent that the Queensland Government in partnership with the Industry Capability Network has established the Black Business Finder, an online database developed to give Indigenous businesses an opportunity to be involved and that DE TE is also responsible administering the Supporting Women Scholarships which are opening up new opportunities for Queensland women of all ages and at all stages of their working life.

QPS requested in its submission that the proponent considers a behaviour management plan to ensure standards of behaviour of employees living and socialising within the local community are maintained and that the proponent considers a behavioural code as part of an individual's employment contract to highlight and emphasise community concerns held around temporary and permanent camps. The proponent responded that the SIMP contained an existing commitment to the implementation of the Anglo American Workforce Code of Conduct, which ensures all contractors and employees understand proponent and community expectations of their behaviour in their place of residence and in their place of work.

QPS also outlined the need to identify and discuss appropriate mitigation for cumulative socio-economic impacts. The proponent stated that the SIMP described the range of actions to be implemented by Anglo American to address cumulative socio-economic impacts associated with the proposed project.

Several agencies requested further information regarding potential impacts on health services as part of the proposed project. QAS requested that the proponent should identify the potential impacts on the surrounding community health and services infrastructure if the proposed project would result in a significant increase in population. Similarly, the IRC stated in its submission that the EIS did not provide any advice on the demand management and increased supply of medical service in the Moranbah community as a result of the proposed project. The proponent responded that the social impact assessment in the EIS assessed the potential impact of the additional population on the supply and demand for social infrastructure and services in Moranbah. The EIS predicted that impacts would be predominantly cumulative in nature and would be addressed through a range of public and private sector initiatives, such as the Anglo American Moranbah 2020 Fund and the Health Care Partnership Group. A number of the management commitments described in the SIMP would support the implementation of the recommendations outlined by Health Workforce Queensland (2012) and would include provision of accommodation for visiting specialist and allied health professionals and provision of information to the project workforce about available health services. Furthermore, the proponent stated that the social impact assessment discussed the impact of the project on the demand and supply of medical services in Moranbah.

QH recommended that the proponent determine how it would manage the delivery of health services to the construction and operational workforce and/or support or strengthen local health services. The proponent responded that the social impact assessment report looked at the available health services and the potential impacts of the proposed project. The proponent is also in the process of evaluating the requirement for and potential options for the delivery of health services at the on-site accommodation village and participates in the Health Care Partnership Group in Moranbah along with BMA and the IRC.

QH further recommended that the proponent communicate with local and regional health services regarding emergency management protocols and procedures. The proponent responded that the EIS outlined the consultation with local and regional representatives of key government agencies that would be undertaken as a key part of emergency response management. However, the SIMP was

amended to include emergency response and management planning.

4.15.5 Conclusions and recommendations

The social impact assessment outlined in the EIS met the requirements of the TOR. The requirements of the TOR in relation to describing the existing social environment, outlining potential impacts of the proposed project and proposing management measures to mitigate social impacts through the form of a SIMP have been adequately met in the EIS. The ability of the proposed project to minimise adverse social impacts of the project on the local and regional area, would rely on the successful implementation of these strategies by the proponent as well as on-going monitoring and communication with agencies/stakeholders/community to assess the effectiveness of strategies in mitigating potential negative cumulative impacts of the proposed project.

Recommendation

- *DSDIP requested that in line with social impact assessment guidelines, the proponent should report social impacts to stakeholders and EHP annually during construction and the first two years of operation, whichever is greater.*

4.16 Economy

The economic values potentially affected and the potential impacts of the proposed project were outlined in EIS Chapter 19. Impacts on economic values in relation to the baseline social environment and social impacts of the proposed project were also described in the Social Impact Assessment Report in Appendix N of the EIS.

Generally, the economic assessment outlined in the EIS met the requirements of the TOR. A summary of the potential impacts and proposed mitigation measures, as well as an assessment of the major issues identified during the EIS are outlined below.

4.16.1 Methodology

The EIS described the results of the assessment of potential positive and negative economic impacts undertaken for the construction and operation of the proposed project, including the results of an input-output modelling undertaken. The regional study area for the economic impact assessment was defined as the Mackay, Isaac and Whitsunday Region incorporating the Whitsunday, Isaac and Mackay LGAs. The local study area is defined as the Isaac LGA including the town of Moranbah.

The economic impacts identified in the EIS were estimated using an input-output modelling which provided a quantitative approach to estimate economic impacts. Economic impacts were identified for the construction and operation phases for the Isaac LGA, the Mackay, Isaac, and Whitsunday Region and the State of Queensland.

The construction phase impacts were modelled on employment and expenditure in the existing construction sectors of the local, regional and state economies. The operation phase impacts were modelled on a new sector defined for the proposed project in which direct employment consisted of employees only and contractors were counted in the flow-on employment. The EIS described that the separation of contractors and employees would offer a more conservative estimate of local, regional and state impacts given that input-output modelling often overstates the magnitude of impacts.

4.16.2 Identified economic values

The predicted net production benefits of the proposed project were estimated in the EIS to be potentially \$1.6 billion over the life of the project, including:

- royalty payments to the Queensland Government of potentially \$1.5 billion
- increased tax receipts to the Australian Government in the form of any company tax payable or minerals resource rent tax from the project.

The EIS stated that in addition to the direct 1314 full time equivalent positions created by the proposed project, a further 5687 flow-on full time equivalent jobs would be expected for Queensland; with 2785 to be located in the Mackay, Isaac and Whitsunday Region and 1209 in the Isaac LGA. The project workforce has been described in detail the social impact assessment section of this report

(refer to section 4.15). The EIS concluded that while the net production benefits and job creation would represent a significant boost to the regional and local economies, the increase in employment would place further stress on the already tight labour market.

The EIS further outlined that the proposed project would generate:

- during construction an average of \$154 million in income
- during dual longwall operations \$647 million in income in Queensland annually:
 - with \$310 million in the Mackay, Isaac, and Whitsunday Region
 - \$94 million is expected in the Isaac LGA thus ensuring the economic benefits extending beyond the immediate project location.

Value-added were estimated in the EIS to be in the range of:

- during construction \$236 million in value-added for Queensland annually
- during dual longwall operations \$1.98 billion in value-added to the Queensland economy annually with:
 - \$1.6 billion in the Mackay, Isaac and Whitsunday Region
 - \$1.4 billion in the Isaac LGA economy.

4.16.3 Major issues raised in submissions

Several comments were received on socio-economic issues which have been addressed in section 4.15.4 (Social) of this assessment report.

QAS outlined that the QAS may be required to fund and expand radio networks in the area and hence would request support to piggy back communication technology on planned towers or investigate assisting QAS to install appropriate technology in the area. The proponent responded that expansion of communication technology for QAS may be eligible for funding under the Anglo American Moranbah 2020 Fund. The proponent encouraged QAS to investigate eligibility and submit an application.

The Mackay Regional Council commented in its submission that the economic impact on Mackay relates to the industrial support services that would service the mine, which is viewed as a positive impact. However, the significant proportion of fly in/fly out workforce does raise concern as it does not support spending within the local or regional economy. The council stated that it would be preferable that a larger proportion of workers live in the Mackay, Isaac and Whitsunday Region. The proponent responded that project planning was based on the assumption that almost 60% of the workforce would reside permanently in the Mackay, Isaac and Whitsunday Region. The remaining workforce (approximately 40%) would be employed on a fly in/fly out basis from South East Queensland.

4.16.4 Conclusions and recommendations

The EIS documents adequately met the requirements of the TOR in relation to economic impacts. The existing economic environment of the project area was adequately described in the EIS, potential impacts of the proposed project predicted and broad strategies to minimise economic impacts described.

4.17 Hazard and risk

A qualitative risk assessment of potential hazards to the community, including actions for mitigating or reducing the level of risk during the construction and operation phases of the proposed project was discussed in EIS Chapter 23. A hazard and risk assessment of the site water management system and hazards which have the potential to impact directly upon surrounding land uses were also included. Occupational health and safety hazards, such as slips, trips and falls were not addressed within this section, unless specifically required by the TOR.

The EIS adequately addressed the hazard and risk requirements of the TOR. A summary of the potential impacts and proposed mitigation measures, as well as an assessment of the major issues identified during the EIS are outlined below.

4.17.1 Potential hazard and risk impacts and proposed mitigation measures

EIS Chapter 23 discussed the following topics:

- Legislation and Australian Standards relevant to assessing and managing hazard and risk.
- Surrounding land uses and community values that could potentially be exposed to hazards and risks from the proposed project.
- The safety and health management systems that would be implemented by the proponent, including information on emergency preparedness and response.
- The hazardous substances and dangerous goods that would be transported, stored or processed as part of the proposed project and the preliminary hazard analysis that was undertaken to assess the level of risk that the proposed project would present to surrounding land uses and community values.
- The ongoing consultation that would be undertaken with local and regional representatives from the emergency services in relation to the management of hazard and risk.

The EIS described the legislation that exists in relation to occupational health and safety (OHS) at mine sites and any code of practice issued under regulations and Australian standards that would represent best practice for managing risks. The EIS further stated that OHS measures would be addressed in full as part of the safety and health management system that would be implemented to govern OHS throughout the life of the proposed project.

4.17.1.1 Land use

The EIS identified that the surrounding land uses associated with Moranbah Township included residences, schools, hospitals, kindergartens and day care facilities, aged care facilities, office buildings, factories, workshops, sports fields and recreational areas. The proposed project site is surrounded by a number of mines, such as the Peak Downs Mine to the south, Caval Ridge Project to the west, Eagle Downs Project to the south-east, Grosvenor Project to the north, and overlaps with parts of the Isaac Plains South Project to the east. The built infrastructure on the proposed project site included a service station, powerlines, water and gas pipelines, Moranbah Airport, as well as state and local government controlled roads. No forests or stock route watering points were located within 5km of the proposed project site.

Sensitive receptors associated with surrounding land uses included:

- Moranbah township and the Moranbah priority development area – including locations where sensitive human health receptors such as young children and the elderly may reside or congregate
- rural residences
- recreational reserves
- commercial / light industrial areas
- the Moranbah Airport
- accommodation villages that house mine and industrial workers.

Any potential impacts identified during the EIS for the proposed project on downstream surface water or groundwater extraction for potable use were discussed in sections 4.9–4.11 of this report. Likewise any potential for the proposed project to emit odours or otherwise impact air quality was discussed in section 4.12 of this report. The EIS concluded that the proposed project would be unlikely to cause significant health or nuisance issues for sensitive human health receptors.

4.17.1.2 Community values

Community values and concerns relevant assessed in the EIS included:

- safety in relation to the impacts of major accidents when in public spaces and on private property
- amenity value in residential areas
- continuity of services, including emergency services

- clean air and water.

4.17.1.3 Safety and health management systems

In order to manage the safety and health of employees, contractors and the wider community, the proponent would implement a safety and health management system to address the construction, operations and decommissioning phases of the proposed project. As part of this system site emergency response would be integrated with the emergency services response. The EIS stated that all project personnel would be expected to comply with these requirements in order to achieve the proponent's objectives in the area of safety and health. The safety and health management system would further meet all legislative, regulatory and voluntary requirements and would comply with Anglo American Metallurgical Coal Pty Ltd corporate standards.

The safety and health management system would address the following components:

- operational hazard analysis
- regular hazard audits
- fire safety, emergency response plans
- qualitative risk assessment
- construction safety.

The proponent committed to create a detailed risk register containing critical controls. Roles and responsibilities would further be clearly defined to ensure transparency and accountability. Furthermore, the proponent would develop a series of principal hazard management plans that would outline the framework for addressing the requirements of an integrated risk management plan. The integrated risk management plan would be developed for the whole life of the project including construction, operations and decommissioning phases, subject to ongoing review as part of the continual improvement process.

The proponent would also develop a detailed standard for emergency preparedness and response. An emergency response management plan would be developed to specifically address major emergencies and incidents that could impact upon surrounding land uses, including disaster management techniques, emergency response plans, first response and mine rescue plan, first aid, including provision of first aid facilities, risk assessments, evacuation and site access plans, emergency drills and responses, monitoring of flood warnings, and fire management.

The proponent would consult with key stakeholders including the emergency services, IRC and state government. An on-site team for first aid, fire fighting and emergency response would be established which would undergo regular training drills and assessment. Incident and hazard reporting would be managed via an incident recording, notification and investigation system.

As part of the safety and health management system all site personnel contractors would undergo a comprehensive site induction and familiarisation, including all aspects of the safety and health management system. Refresher training would also be provided regularly and training in basic first aid and fire training.

The proponent would also develop a hazard, defect and incident procedure to monitor conformance with the safety and health management system. Internal and external audits, inspections, reviews and independent contributions would be used to identify corrective actions as part of the process of continual improvement.

4.17.1.4 Hazardous substances and dangerous goods

The EIS identified that no infectious substances would be used, transported or produced. Any radioactive material would be managed via a radiation safety officer to ensure that industrial gauges containing some radioactive substances would be stored and maintained in accordance with the relevant legislation, regulation and radiation safety standards. No blasting would not be undertaken as a normal part of operations. Small scale blasting at longwall mines would be conducted as part of the construction of mine entries (i.e. the box cuts) or conducted infrequently during mining operations due to the occurrence of unexpected rock intrusions in the coal seams. Underground roadways would not be disturbed by blasting. Any bulk explosive material would be brought to site by a licensed contractor and the blasting would be undertaken by experienced and appropriately trained explosives

contractors. The proposed site of the explosives magazine would be located well away from any sensitive receptors.

The EIS proposed a range of management strategies, including but not limited to:

- transport, storage and handling of all dangerous goods, explosives and hazardous substances
- register of hazardous materials
- provisions of material safety data sheets for every chemical and proprietary substance used
- handling, storage and management of hydrocarbons and chemicals
- management of bulk fuel storage and refuelling facilities
- bunding requirements for stormwater treatment, disposal and chemical storage areas and fuel and oil storage facilities
- risk management of storage tanks; training of key staff in spills prevention and clean up
- regular inspections of the structural integrity of fuel tanks and bunds
- installation of fire fighting facilities and fire suppression systems
- strict control of ignition sources
- training of equipment and vehicle operators in the safe operation of the equipment and the emergency response procedures
- development of a spill management plan as part of the emergency response plan.

Preliminary hazard analysis

A preliminary hazard analysis was prepared as part of the EIS. The emphasis of the preliminary hazard analysis was said to be the prevention or minimisation of major hazardous incidents (e.g. fire, explosion and the release of toxic biologically harmful chemicals) on-site that could potentially result in significant off site effects. Identified hazards included project operations; natural events (e.g. floods, bushfires and landslides); technical events (e.g. vehicle impacts); malicious acts (e.g. vandalism and sabotage); and catastrophic events at neighbouring sites (e.g. explosions, fire, release of contaminants, gases and chemicals into the air or water bodies).

Factors used in the preliminary hazard analysis included the following:

- nature and quantities of hazardous materials stored and processed
- type of plant and equipment in use
- adequacy of proposed technical, operational and organisational safeguards
- surrounding land uses or likely future land uses
- interaction of these factors.

The consequences and likelihood of each identified hazardous incident were used to estimate the risk of a hazardous outcome being realised. The analysis included the positive effects of risk control measures to be implemented. The overall low risk profile identified for the proposed project was then used in the assessment to consider other sources of risk within the surrounding land use. These included the following potential hazards:

- **Bulk fuel storage and transport:** The EIS identified that a portion of the Moranbah Airport and a service station would be located within the proposed project area. However, the EIS concluded that the project layout was designed to avoid creating any cumulative risks.
- **Combustion risk:** Locations of stockpiles were designed to be sited approximately 1.5km from the airport stores in order to mitigate combustion risks to airport stores and patrons.
- **Traffic related risks:** The mine access would be located approximately 2km south of the access road to the airport to reduce cumulative traffic hazards.
- **On-site storage of hazardous substances in proximity to the airport:** Locations of the mine surface facilities were designed to be at least 700m from the project site boundary to mitigate

risks to the airport. The storage of hazardous substances would also be minimised through best practice handling and storage practices adopted to further offset the relative proximity of the airport.

- **Cumulative risks associated with fuel movement and storage:** The EIS outlined that the service station would be located at a greater distance than the airport, therefore mitigating any potential cumulative risks associated with fuel movement and storage.

The EIS concluded that no significant cumulative risks were identified as the level of risk at identified receptors would be comparable to the individual risk profiles of the proposed project and surrounding hazards. Furthermore, the EIS outlined that the preliminary hazard analysis demonstrated a low level of risk to private infrastructure and people using public land.

4.17.1.5 Ongoing consultation with government agencies

As part of the development of the safety and health management systems the proponent committed to consult with key stakeholders (local and regional representatives from Queensland's emergency services (QFRS, QPS, QAS and Emergency Management Queensland) about emergency preparedness and response planning. This would include regular review of the emergency preparedness and response, the development of evacuation and access maps and the development of emergency response management plan. A copy of the emergency response management plan would then be provided to the emergency services.

In order to prepare the emergency services should they be required to respond to an incident at the proposed project site, the proponent has committed to provide information as it becomes relevant or available. These actions would be designed to ensure a timely, effective and appropriate level of emergency preparedness and response, including emergency on-site care, on the part of the proponent and the public emergency services; and would include:

- Information on equipment and materials used on-site to ensure compatibility with that of the emergency services.
- Evacuation and access maps of the mine site and accommodation village (once developed).
- Training sessions, site inductions and tours (as required).
- Notification of planned exercises, either practical or tabletop, and discussion with the emergency services on any requirement for their participation in these exercises.
- Information on the status of the project.
- Information on accident organisational responsibilities and authorities (and agreed procedures for handover of responsibilities).

The EIS further stated that consultation with the Queensland Police Service would also be undertaken during the development of the site traffic management plan.

4.17.2 Major issues raised in submissions

The Department of Community Safety (DCS) commented in its submission that in regards to the SPP 1/03 Flood, the EIS did not provide mitigation measures to address flood hazards and recommended that the EIS would be amended to include an action for monitoring flood warnings. As a consequence to this comment, the proponent amended the EIS to include the measure "monitoring of flood warnings" as part of the emergency response management plan to further address emergency preparedness and response.

QAS submitted several comments on hazards and risks, mainly in regards to being involved during the preparation of health and safety systems and hazard management, including consultation with the Medical Director of QAS in relation to treatment plans for injured workers due to chemical processes used on-site. The proponent responded to each of the comments and also outlined that DCS would be a key stakeholder in the ongoing consultation with regards to the emergency response management plan, which will be issued to emergency services.

Both Ergon and Powerlink commented that the following legislation and code should be implemented when working in the vicinity of electricity infrastructure/live parts, such as the *Electrical Safety Act 2002*, *Electrical Safety Regulation 2002* (including any safety exclusion zones defined in the

regulation), and the Code of Practice – Working near exposed live parts. The proponent responded that the relevant chapters of the EIS were amended to include reference to the legislation and regulatory measures concerning hazards management as recommended in these submissions.

QFRS requested compliance where necessary with the *Fire and Rescue Service Act 1990*. The proponent replied that it is committed to meeting its statutory obligations, and amended the EIS to include the *Fire and Rescue Service Act 1990* as a relevant legislative and regulatory measure for the project.

QH outlined the proponent's requirements to supply potable water supply on-site in accordance with the requirements of the Australian Drinking Water Guideline 2004. Furthermore, QH requested that a water quality sampling and monitoring program should be implemented for potable water supplies and that any non-drinking water stores and supplies would be managed to preclude the potential for direct and indirect contact with humans in order to minimise the potential for water borne disease transmission. QH further stated in its submission that all accommodation village/camp kitchens must be designed, approved and constructed in accordance with the requirements of the *Food Act 2006* and that these camp kitchens must be approved and licensed by the IRC prior to use. The proponent responded that the EIS discussed that the potable water system for the project would be managed, controlled and monitored on a regular basis in accordance with the safety and health management system which would ensure compliance with drinking water standards. As a result the EIS was amended to include a reference to the Australian Drinking Water Guideline 2004. The proponent further stated that potable supplies would be treated, managed, controlled and monitored on a regular basis to ensure compliance to drinking water standards. Potable waters would be contained in a system separate to the mine-affected waters and other waste waters, and therefore the likelihood of water borne disease transmission would be extremely low. In regards to the legislative requirements under the *Food Act 2006* the proponent outlined that the EIS was amended and to include that the design and construction of kitchen/mess facilities would be in accordance with appropriate Australian, standards, guidelines and legislation regarding food preparation facilities.

EHP detailed impact assessment for surface water, including an assessment of how water quality would be impacted by impacts such as leaks and spills, construction activities, and mine affected water release. The proponent responded that the EIS included a comprehensive assessment of all potential project impacts to surface water; including that the majority of surface infrastructure and clearing would not be located near watercourses or aquatic habitat and therefore poses a very low risk of potential harm to surface water values. The majority of surface infrastructure, that would give rise to potential surface water impacts, would be located within isolated catchments that report directly to mine water dams preventing the potential for surface water impacts and uncontrolled releases. Furthermore, hazardous materials would be managed under a comprehensive safety and health management system and in accordance with relevant regulatory requirements for the storage and handling of these materials.

4.17.3 Conclusions and recommendations

The EIS adequately addressed the hazard and risk requirements of the TOR and adequately described the potential hazards and risk to people and property that may be associated with the project. No outstanding issues remain.

4.18 Ecology

Ecology was discussed in the EIS Chapter 9, Appendix E (Terrestrial Flora and Fauna Report), Appendix G (Aquatic Ecology Report) and Appendix H (Stygofauna Report). Groundwater dependant ecosystems were also discussed in the Chapter 11 and Appendix I (Groundwater Report).

In response to submissions on the EIS, the proponent provided a 'Report on Potential Disturbance of Vegetation due to Surface Subsidence Effects' (Response to Submissions; Appendix K); a 'Peer Review Report on Subsurface Subsidence Cracking' (Response to Submissions; Appendix L) and an updated 'Conceptual Biodiversity Offset Strategy' (EIS Addendum; Appendix F).

MNES (controlling provisions under the EPBC Act relating to threatened species and ecological communities) were addressed in EIS Chapter 10 and Appendix Q (MNES Report). However, section 4.19 of this report provides a stand-alone assessment for potential impacts on MNES as required under the bilateral agreement between the Australian Government and the State of Queensland (refer to section 3.1.2 of this report for more information). The ecology section of this assessment report

discusses threatened species listed under the *Nature Conservation Act 1992* (NC Act) and threatened vegetation communities (regional ecosystems; REs) listed under the *Vegetation Management Act 1999* (VM Act).

4.18.1 Methodology

The EIS described that desktop terrestrial and aquatic flora and fauna studies were undertaken prior to field surveys to obtain information on the historical and potential presence and distribution of species and ecological communities, particularly communities and species listed as threatened under the VM Act, NC Act and EPBC Act. The desktop studies included database searches, reviews of previous flora and fauna studies undertaken on properties adjacent to the project site, interpretation of recent high resolution aerial photography, and review of published vegetation mapping. The desktop studies refined the field methodology to target the relevant vegetation communities and terrestrial flora and fauna species, including listed species and communities.

Flora surveys were conducted in the dry season between 26 October and 7 November 2011 and in the late wet season between 8 and 25 May 2012 and on 11 June 2012. Fauna surveys were conducted in the pre-wet season from 24 October to 9 November 2011 and post-wet season between 12 and 27 April 2012. After the field survey was complete, the likelihood of presence of listed threatened species and vegetation communities under the EPBC Act or the NC Act were assessed using:

- each listed threatened species/vegetation community detected during field surveys
- the availability and condition of potential habitat within the project site
- species habitat requirements and ecology such as habitat type, roosting and/or foraging needs, home range and other biological requirements.

Four categories were used to describe the likelihood of a species being present: present, high, moderate and low. Any potential impacts on groundwater dependent ecosystems and on stygofauna were also discussed, as well as the presence and extent of any pest plant and animal species listed under the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act).

Significant impacts to threatened species and threatened ecological communities (TECs) listed under the EPBC Act were assessed in accordance with the requirements of the Department of the Environment's Matters of National Environmental Significance: Significant Impact Guidelines 1.1 (hereafter MNES Significant Impact Guidelines). These are discussed in more detail in section 4.19 (MNES).

4.18.2 Identified ecological values

The EIS stated that the proposed project site and surrounding area was largely cleared of native woody vegetation with a significant proportion of the vegetation that remained associated with the watercourses that traverse the area. The EIS identified that these watercourses would be important for maintaining landscape connectivity in the fragmented landscape. The Isaac River is mapped as a state significant corridor under the Queensland Government Biodiversity Planning Assessment Mapping in recognition of the river's importance as a corridor. The vegetation associated with the smaller watercourses, such as Grosvenor and Cherwell creeks, were also identified in the EIS as wildlife corridors.

The project site would be surrounded by existing mines including the Caval Ridge mine (under construction), Peak Downs mine (operating), the Eagle Downs mine (under construction) and the Grosvenor mine (under construction) to the north (Figure 3). The proposed Isaac Plains South Project would overlap the eastern part of the project site (refer to section 2.6 of this report). The EIS stated that the vegetation in the overlap area was excluded from the impact assessment for the proposed Moranbah South Project.

The EIS identified the ecological values occurring within the survey area. These values are summarised in the following sections.

4.18.2.1 Vegetation communities

Terrestrial flora and fauna surveys identified 5542ha of remnant or high value regrowth (HVR) vegetation and 11,955ha of cleared land. Vegetation communities identified by the EIS were as follows:

- Three REs representing seasonal wetlands:
 - RE 11.3.27i – freshwater wetland
 - RE 11.5.3b and HVR 11.5.3.b – palustrine wetland (e.g. vegetated swamp); poplar box on closed depressions
 - RE 11.5.17 – *Eucalyptus tereticornis* woodland in depressions on Cainozoic sand plains/remnant surfaces.
- Remnant and HVR endangered REs (approximately 536ha) including:
 - RE 11.3.1 – *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains
 - RE 11.3.21 – *Dichanthium sericeum* and/or *Astrebla spp.* grassland on alluvial plains, cracking clay soils
 - RE 11.4.8 – *Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains
 - RE 11.4.9 – *Acacia harpophylla* shrubby open forest with *Terminalia oblongata* on Cainozoic clay plains
 - RE 11.5.17 – *Eucalyptus tereticornis* woodland in depressions on Cainozoic sand plains/remnant surfaces
 - RE 11.8.13 – Semi-evergreen vine thicket and microphyll vine forest on Cainozoic igneous rocks.
- Remnant and HVR of 'of concern' REs (approximately 1860ha) including:
 - RE 11.3.2 – *Eucalyptus populnea* woodland on alluvial plains
 - RE 11.3.3 – *Eucalyptus coolabah* woodland on alluvial plains
 - RE 11.3.4 – *Eucalyptus tereticornis* and/or *Eucalyptus spp.* tall woodland on alluvial plains
 - RE 11.8.11 – *Dichanthium sericeum* grassland on Cainozoic igneous rocks.
- Eight least concern REs comprising 3146ha.
- Riparian vegetation including moderate quality riparian woodland fringing the Isaac River.

Field surveys identified differences between the ground-truthed vegetation communities (REs; Table 12) and the published and certified REs maps based on the Queensland Herbarium Regional Ecosystem Description Database (REDD). At the time of finalising the EIS assessment report, the ground-truthed data has not been officially certified or accepted by the Queensland Herbarium. The proponent has made a commitment to have its ground-truthed data submitted and considered for certification by the Queensland Herbarium post-EIS assessment stage.

Table 12 Regional ecosystems ground-truthed in the project area
 (Source: EIS; Appendix E Terrestrial Flora and Fauna Report, Tables 13 and 23)

Regional ecosystem	Description	VM Act class ¹	Biodiversity status ²	Corresponding TEC ³	Total area on project site (ha)	Area to be cleared (ha)
11.3.1	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains	Endangered	Endangered	Brigalow	4.5	0
11.3.2	<i>Eucalyptus populnea</i> woodland on alluvial plains	Of concern	Of concern		485.2	4.9
11.3.3	<i>Eucalyptus coolabah</i> woodland on alluvial	Of concern	Of concern		134.2	4.5
11.3.4	<i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. tall woodland on alluvial plains	Of concern	Of concern	-	98.6	4.2
11.3.7	<i>Corymbia</i> spp. woodland on alluvial plains	Least concern	Of concern		51.3	2.4
11.3.21	<i>Dichanthium sericeum</i> and/or <i>Astrelba</i> spp. grassland on alluvial plains. Cracking clay soils	Endangered	Endangered	Natural grasslands	48.7	24.9
11.3.25	<i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines	Least concern	Of concern		541.7	6.5
11.3.25e	<i>Eucalyptus raveretiana</i> (sometimes emergent), <i>Melaleuca fluviatilis</i> woodland fringing drainage lines				9.8	0
11.3.27	Freshwater wetlands	Least concern	Of concern		1.4	0
11.4.4	<i>Dichanthium</i> spp., <i>Astrelba</i> spp. grassland on Cainozoic clay plains	Least concern	No concern at present	Natural grasslands	5.2	0
11.4.8	<i>Eucalyptus cambageana</i> woodland to open-forest with <i>Acacia harpophylla</i> or <i>A. argyrodendron</i> on Cainozoic clay plains	Endangered	Endangered	Brigalow	21.4	0
11.4.9	<i>Acacia harpophylla</i> shrubby woodland with <i>Terminalia oblongata</i> on Cainozoic clay plains	Endangered	Endangered	Brigalow	122.2	6.3
11.5.3	<i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i> +/- <i>Corymbia clarksoniana</i> on Cainozoic sand plains/remnant surfaces	Least concern	No concern at present		2232.1	53.7
11.5.3b	Palustrine wetland (e.g. vegetated swamp). <i>Eucalyptus populnea</i> on closed depressions				20.5	0

Regional ecosystem	Description	VM Act class ¹	Biodiversity status ²	Corresponding TEC ³	Total area on project site (ha)	Area to be cleared (ha)
11.5.9	<i>Eucalyptus crebra</i> and other <i>Eucalyptus spp.</i> and <i>Corymbia spp.</i> woodland on Cainozoic sand plains/remnant surfaces	Least concern	No concern at present		5.7	0
11.5.17	<i>Eucalyptus tereticornis</i> woodland in depressions on Cainozoic sand plains/remnant surfaces	Endangered	Endangered		15.2	0
11.8.5	<i>Eucalyptus orgadophila</i> open woodland on Cainozoic igneous rocks	Least concern	No concern at present		191.8	0
11.8.5a	Mountain Coolabah woodland with a dense understorey of low trees				2.2	1
11.8.11	<i>Dichanthium sericeum</i> grassland on Cainozoic igneous rocks	Of concern	Of concern	Natural grasslands	1176.5	317.8
11.8.13	Semi-evergreen vine thicket and microphyll vine forest on Cainozoic igneous rocks; lowlands	Endangered	Endangered	Semi-evergreen vine thickets*	1.4	0
11.9.3	<i>Dichanthium spp.</i> , <i>Astrebla spp.</i> grassland on finegrained sedimentary rocks	Least concern	No concern at present	Natural grasslands	9.5	0
⁴ HVR 11.3.1				Brigalow	5.9	0
⁴ HVR 11.3.4					7.9	1.9
⁴ HVR 11.3.25					12.8	0
⁴ HVR 11.4.9				Brigalow	273.8	4.8
⁴ HVR 11.5.3					38.1	0
⁴ HVR 11.5.3b					4.3	0
⁴ HVR 11.8.5					20.1	0
⁴ HVR 11.8.13				Semi-evergreen vine thickets*	45.7	3.3

¹VM Act class - Conservation status under the VM Act

²Biodiversity status - Conservation status under the EP Act

³TEC – Threatened ecological community under the EPBC Act

⁴HVR – High value regrowth

*The EIS stated that the semi-evergreen vine thickets (SEVT) were degraded and had very few SEVT species present. The EIS concluded that this community did not meet the EPBC threshold criteria.

4.18.2.2 Terrestrial flora species

A total of 402 flora species were identified during field surveys: 340 native and 62 exotic plant species, including eight declared weed species (of these, 5 species are declared weeds of national significance; WONS).

Two species, listed as vulnerable or near threatened under the NC Act, were found to occur in the survey area:

- *Dichanthium queenslandicum* (king bluegrass) – vulnerable
- *Dichanthium setosum* – vulnerable (least concern as of 9 May 2014).

The EIS also identified the likelihood of listed threatened species (under the NC Act) to occur within the survey area based on habitat assessment and availability including:

- Species considered to have a medium potential of occurring:
 - *Desmodium macrocarpum* – near threatened (least concern as of 9 May 2014).
- Species considered to have a low potential of occurring:
 - *Bertya pedicellata* – near threatened
 - *Rhodamnia pauciovulata* – near threatened.

4.18.2.3 Terrestrial fauna species

A total of 206 terrestrial vertebrate fauna species were recorded during fauna surveys within the survey area, comprising 120 bird, 13 amphibian, 29 reptile, 44 mammal and eight introduced fauna species. The greatest fauna diversity was found at a trapping site on the Isaac River.

The following four species listed as threatened under the NC Act, were found to occur in the survey area:

- squatter pigeon (*Geophaps scripta scripta*) – vulnerable
- Australian painted snipe (*Rostratula australis*) – vulnerable
- ornamental snake (*Denisonia maculata*) – vulnerable
- little pied bat (*Chalinolobus picatus*) – near threatened.

Two species listed as special least concern under the NC Act were found during field surveys:

- koala (*Phascolarctos cinereus*)
- echidna (*Tachyglossus aculeatus*).

The EIS also identified the likelihood of listed threatened species (under the NC Act) to occur within the survey area based on habitat assessment and availability:

- Species considered to have a high potential of occurring:
 - brigalow scaly foot (*Paradelma orientalis*) – vulnerable
 - rough-collared frog (*Cyclorana verrucosa*) – near threatened
 - cotton pygmy goose (*Nettapus coromandelianus*) – near threatened
 - black-necked stork (*Ephippiorhynchus asiaticus*) – near threatened.
- Species considered to have a moderate potential of occurring:
 - red goshawk (*Erythrotriorchis radiatus*) – endangered.
- Species considered to have a low potential of occurring within the project site due to a lack of suitable habitat:
 - star finch (*Neochmia ruficauda ruficauda*) – endangered
 - south-eastern long-eared bat (*Nyctophilus corbeni*) – vulnerable (least concern as of 9 May 2014).

- yakka skink (*Egernia rugosa*) – vulnerable
- Dunmall's snake (*Furina dunmalli*) – vulnerable
- retro slider (*Lerista allanae*) – endangered
- Fitzroy River turtle (*Rheodytes leukops*) – vulnerable.

4.18.2.4 Aquatic species

The aquatic ecology assessment identified the following aquatic values as occurring within the survey area:

- 14 fish species, three of which had not been recorded in the Lower Isaac River Sub-basin before but were known to occur within the greater Fitzroy catchment
- one species of freshwater turtle, the Kreft's turtle (*Emydura macquarii krefftii*)
- 11 species of macrophytes (aquatic flora) occurring only in farm dams
- stygofauna including a number of oligochaetes (segmented worms which could be surface water species or stygofauna) in alluvium, and obligate stygofauna from the sub-order *Harpacticoida* in a shallow bore within basalt.
- one introduced fish species, *Gambusia holbrooki*.

In summary, the aquatic ecology assessment of the EIS stated that:

- No listed (NC Act or EPBC Act) threatened aquatic flora and fauna species were identified as occurring within the survey area and none were expected to occur based on the assessment of available habitat.
- No wetlands of state, national or international significance occurred within the project site although a high ecological significance wetland was located approximately 6.5km downstream of the project site.
- Although the alluvium did not contain continuous groundwater, the riparian vegetation using water in the alluvium on an occasional basis would be classified as a ground-dependent ecosystems according to the 'GDE Toolbox'. The EIS; however, noted that the riparian vegetation would make use of other water supplies as the alluvium does not provide a reliable water supply. Furthermore, it was stated that the riparian vegetation is typical of the riparian vegetation in the region and there are no unique assemblages of species or communities associated with groundwater within the project site.

4.18.3 Potential ecological impacts

The EIS identified that the proposed project would result in disturbance (including the removal) of habitat and other ecological impacts on the project site. These impacts would be caused by the construction of surface infrastructure; the repair of surface tension cracks resulting from subsidence following longwall underground mining; changes to drainage caused by subsidence and subsequent remediation; vegetation disturbance from the seismic exploration program; activities that may spread weeds; and indirect impacts due to the effects of noise, vibration and lighting from operating equipment and infrastructure.

4.18.3.1 Vegetation communities

Based on the mapping of vegetation communities undertaken by the proponent, the EIS stated that 456ha of remnant vegetation would be removed for surface infrastructure comprising endangered REs (31ha), of concern REs (331ha) and least concern REs (94ha). A total of 10ha of HVR vegetation would also be removed comprising endangered HVR (8ha) and of concern HVR (2ha). Nine per cent of the total area of remnant vegetation and 2.5% of the total area of HVR vegetation within the project site would be within the surface infrastructure disturbance footprint.

Regional ecosystems listed as of concern or endangered that would be cleared as part of the construction of the surface facilities include: 11ha of brigalow communities (RE 11.4.9); 343ha of natural grassland communities (RE 11.3.21), and 3ha of semi-evergreen vine thicket (RE 11.8.13). Where condition criteria are fulfilled these communities are also considered representative of the following three threatened ecological communities (TECs) listed under the EPBC Act:

- natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin (natural grasslands TEC)
- brigalow (*Acacia harpophylla*) dominant and co-dominant ecological community (brigalow TEC)
- semi-evergreen vine thickets (SEVT) of the Brigalow Belt (North and South) and Nandewar Bioregions (SEVT TEC).

Although some areas of the SEVT TEC (RE 11.8.13) were mapped on the project site (3ha), ground-truthing identified that the community was degraded with very few SEVT species present. The EIS concluded that these communities did not meet the EPBC Act threshold criteria for the SEVT TEC.

The EIS considered the potential impacts of the project on threatened ecological communities against the MNES Significant Impact Guidelines and concluded that the potential project impacts on the brigalow TEC (11ha) was not significant based on the small area of clearing, fragmented occurrence, and poor condition of these communities. However, the EIS acknowledged significant impact on the natural grassland community. These impacts are discussed in more detail in section 4.19.4.2 of this assessment report.

Clearing of small areas (less than 5ha) of the 'of concern' REs: 11.3.2 (poplar box woodland on alluvial plains), 11.3.3 (coolabah woodland on alluvial plains), and 11.3.4 (Queensland blue gum and/or *Eucalyptus* spp. tall woodland on alluvial plains); were not considered to represent a significant impact on these woodland communities. The EIS stated that remedial drainage works following subsidence would ensure that the natural hydrology in areas supporting wetland REs (REs 11.3.27i and 11.5.3b) would be maintained.

4.18.3.2 Terrestrial flora and fauna

The EIS concluded that the king bluegrass (vulnerable under the NC Act and EPBC Act) would be the only listed threatened plant species that would be significantly impacted by the project (105ha of high value habitat disturbed). Although 48ha of known high value habitat for the listed threatened grass species *D. setosum* and potential habitat for *D. macrocarpum*, would be disturbed, the EIS concluded that these species would be unlikely to be significantly impacted.

The EIS identified the following impacts to fauna species due to the construction of surface infrastructure for the mine included the clearing of:

- 7ha of high value habitat for the red goshawk (endangered under the NC Act and vulnerable under the EPBC Act). The EIS concluded that the project would be unlikely to result in a significant impact to this species due to the species not being recorded on-site, the project site primarily supporting low value habitat and impacts to high value potential habitat are relatively small in comparison to the remaining habitat within the region.
- 124ha of the total 4302ha of remnant and regrowth habitat within the project area for the little pied bat (near threatened under the NC Act) would be cleared and additional areas would be temporarily impacted by seismic surveys.
- 483ha of high value squatter pigeon habitat (vulnerable under NC Act and EPBC Act). Although the species was recorded on site, the EIS concluded that there would not be a significant impact to this species as: the population size was not considered to constitute an important population; the EIS considered the species to be common to the region; the species is avian and inherently mobile; the project site did not contain any habitat critical to the survival of the squatter pigeon; and the species is known to occur within disturbed areas.
- 111ha of high value koala habitat (species least concern under the NC Act, vulnerable under EPBC Act). Although the species was recorded on site, the EIS concluded that there would not be a significant impact to this species as: the project site is not anticipated to contain an important population of the species; the amount of cleared habitat on site is a small proportion 3% of the overall habitat available to the koala on site; the koala is known to readily cross cleared areas and the removal of 3% of habitat on site is unlikely to fragment an important population of koala.
- 2ha of high value ornamental snake habitat (vulnerable under NC Act and EPBC Act). Although the species was recorded on site, the EIS concluded that there would not be a significant impact as to this species as: the project site not representing especially significant or critical habitat for the species; only a relatively small area of habitat likely to be affected by the project; and, disturbance would not lead to long-term disruption, fragmentation or reduction of any populations

of the species or the occurrence of the species in the project site.

Overall, the EIS concluded that there would be no significant impacts to listed threatened fauna species or their habitat as a result of the proposed project. The Department of the Environment and EHP have not yet completed the assessment of the project in terms of the nature and extent of additional unacceptable residual impacts to MNES and significant residual impacts to MSES, that would require offsets as a result of the proposed project .

4.18.3.3 Potential impacts due to subsidence

In regards to impacts due to subsidence, the EIS stated that the proposed rehabilitation program for surface cracking resulting from subsidence following longwall mining would limit habitat disturbance to strips up to 3m wide. Ponding of water resulting from subsidence would be managed by limited earthworks to restore free drainage or to maintain natural hydrology in existing wetlands (refer to section 4.10 of this assessment report). Disturbance to habitat resulting from crack rehabilitation and remedial drainage works would occur progressively over the life of the mine, with the area of habitat disturbed relatively small at any one time.

Seismic equipment proposed to be used would not require seismic lines to be completely cleared before undertaking seismic activities. Seismic survey work would involve 4m wide slashing of woody vegetation every 45–165m (avoiding large trees where possible) resulting in disturbance of approximately 10–15% of any surveyed area. The disturbance would leave the soil, seed bank and grasses intact and would only occur for a few weeks a year in a part of the project site ahead of the mining front.

4.18.4 Proposed mitigation measures

Several avoidance and mitigation strategies were proposed in the EIS to mitigate potential impacts on vegetation communities:

- development and implementation of a species management program in accordance with the requirements of the NC Act detailing all mitigation and management measures
- avoidance of endangered REs and threatened fauna habitat where possible
- limiting clearing to the minimum necessary as required
- pre-clearing surveys to identify areas to be cleared, habitat trees, native fauna management requirements
- installation of nest boxes for native fauna
- construction in and adjacent to watercourses only during the dry season with measures to limit clearing and erosion
- avoidance of threatened species habitat and high value fauna habitat especially during breeding periods
- possible seed collection in natural grassland areas
- development and implementation of a number of management plans, including but not limited to:
 - rehabilitation management plan
 - pest animal and weed management plan
 - subsidence management plan
 - erosion and sediment control plan
 - offsets strategy and plans for managing offsets areas
- avoidance of slashing of natural grasslands TEC, including king bluegrass and *D. setosum* during peak flowering season between 1 January and 31 March
- clearing of brigalow communities, where not avoidable, hand clearing would be undertaken. Following hand clearing, mechanical means would only be used if required to make the area safe for personnel and equipment.

4.18.5 Biodiversity offsets

A conceptual biodiversity offset strategy was provided in the amended EIS (Appendix F), replacing the previous strategy for offsets presented in the EIS. The conceptual biodiversity offset strategy stated that offsets would be provided in accordance with the requirements of the Commonwealth EPBC Act Environmental Offsets Policy (EPBC Act Offset Policy) and the Queensland Biodiversity Offsets Policy and outlined the options being considered for delivery of required offsets.

Since the amended EIS was submitted with EHP, a new framework for environmental offsets in Queensland commenced with the introduction of the *Environmental Offsets Act 2014* (Offsets Act). The Offsets Act commenced on 1 July 2014. It is supported by the Environmental Offsets Regulation 2014, the Queensland Environmental Offsets Policy and the Financial Settlement Offset Calculation Methodology.

Under the Offsets Act an offset condition cannot be required by the state if the Commonwealth has imposed a condition for the same, or substantially the same, impact on the same matter or if the Commonwealth has decided an offset is not required. Hence, state offsets will not be assessed until the Commonwealth offsets have been finalised. Offsets required under Queensland legislation would be regulated through conditions of an EA (refer to recommended draft EA conditions, Schedule H of this report). Offset requirements under the EPBC Act are discussed in section 4.19.5 of this report.

4.18.6 Major issues raised in submissions

Regional ecosystem mapping

EHP accepted the mapping of the natural grassland REs included in the EIS (Appendix E) but requested that the proponent seek Queensland Herbarium review and acceptance of the revised mapping of brigalow REs. Based on the information provided in the EIS, EHP considers that there would be a greater proportion of remnant brigalow community within the project site than was shown in the revised RE mapping presented in the EIS, and therefore a greater extent of the brigalow TEC. The proponent considered that this verification should occur through VM Act property map of assessable vegetation process requiring landholder consent which would be costly and time consuming, and asserted that the surveys conducted for the EIS ensured that the revised RE mapping presented in the EIS was of high accuracy and would form the basis for calculation of offset requirements. The proponent subsequently agreed to refer the mapping of brigalow REs and relevant field data to the Queensland Herbarium for confirmation. Until the required information has been submitted and verified by the Queensland Herbarium, the mapping of the brigalow TEC presented in the EIS cannot be accepted by EHP. Any changes to the mapped extent of brigalow that could result from review of survey data by the Queensland Herbarium would not significantly change the assessed level of potential impact as it is unlikely that edge effects resulting from clearing would increase the existing threats to the remnants.

Table 13 presents an overview of the potential impacts on vegetation based on the existing REDD data certified by the Queensland Herbarium. Those RE that would be affected by the project and the extent of impact were identified by EHP by calculating the area based on the REDD with digital data provided by the proponent outlining the proposed disturbance area. However the proponent has made a commitment to have its ground-truthed data certified by the Queensland Herbarium. It is likely that the certification process will result in changes to REDD resulting in changes in the areas shown in Table 13. This will have implications for the offsets required.

**Table 13 Regional ecosystems using Queensland Herbarium mapping in the project area
(Source: EHP*)**

Regional ecosystem	Description	VM Act class ¹	Biodiversity status ²	Corresponding TEC ³	Total area on project site (ha)	Area to be cleared (ha)
11.3.1	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains	Endangered	Endangered	Brigalow	10.6	0
11.3.2	<i>Eucalyptus populnea</i> woodland on alluvial plains	Of concern	Of concern		590.3	0
11.3.3	<i>Eucalyptus coolabah</i> woodland on alluvial	Of concern	Of concern		139	0
11.3.4	<i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. tall woodland on alluvial plains	Of concern	Of concern		27.9	0
11.3.7	<i>Corymbia</i> spp. woodland on alluvial plains	Least concern	Of concern		248.3	0
11.3.21	<i>Dichanthium sericeum</i> and/or <i>Astrebla</i> spp. grassland on alluvial plains. Cracking clay soils	Endangered	Endangered	Natural grasslands	82.8	31.1
11.3.25	<i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines	Least concern	Of concern		647.6	0
11.3.27	Freshwater wetlands	Least concern	Of concern		5.9	0
11.4.4	<i>Dichanthium</i> spp., <i>Astrebla</i> spp. grassland on Cainozoic clay plains	Least concern	No concern at present		34.3	0
11.4.8	<i>Eucalyptus cambageana</i> woodland to open-forest with <i>Acacia harpophylla</i> or <i>A. argyrodendron</i> on Cainozoic clay plains	Endangered	Endangered	Brigalow	15.9	0
11.4.9	<i>Acacia harpophylla</i> shrubby woodland with <i>Terminalia oblongata</i> on Cainozoic clay plains	Endangered	Endangered	Brigalow	402.4	0
11.5.3	<i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i> +/- <i>Corymbia clarksoniana</i> on Cainozoic sand plains/remnant surfaces	Least concern	No concern at present		3542.1	13.3
11.5.9	<i>Eucalyptus crebra</i> and other <i>Eucalyptus</i> spp. and <i>Corymbia</i> spp. woodland on Cainozoic sand plains/remnant surfaces	Least concern	No concern at present		129.7	0
11.5.17	<i>Eucalyptus tereticornis</i> woodland in depressions on Cainozoic sand plains/remnant	Endangered	Endangered		0	0

Regional ecosystem	Description	VM Act class ¹	Biodiversity status ²	Corresponding TEC ³	Total area on project site (ha)	Area to be cleared (ha)
	surfaces					
11.7.2	<i>Acacia ssp. woodland n Cainozoic lateritic duricrust.</i>	Least concern	No concern at present		0.7	0
11.8.5	<i>Eucalyptus orgadophila</i> open woodland on Cainozoic igneous rocks	Least concern	No concern at present		1584.1	139.7
11.8.11	<i>Dichanthium sericeum</i> grassland on Cainozoic igneous rocks	Of concern	Of concern	Natural grasslands	1131.2	42.2
11.8.13	Semi-evergreen vine thicket and microphyll vine forest on Cainozoic igneous rocks; lowlands	Endangered	Endangered	Semi-evergreen vine thickets	156.5	4
11.9.2	<i>Eucalyptus melanophloia +/- orgadophila</i> woodland on fine-grained sedimentary rocks	Least concern	No concern at present		90.9	5.1
11.9.3	<i>Dichanthium spp., Astrebla spp.</i> grassland on finegrained sedimentary rocks	Least concern	No concern at present	Natural grasslands	0	0
11.9.5	<i>Acacia harpophylla and/or Casuarina cristata</i> open-forest on fine-grained sedimentary rocks	Endangered	Endangered	Brigalow	57.7	7.2
⁴ HVR 11.3.1				Brigalow		0
⁴ HVR 11.3.4						0
⁴ HVR 11.3.25						0
⁴ HVR 11.4.9				Brigalow		0
⁴ HVR 11.5.3						0
⁴ HVR 11.8.5						0
⁴ HVR 11.8.13				Semi-evergreen vine thickets		0

¹Data derived from calculating the area of REs on the certified REDD data with digital data on the footprint of the project provided by the proponent

¹VM Act class - Conservation status under the VM Act

²Biodiversity status - Conservation status under the EP Act

³TEC – Threatened ecological community under the EPBC Act

⁴HVR – High value regrowth – not quantified by EHP.

Subsidence impacts on ecological values

EHP and the Department of the Environment requested that the proponent estimate the habitat impact area due to ponding, cracking and longwall maintenance infrastructure, such as service tracks to air vents. The proponent provided a commitment to locate longwall maintenance infrastructure to avoid impacts (where practicable) and to rehabilitate the subsidence cracking and ponding to avoid significant, residual impacts on flora and fauna. Proposed mitigation measures included:

- monitoring subsided areas for subsidence cracks and repairing cracks as they appear
- surveying subsided areas to identify any areas of potential ponding and the need for remedial drainage works
- repair of subsidence cracks and installation of remedial drainage works
- causing only minor disturbance to vegetation
- monitoring to confirm the re-establishment of any disturbed vegetation and identify additional rehabilitation works that may be required.

In response to concerns in relation to the impacts of surface cracking and crack remediation on biodiversity values, the proponent commissioned surveys at two comparable operating longwall mines (Grasstree Mine and Moranbah North Mine) to accurately record the location and dimensions of surface cracks resulting from subsidence. Information on this study was provided in Appendix K of the Response to Submissions. The data obtained from this study was consistent with theoretical predictions of subsidence cracking for the project used in the EIS to estimate potential impacts on ecological values. The estimated extent of disturbance associated with surface cracking presented in Appendix K included disturbance areas for each RE and for high value habitat for threatened species. These areas were extremely small, with 17ha over 27 years of disturbance due to the rehabilitation of subsidence cracking (less than 1ha/annum on average), and the majority of the vegetation that would be disturbed would have a status of least concern, confirming the assessment of no significant residual impact on threatened species or communities as a result of subsidence cracking or crack rehabilitation. Section 4.6 of this report provides further detail on subsidence predictions.

The EIS included a commitment to install remedial drainage works to re-establish free drainage following subsidence and provided a figure showing the indicative location of remedial drains. The EIS concluded that there would be no significant residual ponding caused by mine subsidence and consequently no impact on vegetation due to ponding of water. The proponent provided a commitment to monitor the areas above longwall panels to confirm that drainage works were effective. However, the EIS did not quantify the area of vegetation that would be cleared for the construction of remedial drains and further detail was requested. Further work was undertaken by the proponent to provide an estimate of potential vegetation clearing that would result from remedial drainage works. This work was presented in Appendix K of the Response to Submissions and included estimates of clearing areas for each RE and for high value habitat for threatened species. An estimated 4ha of vegetation would be cleared over the 27 year life of the longwall mine associated with the installation of remedial drainage works, confirming the assessment of no significant residual impact on threatened species or communities as a result of drainage works.

EHP considers that, provided the stated impacts would be as described by the proponent and the appropriate avoidance and mitigation measures are undertaken, the residual impacts associated with rehabilitation of subsidence related surface impacts would not be required to be offset. The draft EA conditions relating to subsidence (condition J11; Schedule J in Appendix 2 of this report) would require the proponent to report annually on the actual impacts to MSES resulting from surface effects of subsidence and associated rehabilitation, and to commence an investigation and mitigation (and potentially offsets) if the observed impacts are greater than that predicted by the EIS.

Offsets

The proponent did not propose to offset significant residual impacts to the brigalow based on the relatively small area proposed to be cleared or disturbed, the highly fragmented and disturbed condition of remnants, and proposed mitigation measures.

The Department of the Environment requested a revision of the offset requirement estimates to include impacts on MNES resulting from alteration of the surface drainage. The proponent responded with further information based on experience at other mine projects involving subsidence and surface drainage management which indicated that significant impacts were not likely to occur. Consequently,

the updated offsets strategy contained in the amended EIS (Conceptual Biodiversity Offset Strategy) included no additional impact areas for MNES and no additional proposed offset.

However, it should be noted that the Department of the Environment has not yet completed the assessment of the project and is yet to determine whether there are additional unacceptable residual impacts to MNES as a result of the project other than those identified within the EIS. Hence, state offsets will not be assessed until the Commonwealth offsets have been finalised.

DAFF requested further information on fish passage impacts and any offset requirement for those impacts. The proponent responded that fish passage would not be significantly impacted and no offsets for fish passage were proposed. DAFF further requested ongoing consultation on the design of works in watercourses affecting fish passage (including MNES species). The proponent's response was to amend the EIS in relevant sections detailing how DAFF guidelines and ongoing DAFF advice during consultation would be incorporated in the design of levees, crossings, and water flows for fish passage on the site.

Impacts on aquatic ecology

The IESC recommended ongoing monitoring of cumulative impacts to aquatic ecology due to the number and extent of other projects in the region and potential impacts as a result of subsidence, altered flow regimes and potential connectivity with groundwater. The proponent responded that the EIS included commitments to ongoing monitoring prior to, during, and following completion of mining operations. Monitoring of the aquatic ecosystem would be undertaken as part of the receiving environment monitoring plan and would be required under the Queensland Government's model mining conditions. Section 4.19 of this assessment report provides further detail on IESC concerns.

4.18.7 Conclusions and recommendations

The ecology assessment met the requirements of the TOR. The proponent has made commitments to managing, monitoring and rehabilitating disturbed areas to achieve appropriate ecological outcomes.

Following Commonwealth assessment and approval, the proponent would need to propose a suitable offset proposal that would compensate for significant residual impacts to MSES and MNES under the requirements of the Queensland Offset Act and the EPBC offset policy. Furthermore,

Recommendations

- *Draft EA conditions in Schedule F and H of Appendix 2 are required to limit and manage adverse impacts to biodiversity likely to be caused by the project.*
- *In order for the projected impacts from subsidence be managed, a subsidence management plan (including rehabilitation) should be developed and implemented. The plan would also need to include monitoring of subsidence impacts (such as cracking and ponding) on ecological values, particularly where these impacts affect the Isaac River and Grosvenor Creek, any ground-dependent ecosystems, MSES and MNES.*
- *During the operation of the project, should monitoring identify unforeseen impacts on any MSES or MNES, the proponent must minimise, mitigate and, if unsuccessful, offset these in accordance with state and Commonwealth legislation (refer to section 4.19 and recommended draft EA conditions in Schedule H of Appendix 2).*
- *The proponent should provide the necessary information to EHP and/or the Queensland Herbarium to justify variation from the certified RE mapping to the RE mapping presented in the EIS. This information should be in the form of a RE mapping amendment report including site data, spatial information, photos and justifications for each change (as requested by the Queensland Herbarium).*
- *The proponent should update its Biodiversity Offset Strategy to be consistent with the requirements of legislation and policy relevant to the EA for the project and any relevant conditions of approval under the EPBC Act prior to commencement of works on-site.*
- *The proponent should liaise with EHP's wildlife management branch to determine whether clearing permits and/or species management plans under the NC Act are required under the Nature Conservation (Wildlife Management) Regulation 2006.*

4.19 Matters of National Environmental Significance

Matters of National Environmental Significance (MNES) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were addressed in EIS Chapter 10 and Appendix Q (MNES Report).

As part of the EIS submissions, the proponent provided a 'Report on Potential Disturbance of Vegetation due to Surface Subsidence Effects' (Response to Submissions; Appendix K); a 'Peer Review Report on Subsurface Subsidence Cracking' (Response to Submissions; Appendix L) and an updated 'Conceptual Biodiversity Offset Strategy' (EIS Addendum; Appendix F).

This section of the assessment report addresses the requirements of the Queensland Government's assessment as specified by Schedule 1 of the bilateral agreement between the Australian Government and the Queensland Government relating to environmental assessment, section 59 of the *Environmental Protection Act 1994* (EP Act), and section 9 of the Environmental Protection Regulation 2008 (refer to section 3.1.2 of this report for more information).

4.19.1 Controlling provisions

On 10 April 2012, Anglo American Metallurgical Coal Pty Ltd referred the Moranbah South Project to the Commonwealth Environment Minister for a determination as to whether the project would constitute a 'controlled action' with respect to potential impacts on MNES.

On 24 May 2012, the delegate of the Commonwealth Environment Minister decided under sections 75 and 77A of the EPBC Act that the project is a 'controlled action' for the relevant controlling provisions of listed threatened species and threatened ecological communities (sections 18 and 18A) and that the project required assessment and approval under the EPBC Act before it could proceed. On 21 March 2013, a variation to amend the proposal to exclude the 'proposed 2013 seismic area' was accepted under section 156B of the EPBC Act.

On 24 October 2013, the Commonwealth Environment Minister decided, under item 23 of Schedule 1 to the *Environment Protection and Biodiversity Conservation Amendment Act 2013*, that water resources is a controlling provision for the project, and sections 24D and 24E (a water resource, in relation to coal seam gas development and large coal mining development) of the EPBC Act therefore apply.

The Australian Government established an Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC) in late 2012 through amendment to the EPBC Act. The IESC provides advice to the Commonwealth Environment Minister on research priorities to improve the understanding of potential impacts of coal seam gas and large mining developments on water resources. The committee can be requested by federal, state and territory governments to provide advice on water-related aspects of environmental impact assessments.

The Moranbah South Project EIS and supplementary materials were referred to the IESC on 20 December 2013 by the Department of the Environment and EHP. The committee's advice to the departments, dated 11 February 2014, has been considered in the preparation of this assessment report (section 4.19.8.3 below).

4.19.2 Assessment process

The proposed project was assessed under Part 1 of Chapter 3 of the *Environmental Protection Act 1994* (EP Act) in accordance with the bilateral agreement under section 45 of the EPBC Act between the Australian Government and the Queensland Government as amended 13 December 2013 (the bilateral agreement). The controlled action will be considered for approval under section 133 of the EPBC Act once the Commonwealth Environment Minister has received this EIS assessment report from the delegate under the EP Act.

The evaluation of potential impacts on MNES presented in this report was based on information contained in the submitted EIS, the proponent's Response to Submissions, and any subsequent amendments made to the submitted EIS (referred to by the proponent as the 'EIS Addendum').

The Department of the Environment has been consulted in relation to the assessment of potential impacts on MNES and proposed mitigation measures, and on the adequacy of information provided by the proponent, throughout the EIS process and during the preparation of this report, in accordance with the bilateral agreement.

Following is an evaluation of the potential impacts of the project on MNES determined by the Australian Government to be controlling provisions under the EPBC Act and should be read in conjunction with EIS Appendix Q (MNES Report) which addressed the controlled action Referral No. EPBC 2012/6337.

This MNES section of this assessment report contains two distinct sections:

- assessment of listed threatened species and communities (section 18 and 18A of the controlling provisions)
- assessment of impacts on water resources by large coal mining development (sections 24D and 24E of the controlling provisions).

4.19.3 Description of the proposed action

The proposed Moranbah South Project would include the construction and operation of an 18 million tonnes per annum (Mtpa) of run of mine (ROM) underground coal mine on a greenfield site in Central Queensland. The project proponent is a 50:50 unincorporated Joint Venture between Anglo Coal (Grosvenor) Pty Ltd and Exxaro Australia Pty Ltd. Anglo American Metallurgical Coal Pty Ltd is the manager of the project. Anglo American Metallurgical Coal Pty Ltd also has interests in the Moranbah North Mine and the Grosvenor Project near Moranbah.

The proposed project would be located within parts of exploration permit coal (EPC) 602 and EPC 548, and mineral development licence (MDL) 277 (whole) and MDL 377 (part). The project site was described in the EIS as approximately 17,550 hectares (ha) in area. The MDLs and EPCs are held by the proponent or the joint venture partners. The proposed project would produce up to 14 million tonnes per annum (Mtpa) of high quality coking coal for the export market. Coal would be mined using two longwalls and a bord and pillar operation. The proposed project would target the Goonyella Middle seam. The proposed longwall mining area would be located in the central and southern part of the proposed project site, where the coal seam was found to be deeper. Longwall panels would be approximately 410m wide and vary in length from approximately 900m to 6.2km. The proposed extraction height of the Goonyella Middle seam would vary across the proposed project site, with a proposed maximum extraction height of 4.2m. The depth of the target coal seam in this area ranges from approximately 145m to 560m below surface level. The bord and pillar mining area would be in the northern part of the proposed project site. The bord and pillar mine was designed to ensure that there would be no surface subsidence above the underground bord and pillar workings.

4.19.3.1 Project site

The proposed project site (the area within which the proposed project would be located) would be located directly to the south of the township of Moranbah in Central Queensland, approximately 150km south-west of Mackay. The project site would be located in the Isaac Regional Council (IRC) area. Project surface facilities were proposed to be located approximately 3km south-east of Moranbah. There are a number of existing and proposed coal mines adjacent to the proposed project site, including the Caval Ridge Project to the west, the Grosvenor Project to the north, the Isaac Plains South Project to the east (with the Isaac Plains South tenement partially overlapping a portion of the Moranbah South Project site), Eagle Downs Project to the south-east and the Peak Downs mine to the south.

The proposed project would cover an area of approximately 17,550ha of gently undulating land. Much of the project site has been cleared in the past, primarily for beef cattle grazing activities, although the site historically contained areas of open woodlands and natural grasslands. The project site is traversed by the Isaac River and its tributaries Grosvenor Creek and Cherwell Creek. Government mapping and ground-truthing confirmed the presence of Strategic Cropping Land (SCL) within the project site.

Current land use identified within the proposed project site included beef cattle grazing, coal seam gas exploration and basalt quarrying operations. Arrow Energy's coal seam gas tenements cover the northern part of the project site, and Arrow Energy currently has a petroleum licence application for the central part of the project site. Arrow Energy also operates several exploration, development and appraisal coal seam gas wells within the proposed project site. There are two basalt quarry operations on the project site, the Quarrico Quarry Operation located on the north-western part of the project site; and the MCG Quarry Operation located on the southern part of the project site. Other key land uses included the operation of infrastructure (roads, powerlines and water/gas pipelines).

4.19.3.2 Underground mining

The proposed project would undertake two types of underground mining, namely longwall mining and bord and pillar mining.

Longwall mining

The proposed longwall mining would include a complex system of mining equipment that would incorporate hydraulic roof supports (called 'chocks' or 'shields'), coal cutting and coal transport equipment. The proposed conceptual Moranbah South mine longwall layout is shown in Figure 1. The proposed longwall panels would be approximately 410m wide and vary in length from approximately 0.9–6.2km. The proposed extraction height of the Goonyella Middle seam would vary across the project site, with a maximum extraction height of 4.2m proposed. The width of the proposed chain pillars (the coal left between the longwall panels) would be approximately 55m.

Longwall panels would be defined by access roadways that would be constructed around the perimeter of each longwall panel. These roadways would provide access for the installation of the longwall mining equipment, mine workers and equipment and services.

The longwall mining equipment (coal shearer) would travel back and forth across the width of the longwall panel, starting from the furthest point progressively removing the coal from the panel back to the main headings. The shearer would cut the coal from the coalface on each pass and would deliver the coal to a face conveyor that would run along the full length of the longwall. The face conveyor would transport the coal from the coalface to another conveyor in an access roadway. Coal would then be transported to the surface via a series of connecting underground conveyors.

The roof at coalface would be held up by a series of hydraulic roof supports. After each shear of coal is removed, the face conveyor, hydraulic roof supports and the shearer would move forward. The roof immediately above the mined seam would collapse into the void (called a 'goaf') that would be left as the roof supports progressively retreat through the panel. As the roof material collapses into the goaf behind the roof supports, the fracturing and settlement of the rocks would progress through the overlying strata and would result in the sagging and bending of the near surface rocks. This would result in the progressive formation of gentle trough-like depressions on the surface relative to the natural topography (called subsidence). The anticipated subsidence effect would move across the ground at approximately the same speed as the advance of the mining face, which would be typically up to 100m per week. The majority of subsidence at a point on the surface would occur within three months of undermining and all subsidence would generally be complete within 12 months.

Mine access roadways would be developed to provide access to the longwalls for mine workers, ventilation and equipment. These roadways would be developed within the coal seam and would typically be 5m wide and 3–4m high.

Bord and pillar mining

The proposed bord and pillar mining method would involve dividing the target coal seam with underground roadway excavations into a regular block-like array. Main headings (mined roadways) would be intersected at regular intervals by connecting cut-throughs (mined roadways perpendicular to the primary headings). The bords would be the headings and cut-throughs, and the panel pillars would be blocks of coal bounded by the bords. The target coal seam in the bord and pillar mining area would be at a depth of between approximately 40m and 440m.

Mining would be carried out by a continuous miner (cutting machine) that loads coal onto a shuttle car which transports and loads the coal onto an underground conveyor belt system. Once a bord is excavated to the required distance, the continuous miner would move to the next mining area and roof support would be installed in the previous bord. The coal pillars would support the overlying strata as the bords would be mined and would remain in place after the completion of mining. The proposed roadways (bords) would be 6.5m wide while the coal pillars would have a cross-sectional area of approximately 30m by 30 m. The mining height would be between 2m and 3m. The bord and pillar mine layout has been specifically designed with sufficient roadway and pillar strength and stability to ensure that there would be no surface subsidence above the underground bord and pillar workings.

Mine access roadways would be developed to provide access to the bord and pillar mining area for mine workers, ventilation and equipment. The roadways would be constructed using continuous miners.

4.19.3.3 Mine infrastructure

The proposed mine surface facilities would include:

- box cuts providing access to the underground mine portals
- surface conveyors
- coal stockpiles
- coal preparation plant and associated equipment
- a conveyor for transporting dry rejects to the dry rejects emplacement area (DREA)
- an emergency tailings cell
- rail loop and train loading facilities
- mine industrial area including:
 - administration buildings, bathhouse, employee facilities and car parks
 - workshop, warehouses, vehicle wash down, servicing and refuelling facilities
 - security, first aid, mine rescue and fire services facilities
- various sediment, raw water and mine water storage dams
- power and water supply infrastructure
- buildings specifically associated with the bord and pillar operations, including a radio control centre, offices and employee facilities
- underground support facilities such as compressed air, ventilation shaft and mine air conditioners
- gas drainage plants.

The majority of the mine surface facilities would be located to the east of the Moranbah Airport (Figure 1). Coal would be washed and processed on-site, and product coal would be transported from site by rail. A sealed mine access road would be constructed from Moranbah Access Road to the mine surface facilities. The disturbance footprint of the mine surface facilities would be approximately 510ha. Figure 2 outlines the proposed mine surface facilities.

Auxiliary mine surface facilities would be developed approximately 7km to the south-east of the primary mine surface facilities in approximately project year 11. These would cover a small area (approximately 20ha) and would include facilities such as a personnel and materials shaft, minor workshops and administration buildings. Minor surface facilities, such as ventilation shafts, underground communication cables, gas drainage and mine dewatering boreholes, would also be constructed progressively above the underground mining areas. The EIS stated that there would be considerable flexibility with respect to the location of these surface facilities which would allow for avoidance of waterways and other significant surface landscape features. Raw coal from the proposed project would be washed at the coal preparation plant, resulting in tailings and rejects. Tailings would be dewatered using belt presses and then mixed with rejects. The resultant dry rejects material would be placed in the proposed DREA that was proposed to be located 3.5km to the south-east of the mine surface facilities. Rejects from the coal preparation plant would be transported to the DREA via an overland conveyor terminating at a surge bin. Trucks and dozers would then place the rejects in the DREA in accordance with the DREA staging plans. Completed areas of the DREA would be progressively rehabilitated.

An accommodation village would be constructed to the north of the mine surface facilities area to accommodate the project workforce. Access to the village would be via a sealed access road to be constructed off Moranbah Access Road. The accommodation village would comprise 1100 rooms and would include facilities, such as a dining room and kitchens, wet mess, common rooms and recreational facilities. The proposed project would require the construction of a 132 kilovolt (kV) powerline and a raw water pipeline. The EIS stated that the proponent was in discussions with utility providers SunWater, Powerlink and Ergon in relation to this infrastructure with the aim that this infrastructure would be constructed by the utility provider. The project would also require a rail connection between the proposed project site and the Blair Athol Rail Line and the proponent is in discussions with Aurizon in relation to this rail line. An ongoing exploration program would be

undertaken over the life of the mine. The EIS stated that this may include installation of exploration boreholes, as well as seismic survey in some areas. These activities would be similar to the exploration activities currently being undertaken on the project site. However, the EIS further outlined that there would be considerable flexibility with respect to the location of exploration bores and exploration bores would be to be sited to avoid significant landscape surface features as far as possible.

4.19.3.4 Off lease infrastructure

The EIS outlined that some infrastructure beyond the project site would be required for the proposed project. Potential off lease infrastructure would include a rail connection between the project site and the Blair Athol Rail Line, a water pipeline, and a powerline. The off lease infrastructure was not assessed as part of the EIS.

4.19.3.5 Overlap area with the proposed Isaac Plains South Project

The EIS stated the eastern part of the Moranbah South project site would overlap with part of the mining lease application area for the Isaac Plains South Project (the 'overlap area'; Figure 3). The Isaac Plains South Project is unrelated to the Moranbah South Project and is applying for mining leases to mine the Rangal Coal measures, from the surface to a depth of approximately 160m, within the overlap area. Mining would be via open cut mining methods.

The EIS further stated that the Moranbah South Project would apply for mining leases to mine the Moranbah Coal Measures below 160m within the overlap area using underground mining methods. It was concluded in the EIS that this arrangement would allow for the optimum utilisation of the total coal resource in the overlap area. The proponents of the two projects are currently working together under the terms of the agreement to enable their respective exploration programs to take place in the overlap area.

It was stated in the EIS that the proponent for the Isaac Plains South Project has indicated that the construction of the Isaac Plains South Project would commence in 2013, with mining activities in the overlap area scheduled to be completed by 2027. In contrast, the Moranbah South Project's underground longwall mining activities in the overlap area was scheduled in the EIS to commence in approximately 2028 (project year 15), after the Isaac Plains South Project has completed mining in the overlap area and rehabilitated the area.

According to the EIS the Moranbah South Project's mining in the overlap area would result in subsidence of a portion of the Isaac Plains South Project's rehabilitated overburden emplacement and drainage infrastructure. In accordance with the agreement between the two proponents, the Moranbah South Project would be responsible for remedying the subsidence effects on Isaac Plains South's completed rehabilitation in the overlap area. 30

4.19.3.6 Project justification

Coking coal resources identified within the project site would allow a proposed project life of over 30 years based on the proposed coal production rate. The EIS stated that coking coal was currently in high demand around the world and that, despite some recent softening in the price of coking coal, the long-term forecast was for demand to remain strong, particularly in Asia. The EIS stated that the proposed project would provide substantial economic benefits to the region, Queensland and Australia. The operations phase of the proposed project would create approximately 1300 full time equivalent jobs, and 6000 indirect full time equivalent jobs in Queensland. The EIS estimated that the proposed project would contribute up to \$1.6 billion annually to the economy of the Mackay, Isaac and Whitsunday Region during the operations phase. The proposed project would also contribute to Queensland and Commonwealth government revenue through coal royalties (identified in the EIS as potentially \$1.5 billion over the life of the mine) and additional revenues associated with government taxes.³⁰

4.19.3.7 Feasible project alternatives

Alternatives considered for the project relevant to avoidance of impact to MNES included:

- Alternative mining methods having regard to the depth to the economically viable coal seam and other geological factors - open cut mining would be feasible in some areas but would have greater impact than underground mining through total clearing and limited rehabilitation.

- Alternative locations for the mine surface facilities and the DREA having regard to potential subsidence areas, flood risk, residential amenity in the town of Moranbah, existing infrastructure, proximity to access the underground mining operations, impact on biodiversity including MNES, impact on strategic cropping land – the selected layout minimised impacts to MNES.
- Alternative methods for reject disposal including dry rejects disposal, co-disposal, and use of a conventional tailings dam – dry reject disposal was selected to conserve water and result in a dry emplacement area that was stated to be more readily rehabilitated.
- Not proceeding with the project which would avoid impacts to MNES from the project but would forego economic and social benefits outlined in the EIS.

4.19.4 Listed threatened species and communities

4.19.4.1 Methodology

Desktop terrestrial and aquatic flora and fauna studies were undertaken prior to the field surveys to obtain information on the historical and potential presence and distribution of species and ecological communities, particularly communities and species listed as threatened under the EPBC Act as well as the Queensland's *Vegetation Management Act 1999* (VM Act) and the *Nature Conservation Act 1992* (NC Act) (refer also to section 4.18 – Ecology of this report). The desktop studies included database searches, reviews of previous flora and fauna studies undertaken on properties adjacent to the project site, interpretation of recent high resolution aerial photography, and review of published vegetation mapping.

The flora and fauna study involved:

- database searches including the EPBC Act protected matters search tool and the Queensland Springs Database for groundwater dependent ecosystems
- desktop reviews to inform and focus field surveys, including review of environmental impact statements and associated documentation for nearby mining projects
- aerial photograph interpretation with reference to available RE mapping and high value regrowth mapping to delineate map polygons using spatial information software
- flora field surveys during the dry season (October and November 2011) and wet season (May and June 2012) including secondary, tertiary, and quaternary sites (based on Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland, DSITIA 2012)
- ecological equivalence assessment (Ecological Equivalence Methodology, DERM 2011) as part of the wet season surveys
- natural grassland assessment quadrats (wet season) to determine condition class and allow assessment against diagnostic criteria and condition thresholds for the natural grassland threatened ecological community
- threatened grass species quantification quadrats to determine the approximate extent and number of these species
- development of revised mapping for regional ecosystems (REs) and regulated regrowth based on published mapping and field surveys
- fauna field surveys prior to the wet season (November 2011) and post-wet season (April 2012), including:
 - systematic trapping using pitfall, Elliot, cage traps, and infrared cameras
 - supplementary surveys involving spotlighting, bird surveys, Anabat detector, harp trap and active searching
 - fauna habitat assessment
- aquatic flora and fauna surveys at the end of the wet season (April 2012) including:
 - habitat condition and water quality
 - flora

- macro-invertebrates
- fish and turtles.

The desktop studies refined the field methodology to target the relevant vegetation communities and terrestrial flora and fauna species, including listed species and communities. After the field survey was complete, the likelihood of the presence of listed threatened species and vegetation communities was assessed using:

- each listed threatened species/vegetation community detected during field surveys
- the availability and condition of potential habitat within the project site
- species habitat requirements and ecology such as habitat type, roosting and/or foraging needs, home range and other biological requirements.

The location and extent of each threatened ecological community (TEC) within the project area was estimated based on existing RE mapping published by the Queensland Government and revised RE mapping based on surveys conducted for the EIS.

Four categories were used to classify the likelihood that a species was present: present; high; moderate; and low. The listed MNES species and TECs were assessed for significant impact in accordance with the requirements of the MNES Significant Impact Guidelines. The potential occurrence of threatened species within the project site was estimated based on known distribution of each species, field surveys, habitat availability within the project site, and available survey data for adjacent properties with similar habitat.

The significance of impact for each listed species was assessed if:

- the species was known to occur within the project area, or
- there was a high probability of occurrence and potential impact to habitat, or
- there was a moderate probability of occurrence and potential for significant impact to habitat (defined in the EIS as the loss of an area sufficient to support a substantial proportion of a population of the species).

Identified listed threatened species and communities

The EIS stated that the proposed project site and surrounding area was largely cleared of native vegetation with a significant proportion of the vegetation that remained associated with the watercourses that traverse the area. The EIS noted that these watercourses would be important for maintaining landscape connectivity in the fragmented landscape. The Isaac River is mapped as a state significant corridor under the Queensland Government Biodiversity Planning Assessment Mapping in recognition of the river's importance as a wildlife corridor. The vegetation associated with the smaller watercourses, such as Grosvenor and Cherwell creeks, were also identified in the EIS as wildlife corridors.

The project site would be surrounded by existing and approved mines including the Caval Ridge mine (under construction), Peak Downs mine (operating), the Eagle Downs mine (under construction) and the Grosvenor mine (under construction) to the north, and the proposed Isaac Plains South Project that would overlap the eastern part of the project site (Figure 3). The EIS stated that the vegetation in the overlap area was excluded from the impact assessment for the proposed Moranbah South Project.

The EIS identified a total of four EPBC Act listed TECs and 16 EPBC Act listed threatened species as potentially occurring on the proposed project site based on the EPBC Act protected matters search tool. Of these MNES, the following listed (EPBC Act) threatened species and ecological communities were found to occur on the project site:

- Two TECs:
 - natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin (natural grassland TEC) – endangered
 - brigalow (*Acacia harpophylla* dominant and co-dominant) (brigalow TEC) – endangered.
- Two threatened flora species:

- king bluegrass (*Dichanthium queenslandicum*) – vulnerable (at the time of the EPBC decision; now endangered)
- a bluegrass (*Dichanthium setosum*) – vulnerable.
- Four threatened fauna species:
 - Australian painted snipe (*Rostratula australis*) – vulnerable (at the time of the EPBC decision; now endangered)
 - squatter pigeon (southern) (*Geophaps scripta scripta*) – vulnerable
 - ornamental snake (*Denisonia maculata*) – vulnerable
 - koala (*Phascolarctos cinereus*; combined populations of Qld, NSW and the ACT) – vulnerable.

The EIS estimated the likelihood of other threatened species occurring within the survey area based on habitat assessment and availability with the following results:

- Species considered to have a moderate potential of occurring:
 - red goshawk (*Erythrorchis radiatus*) – vulnerable.
- Species identified with a low potential of occurring within the project site due to a lack of suitable habitat:
 - star finch (*Neochmia ruficauda ruficauda*) – endangered
 - northern quoll (*Dasyurus hallucatus*) – endangered
 - south-eastern long-eared bat (*Nyctophilus corbeni*) – vulnerable
 - yakka skink (*Egernia rugosa*) – vulnerable
 - Dunmall's snake (*Furina dunmalli*) – vulnerable
 - retro slider (*Lerista allanae*) – endangered
 - Fitzroy River turtle (*Rheodytes leukops*) – vulnerable.

The EIS identified that the following MNES, identified as potentially occurring through the Department of the Environment's Protected Matters search tool (and shown on Figure 8), were not present on-site:

- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (SEVT TEC):
 - although 3ha of the SEVT TEC (RE 11.8.13) were mapped on the project site, ground-truthing identified that the community was degraded with very few SEVT species present. The EIS identified that the 3ha were degraded with very few SEVT species present and concluded that this did not meet the EPBC Act threshold criteria to be considered as a SEVT TEC.
- Weeping myall woodlands TEC:
 - the EIS determined that the weeping myall woodland TEC was not found during ground-truthing of the proposed project site.
- A cycad *Cycas ophiolitica* – endangered:
 - The EIS determined that this large cycad is conspicuous and identifiable at all times of the year but was not found during ground-truthing of the proposed project site.

Listed threatened species not included in this EIS assessment report

The following two species have been delisted as listed threatened species under the EPBC Act since the referral was submitted and this report was prepared. These species are listed below and will not be included in the impact assessment:

- finger panic grass (*Digitaria porrecta*) – delisted
- brigalow scaly foot (*Paradelma orientalis*) – delisted.

Weeds of national significance and pest animals

Five weeds of national significance (WONS) were identified from the project site during field surveys:

- athel pine (*Tamarix aphylla*)
- bellyache bush (*Jatropha gossypifolia*)
- common lantana (*Lantana camara var. camara*)
- parthenium (*Parthenium hysterophorus*)
- prickly acacia (*Acacia nilotica*).

The EIS stated that evidence of pest animals such as pig diggings and rabbit scats were generally isolated suggesting that these species were not present in large numbers during field investigations of the project site. Some larger areas of pig diggings were observed in some areas along the Isaac River.

4.19.4.2 Potential ecological impacts

Appendix 3 of this EIS assessment report includes a full description of EPBC Act listed threatened species and TECs, including information on the potential impacts on these. The following section is an overview of the EIS findings.

Potential impacts on vegetation communities

The EIS concluded that the proposed activities would result in removal of habitat and other ecological impacts on the project site due to construction of surface infrastructure, repair of surface tension cracks resulting from subsidence following longwall underground mining, changes to drainage caused by subsidence and subsequent remediation works, vegetation disturbance from the seismic exploration program, activities that may spread weeds, and indirect impacts due to the effects of noise, vibration and lighting from operating equipment and infrastructure.

The EIS stated that the proposed rehabilitation program for surface cracking resulting from subsidence would limit habitat disturbance to localised strips up to 3m wide. Ponding of water resulting from subsidence would be managed by limited earthworks to restore free drainage or to maintain natural hydrology in existing wetlands. Disturbance to habitat resulting from crack rehabilitation and remedial drainage works would occur progressively over the life of the mine, with the area of habitat disturbed relatively small at any one time.

The EIS identified that a total of 456ha of remnant vegetation would be removed for surface infrastructure, consisting of 343ha of endangered natural grassland TEC (RE 11.3.21) and 11ha of endangered brigalow TEC (Table 14). However, the EIS concluded that project impacts on the brigalow TEC (11ha) were not significant based on the small areas of clearing, fragmented occurrence, and poor condition of these communities. Figure 8 shows the location of these communities in relation to the proposed mine layout.

Table 14 Extent and potential impacts on threatened ecological communities
(Source EIS; Appendix Q MNES Report, Table 13)

Threatened ecological community (TEC)	EPBC Act status	Extent within project area (ha)	To be cleared for surface infrastructure (ha)
Brigalow TEC	Endangered	428 (148ha of remnant vegetation and 280ha of HVR*)	11
Natural grassland TEC	Endangered	1240	343

*HVR - high value regrowth; refer to section 4.18.2.1 of this assessment report for more information on regional ecosystems (REs) under Queensland's *Vegetation Management Act 1999*.

Potential impacts on listed threatened flora species – EIS findings

Two listed (EPBC Act) threatened bluegrass species were found during field surveys, namely the king bluegrass and the bluegrass *D. setosum*.

The EIS concluded that the king bluegrass would be the only listed threatened plant species that would be significantly impacted by the project (105ha of high value king bluegrass habitat disturbed). Design of surface facilities was undertaken to minimise the direct disturbance to king bluegrass. Additionally, the location of linear infrastructure was sited so as to avoid as many tussocks of this species as possible. The proposed infrastructure footprint would directly impact approximately 11 of the 124 locations where king bluegrass was recorded within the project site. The EIS estimated that in the order of 100,000 tussocks of this species would be removed out of a population of an estimated 1 million. This would result in an approximate 10% reduction in the population size of king bluegrass in the project site. Approximately 415ha of high value habitat was mapped for this species in the project site and clearing of 105ha of high value habitat was proposed to accommodate surface infrastructure. Clearing of this species and its high value habitat would be a long-term and permanent impact. The EIS concluded that as with the natural grassland TEC, clearing would likely result in an increase in fragmentation and edge effects for this species.

Although 48ha of known high value habitat for the other listed threatened bluegrass species, *D. setosum*, would be disturbed, the EIS concluded that the species would be unlikely to be significantly impacted. Design of surface facilities was undertaken to minimise the direct disturbance to *D. setosum* and the location of linear infrastructure was sited so as to avoid as many tussocks of this species as possible. The proposed infrastructure footprint would directly impact on one of the 36 known locations of *D. setosum* in the project site along a proposed conveyor and service road corridor just south of the Peak Downs Highway in the centre of the project site. A single tussock of this species was recorded alongside an access track at this location. No additional tussocks were located within the area despite searches.

Table 15 details the estimated extent of these species and their habitat within the project area, and the likely impact of the project on these species.

**Table 15 Extent and potential impacts on listed threatened flora species
(Source: EIS; Appendix Q, MNES Report, Table 14)**

Common name	EPBC Act status	Extent of high value habitat within project area	High value habitat cleared for surface infrastructure
King bluegrass (<i>D. queenslandicum</i>)	Vulnerable	415ha	105ha
Bluegrass <i>D. setosum</i>	Vulnerable	310ha	48ha

Potential impacts on listed threatened fauna species

The EIS identified potential impacts on the following EPBC Act listed fauna species due to the removal of vegetation for the construction of the surface infrastructure:

- Australian painted snipe – found on-site
- squatter pigeon – found on-site
- ornamental snake – found on-site
- red goshawk – high to moderate probability to occur on-site.

Table 16 details the estimated extent of habitat for these species within the project area and the likely impact of the project on this habitat as identified in the EIS.

**Table 16 Extent and potential impact of listed threatened fauna species and their habitat
(Source: adapted from the EIS and EIS Appendix Q, Table 14)**

Common name	EPBC Act status	Total extent of high value habitat (ha)	High value habitat cleared for surface infrastructure area (ha)
Australian painted snipe (<i>R. australis</i>)	Vulnerable	83	0
Squatter pigeon (southern) (<i>G.scripta scripta</i>)	Vulnerable	5051	483
Ornamental snake (<i>D. maculata</i>)	Vulnerable	232	2
Red goshawk (<i>E. radiates</i>)	Vulnerable	501	7
Koala (<i>Phascolarctos cinereus</i>)	Vulnerable	3841	111

4.19.4.3 Cumulative impacts on listed threatened species and communities

The EIS noted that the Brigalow Belt North bioregion has been extensively cleared for grazing and cropping. The region within and surrounding the proposed project area has been subject to clearing for agriculture, coal mining, urban development and coal seam gas developments. Riparian vegetation within the project area provided important habitat connectivity, particularly along the Isaac River. However, the EIS stated that the proposed surface facilities would be located away from riparian areas and infrastructure construction across watercourses would be subject to specific measures to minimise impacts.

The EIS estimated that the project would disturb a maximum of 1.5% of the natural grassland TEC remaining within the sub-region (Brigalow Belt North) and stated that offsets required for impacts to this community and associated habitat for king bluegrass, and proposed rehabilitation of disturbed areas, would mean that the project would not contribute to cumulative impacts to this community.

4.19.4.4 Proposed mitigation measures

Table 17 summarises the potential impacts to MNES from project activities and the general mitigation measures proposed by the proponent to avoid and minimise impacts to listed threatened species and TECs. A full description of potential impacts and proposed mitigation measures for each identified MNES is found in Appendix 3.

Table 17 Overview of the potential impacts to MNES and relevant proposed general mitigation measures (adapted from EIS Chapter 10)

Potential impacts	Proposed mitigation measures
Clearing of vegetation for development of surface infrastructure, surface tension crack rehabilitation, and seismic survey	<ul style="list-style-type: none"> • Clearing to be undertaken sequentially and in accordance with a proponent 'Permit to Disturb' process. • The area of remnant vegetation to be cleared to be restricted to that required for the safe construction and operation of facilities. • Where there is flexibility in the final location of infrastructure (e.g. power lines, water pipelines), the final design to prioritise avoiding endangered vegetation or high value habitat for MNES, where possible. • Work areas in the vicinity of remnant vegetation to be clearly delineated during construction to prevent unnecessary encroachment of disturbance into remnant vegetation. • If brigalow TEC is required to be cleared as part of seismic activities, clearing would be undertaken by hand, followed by mechanical means only if required to make the area safe for personnel and equipment. • Slashing of natural grassland TEC as part of seismic activities to take place outside the peak flowering season of 1 January to 31 March. • Management of disturbance of fauna breeding places in accordance with the requirements of a species management program approved under provisions of the NC Act. • Sediment control works in accordance with the requirements of an erosion and sediment control plan. • Pre-clearing inspection for power line watercourse crossings to identify trees to be retained. • Construction in or adjacent to watercourses and waterways to be undertaken in the dry season when flows have ceased within the watercourses. • Rehabilitation of riparian areas using native flora species. • Consideration of seed collection for rehabilitation (particularly king bluegrass and <i>D. setosum</i>) prior to clearing natural grassland TEC. • Nest boxes/habitat boxes to be installed within suitable areas of habitat within the project site. • Topsoil in all areas of subsidence to be retained and respread once remediation works are finished to encourage natural regeneration through the soil seed bank.
Degradation of terrestrial habitat	<ul style="list-style-type: none"> • Preparation of a rehabilitation management plan to include monitoring to assess the success of natural regeneration of disturbance from seismic surveys, tension crack remediation and remedial drainage works within areas of remnant vegetation. • Rehabilitation management plan to address rehabilitation of any natural grassland TEC disturbed as part of the construction of power lines and pipelines. • Monitoring to be undertaken on a regular basis and include techniques such as photographic reference points and ground cover transects along seismic lines, rehabilitated tension cracks and remedial drainage works to quantify the cover levels of exotic and native ground cover species and inform appropriate weed control actions. • Additional measures such as seeding or planting of native species to ensure a return to the pre-disturbance vegetation if natural regeneration is slow.
Weed and pest fauna invasion and spread	A pest animal and weed management plan to be developed and implemented including measures such as:

Potential impacts	Proposed mitigation measures
	<ul style="list-style-type: none"> • Weed audit and mapping for declared pest species (WONS and species listed under the <i>Queensland Land Protection (Pest and Stock Route Management) Act 2002</i>) to inform prioritisation of weed management actions. • A control program to contain and reduce the extent of declared weed species on the project site and prevent the introduction of additional species. • Monitoring of weed infestations, using photo points and mapping where necessary. • Wash-down of all vehicles and plant prior to entering the project site and exiting the project site if they have been operating off graded site roads. • Inclusion of weed hygiene in site specific inductions. • Passive monitoring of pest animals on the project sites and control options to be implemented when population sizes are considered to require management.
Subsidence impacts in the form of cracking and ponding	<p>A subsidence management plan would be developed and include:</p> <ul style="list-style-type: none"> • A survey of pre-subsidence condition. • Preventative works required to mitigate subsidence impacts. • A monitoring and reporting plan which would detail the data required to demonstrate the stability and functionality of a watercourse over a suitable range of rainfall and flow events.
Erosion and sediment loss	An erosion and sediment control plan including mitigation measures to minimise erosion and release sediment to receiving waters, and the contamination of stormwater.

4.19.5 Offsets for residual impacts to listed threatened species and communities – EIS findings

The EIS assessed the potential impacts of the proposed project on each listed threatened species and TEC against the MNES Significant Impact Guidelines and concluded that the project would result in the following significant residual impacts which would require offsets in accordance with the EPBC Act Environmental Offsets Policy 2012 (EPBC Act Offset Policy):

- Clearing of approximately 343ha of natural grassland TEC for the construction of surface infrastructure including the mine surface facilities and DREA.
- Clearing of approximately 105ha of high value habitat of king bluegrass for the construction of the mine surface facilities.

The EIS concluded, while there would be impacts to MNES, these would constitute significant residual impacts on the following MNES:

- Clearing of approximately 483ha of high value squatter pigeon habitat for the construction of the mine surface facilities. The EIS concluded that the project would be unlikely to result in a significant impact to this species as:
 - its population size was not considered to constitute an important population
 - the EIS considered the species to be common to the region
 - it is avian and inherently mobile
 - the project site did not contain any habitat critical to the survival of the squatter pigeon
 - it is known to occur within disturbed areas.
- Clearing of approximately 111ha of high value koala habitat for the construction of the mine surface facilities. The EIS concluded that the project would be unlikely to result in a significant impact to the koala as:

- the project site was not considered to contain an important population of koalas: The EIS stated that the amount of cleared habitat on site would be a small proportion of approximately 3% of the overall habitat available to the koala on-site
- it is known to readily cross cleared areas and the removal of 3% of habitat on site is unlikely to fragment an important population of koala.
- Clearing of 48ha of *D. setosum* habitat for the construction of the mine surface facilities. The EIS concluded that the project would be unlikely to result in a significant impact to this species as:
 - it would directly impact only on one of 36 known locations of the species within the project site
 - only one tussock of the species was located by survey in the impact area.
- Clearing of 11ha of brigalow TEC for the construction of surface facilities. The EIS concluded that the project would be unlikely to result in a significant impact to the brigalow TEC based on the small area, fragmented nature and poor condition of patches to be cleared.
- Clearing of 7ha of red goshawk habitat for the construction of surface facilities. The EIS concluded that the project would be unlikely to result in a significant impact to this species as:
 - it was not recorded during field studies
 - the project site contained low value habitat
 - impacts to high value potential habitat would be relatively small in comparison to the remaining habitat within the region.
- Clearing of 2ha of high value ornamental snake habitat for the construction of surface infrastructure. The EIS concluded that the project would be unlikely to result in a significant impact to the ornamental snake as:
 - the population was not considered to comprise an important population
 - the project would only impact on 2ha out of 232ha of high value habitat on-site.

The EIS concluded that impacts to MNES as a result of subsidence and the associated remediation of this impact would not be significant due to the temporary, small scale and short duration of this impact.

However, the Department of the Environment has not yet concluded its assessment of the project and is yet to determine the acceptability of residual impacts to MNES as reported in the EIS documentation. Where the residual impact to MNES is unacceptable further offsetting may be required.

4.19.6 Proposed biodiversity offset strategy

The Department of the Environment requested a detailed offsets proposal consistent with the requirements of the EPBC Act Environmental Offsets Policy and Offset Assessment Guide. The Department of the Environment further advised that:

- a comprehensive offsets strategy would need to be developed prior to the Commonwealth assessment process being completed
- the identification of offsets would need to occur prior to a final decision on the project as this information would provide a level of certainty that the proposed offset/s would provide a net gain for MNES, and that the impacts of the proposed action will not be unacceptable.

The amended EIS included a conceptual biodiversity offset strategy which stated that offsets would be provided in accordance with the requirements of the Commonwealth EPBC Act Environmental Offsets Policy and outlined the options being considered for delivery of required offsets. The proponent committed to develop a final biodiversity offset strategy prior to commencement of construction, after approval of the project under the EPBC Act and issue of an EA for the project. The biodiversity offset strategy would define the biodiversity values within proposed offset properties and outline proposed conservation and management measures. A biodiversity offset management plan would be developed within 12 months of commencement of construction to detail offset delivery and management with direct offset areas to be delivered within 24 months of the approval of the

biodiversity offset management plan.

The proponent proposed in the amended EIS a land-based offset and on 5 June 2014 provided information on four potential properties for the provision of natural grassland TEC and king bluegrass offsets for the project (potential offset properties hereafter) as identified in the EIS. These properties were identified in the Galilee Basin Offset Strategy (EHP, 2013) and contain varying amounts of natural grassland TEC ranging from 740-3987ha to offset the identified residual impact to the natural grassland TEC of 343ha. RE mapping available for these properties has also identified that there is suitable king bluegrass habitat available to offset the 105ha of high value habitat identified in the EIS as likely to be impacted. Potential offset properties have yet to be ground-truthed to determine the actual extent and suitability of environmental values on the ground and figures presented in the package are based on a desktop and spatial analysis only.

The Galilee Basin Offset Strategy was developed by EHP in August 2013, with the specific purpose of providing a resource to help proponents locate suitable offset properties within strategic conservation hubs and corridors of the Northern Brigalow Belt and Desert Uplands bioregions. In developing Galilee Basin Offset Strategy, EHP identified properties within these two bioregions that form a strategic footprint that contains state significant values and provides landscape connectivity. The Galilee Basin Offset Strategy properties were selected to ensure that key areas are protected in order to contribute to the long-term conservation outcomes for these bioregions.

The proponent's conceptual biodiversity offset strategy outlined that the potential offset properties:

- would be located within the Northern Brigalow Belt bioregion (the same bioregion as the project) and would be properties identified in the Galilee Basin Offset Strategy
- would contain large areas of natural grassland TEC (based on certified Queensland RE mapping)
- were identified through the EPBC's protected matters search tool as containing king bluegrass or king bluegrass habitat.

The proponent's conceptual biodiversity offsets strategy did not include offsets for MNES other than those listed above. Where the residual impact to a MNES is considered unacceptable by the Department of the Environment, offsetting is required. The Department has not completed the assessment of this project and further offsetting may be required to address impacts other than those identified by the proponent. EHP recommends field surveys to confirm that the identified MNES are present at the proposed offset properties and to identify that the condition and quantity available within the properties is sufficient to offset the residual impact to MNES.

Once EPBC approval has been obtained for the project, the proponent stated that it would enter into formal discussions with the owners of the potential offset properties in order to obtain agreement to undertake field surveys. This would enable the biodiversity offset strategy to be finalised and an offset management plan to be prepared which comply with the EPBC Act Offset Policy. The finalised biodiversity offset strategy would require approval from the Commonwealth Environment Minister. The proponent further stated that the offset management plan would include details of the management methods that would be put in place for the offset properties to achieve appropriate conservation outcomes, such as the management of grazing pressures, pests, weeds and fire. The offset management plan would also describe the agreed monitoring and reporting procedures for the offset properties to ensure regulatory compliance.

4.19.7 Water resources – surface water and groundwater values

The proposed project site would be located within the upper Isaac River catchment and would be traversed by the Isaac River. The Isaac River is a significant regional watercourse which discharges into the Mackenzie River, a major tributary of the Fitzroy River, approximately 90km downstream of the proposed project site. The area of the Isaac River catchment was estimated to be approximately 22,000 km², and the area of the Isaac River sub-catchment to the downstream boundary of the proposed project site approximately 4,075 km².

The regional hydrogeology within the vicinity of the project site broadly was determined in the EIS to consist of three water-bearing strata:

- shallow and thin Quaternary alluvium associated with the Isaac River and Grosvenor Creek
- Tertiary basalts and sediments occupying palaeo-river channels

- Permian sediments including the coal seams of the Permian Moranbah Coal Measures and the Fort Cooper Coal Measures.

Surface water values and groundwater values relevant to the proposed project are outlined in more detail in sections 4.10 – 4.11 of this assessment report.

4.19.7.1 Methodology – water resources

The EIS assessment of the surface water and geomorphic features of the site, and the potential impacts of subsidence on watercourses, was based on water flow and quality data, field observations, and the development of hydrologic and hydraulic models for the site. The assessment of potential impacts on groundwater levels, mine inflow and groundwater quality included gathering and analysing information on the groundwater regime using groundwater, geotechnical and environmental reports from the proposed project site, surrounding mines, exploration bores, existing water bores, and through installation of dedicated monitoring bores and vibrating wire piezometers for measuring groundwater levels, quality and hydraulic parameters. The groundwater information obtained was used to develop a conceptual groundwater model to simulate the existing conditions of the groundwater regime and provide predicted potential impacts of the proposed mining activities for the project.

The assessment methodology for surface water and groundwater values and potential impacts on these values should the project proceed is outlined in sections 4.10 – 4.11 of this assessment report.

4.19.7.2 Potential impacts and proposed mitigation measures – surface water and groundwater

The EIS concluded that discharges to surface water would be unlikely based on modelling of the proposed water management system, and that conditions of any EA would address potential cumulative impacts of discharges from multiple mines in the catchment. The key impact of the project on surface water values was stated to be subsidence of the Isaac River, its tributaries and floodplain as a result of underground longwall mining. Any potential for instability of the river bed due to individual river subsidence events was predicted to be short term prior to the re-establishment of pre-subsidence bed levels following flow events. Modelling of subsidence, supported by subsidence data from Moranbah North mine, predicted that subsurface cracking following longwall subsidence would not connect with surface waters (refer to section 4.11.3.4 of this assessment report).

The key groundwater impacts likely to result should the project proceed were stated to be the drawdown of groundwater aquifers through mine dewatering. No significant water quality changes were predicted and limited impact on existing uses of groundwater. Drawdown of the alluvial aquifer was predicted to be short term only and unlikely to impact on dependant ecosystems. Modelling indicated that the combined impact of the surrounding existing and proposed mines would impact groundwater values significantly more than the proposed project. A full description on the potential impacts to surface water and groundwater values should the project proceed, and proposed mitigation measures are outlined in sections 4.10 – 4.11 of this assessment report.

4.19.8 Major issues raised in submissions

4.19.8.1 Issues regarding listed threatened species and communities

The Department of the Environment requested details on the likelihood of the longwall layout changing, the detailed scope of these changes, and their associated impacts on MNES. The proponent confirmed the layout shown in the EIS with only minor variations likely to be necessary once longwall mining commenced. The proponent has committed to monitoring to confirm the re-establishment of disturbed vegetation and identify additional rehabilitation works to ensure that any future changes to the longwall layout would not give rise to impacts to MNES additional to those described in the EIS. The Department of the Environment noted this commitment and stated that any monitoring and management plans dealing with the impacts of subsidence would therefore need to include adaptive management measures to reflect this uncertainty.

The Department of the Environment requested additional information on the impacts of the changed surface water drainage patterns due to subsidence and any effect on threatened ecological communities as noted in EIS Appendix B-1 and Appendix B-2. The proponent has committed to managing ponding following subsidence such that ponding would not impact on MNES, that substantial alteration of surface drainage patterns would not occur, and that free drainage would be

achieved as demonstrated at the nearby Moranbah North Mine. The Department of the Environment noted the proponent's proposed proactive management framework to ensure DREA drainage would continue to function effectively during and after subsidence events. However, the Department of the Environment stated that these commitments must be reflected in the environmental management plans which would need to include adaptive management mechanisms and measures to mitigate and manage any impacts on MNES associated with subsidence. The proponent reiterated that the proposed adaptive management of the DREA would ensure that there would be no impacts on MNES as a result of runoff from the DREA.

The Department of the Environment was concerned that there may be a residual impact to MNES as a result of subsidence impacts which would likely require offsetting. Furthermore, the Department of the Environment requested further information to support the proponent's conclusion, that impacts caused by subsidence to MNES outside of surface infrastructure areas would be 'not significant', in particular in relation to the direct and indirect impacts of subsidence cracking, ponding and surface/groundwater connectivity on MNES in the short and long-term. In response the proponent commissioned surveys at two comparable operating longwall mines (Grasstree Mine and Moranbah North Mine) to accurately record the location and dimensions of surface cracks resulting from subsidence. Information on this study was provided in Appendix K of the Response to Submissions. The data obtained from this study was consistent with theoretical predictions of subsidence cracking for the project used in the EIS to estimate potential impacts on ecological values. The estimated extent of disturbance associated with surface cracking presented in Appendix K were extremely small, with 17ha over 27 years of disturbance due to the rehabilitation of subsidence cracking (less than 1ha/annum on average). The majority of the vegetation that would be disturbed would have a status of least concern, with only 1ha of brigalow TEC, 2ha of natural grassland TEC and less than 1% of habitat of threatened species within the project site potentially affected. The study confirmed the assessment of no significant residual impact on threatened species or communities as a result of subsidence or progressive rehabilitation of subsidence related surface cracking.

The EIS included a commitment to install remedial drainage works to re-establish free drainage following subsidence and provided a figure showing the indicative location of remedial drains. The EIS concluded that there would be no significant residual ponding caused by mine subsidence and consequently no impact on vegetation due to ponding of water. The proponent provided a commitment to monitor the areas above longwall panels to confirm that drainage works were effective. However, the EIS did not quantify the area of vegetation that would be cleared for the construction of remedial drains and further detail was requested. Further work was undertaken by the proponent to provide an estimate of potential vegetation clearing that would result from remedial drainage works. This work was presented in Appendix K of the Response to Submissions and included estimates of clearing areas for each RE and for high value habitat for threatened species. An estimated 4ha of vegetation would be cleared over the 27 year life of the longwall mine associated with the installation of remedial drainage works, confirming the assessment of no significant residual impact on threatened species or communities as a result of drainage works.

In response to a request from the Department of the Environment, the proponent committed to using a spotter/catcher service for the management of MNES fauna, to hand clear brigalow and only slash the natural grassland TEC, king bluegrass and *D. setosum* (for seismic surveys) outside of the peak flowering season (1 January to 31 March). The amended EIS confirmed that seismic equipment proposed to be used would not require seismic lines to be completely cleared before undertaking seismic activities. Seismic survey work would involve 4m wide slashing of woody vegetation every 45–165m (avoiding large trees where possible) resulting in disturbance of approximately 10–15% of any surveyed area. The disturbance would leave the soils and seed bank and grasses intact and would only occur for a few weeks a year in a part of the site ahead of the mining front.

However, the Department of the Environment advised that it has not yet concluded its assessment of the project and is yet to determine the acceptability of residual impacts to MNES as reported in the EIS documentation. Where the residual impact to MNES is unacceptable further offsetting may be required.

4.19.8.2 Surface water and groundwater issues

The Department of the Environment, EHP and DNRM requested further information on modelled water inflow to underground works as well as the extent of the fractured zone in subsided areas. The proponent pointed to the existing information on vertical hydraulic conductivity and relevant sensitivity results which showed acceptable accuracy (EIS Appendix 7 of EIS Appendix I Groundwater Report).

In the amended EIS, further information was provided on the fractured zone estimates (Response to Submissions, Appendix L: *A Peer Review on Subsurface Subsidence Cracking*), which demonstrated that no subsidence area would result in surface expression of the fractured zone. It further concluded that the Incremental Profile Method used to estimate the cracking was a valid method. The amended EIS concluded that, in the unlikely event that the maximum vertical subsidence was 15% greater than predicted (i.e. maximum vertical subsidence of 3.7m); the impacts and mitigation would not be significantly different from those described in the EIS.

The above three agencies also questioned the recharge rate assumed to restore the alluvium and basalt groundwater aquifers over the long-term. The proponent pointed to the groundwater regime of the alluvium and basalt water bearing units as being related to subsurface cracking in areas that have been subject to longwall mining. Hydrographs of river flow discharge and groundwater level in alluvial bore MB05 were provided in the Response to Submissions, Appendix B (*Alluvial Groundwater Recharge Data*). This information supported the conclusion that surface water flow provides recharge to the highly permeable alluvium. It also stated that, should the alluvium become unsaturated, surface water flows would resaturate these materials. The numerical modelling assumed a conservative recharge value of 0.56mm/yr for the alluvium. Tertiary basalt and basal sediments would be recharged through infiltration of direct rainfall where the basalt outcrops or subcrops beneath weathered cover. EIS Figure 6 (Surface Geology) and EIS Figure 8 (Extent of Tertiary Basalt and Sediments) of the EIS Groundwater Report showed the outcrop and subcrop extents.

In answer to agency queries about the volume of groundwater movements that would equalise the hydraulic head in the affected aquifers, the proponent stated that the volume of water required to equalise the hydraulic head post mining would be approximately equivalent to the volume of coal removed by mining, less the volume replaced by subsidence. As discussed in Chapter 8.4 of the EIS Groundwater Report (Appendix I), the majority of this water would seep directly from the coal seam, with only a small proportion generated by the goaf and fractured material above the coal seam. The groundwater model was used to predict the volume of water inflow to the mined areas showing that inflow would gradually increase to a peak of 19L/s before declining to 10L/s over the life of the mine. Inflow would continue to decrease as groundwater recovered post mining.

4.19.8.3 Issues raised by the IESC

The Department of the Environment and EHP referred the project to the IESC on 18 December 2013 and the IESC provided advice on 11 February 2014. When considering the IESC advice EHP sought assistance from other government departments, including DNRM and the Department of Science, Information Technology, Innovation and the Arts. The IESC provided advice in response to a number of questions in the referral and presented a number of key conclusions. The proponent responded to this advice in Appendix J of the Response to Submissions and the advice and response has been taken into consideration as follows.

Key conclusions of the IESC

Consideration of faulting in the groundwater model

The IESC advised that subsurface fracturing in or near observed areas of faulting, particularly within the longwall area of the mine, may further influence interconnectivity, and that the exclusion of these faults from the groundwater model has the potential to affect drawdown estimates, particularly where faults may act as conduits for groundwater flow.

In response, the proponent noted that there are no major fault systems located within the project site although minor faulting is present in the longwall mining area. Potential for faulting to act as significant vertical groundwater conduits was considered low based on the characteristics of Bowen Basin faults and observed groundwater inflows at local mining operations including the Moranbah North Mine operated by the proponent. The proponent argued that exclusion of faults in the model represented a conservative design assumption in terms of assessing worst case extents of mining impacts and that an accurate representation of the minor faults was not justified or necessary given that the faults did not present a significant risk to the validity of the model results.

Impacts to Isaac River and tributaries

The IESC advised that subsidence related impacts to the Isaac River and tributaries were likely as a result of the underground longwall mine and may result in ponding, changes in groundwater-surface water dynamics, and loss of connectivity along the river and its tributaries. The IESC stated that an

understanding of the degree of groundwater and surface water connectivity along the Isaac River and its tributaries would be needed to evaluate risks associated with ponding.

In response, the proponent referred to the discussion on cumulative and project subsidence impacts on surface waters, drawing upon 8 years of monitoring data across 100km of the Isaac River system, provided in Chapter 12 of the EIS. The proponent also outlined an investigation program conducted to characterise the alluvium along a dry 13km section of the Isaac River which confirmed that the Isaac River has steep banks with a bed typically comprising 2–3m of loose to firm, occasionally coarse, dry sands. The proponent also asserted that the limited potential for groundwater contribution to baseflow was supported by published assessments, including the Grosvenor Project EIS, the Bowen Gas Project EIS, an environmental assessment for the Saraji Mine EA amendment and the Caval Ridge Mine EIS.

Subsurface fracture zone height

The IESC advised that the subsurface fracture zone height following subsidence may have implications for groundwater connectivity between alluvium, Tertiary basalt and Permian groundwater systems, and hydrological impacts could be exacerbated due to the presence of faults within the project site, and noted that site specific calculations for predicted fracture zone height were not presented for the project.

In response, the proponent referred to Appendix L of the Response to Submissions which included a detailed peer review of the EIS subsurface subsidence cracking assessment based on measurements of subsurface subsidence cracking and groundwater inflow measurements from numerous comparable mines including the Moranbah North Mine. The peer review confirmed the EIS assessment method for the prediction of subsurface subsidence cracking due to longwall mining as appropriate for the Moranbah South Project and conservative in its prediction of groundwater impacts from subsurface subsidence cracking. The zone of continuous cracking, in which vertical groundwater connectivity may be enhanced, has been shown to extend to a maximum of 125m above the target coal seam at the Moranbah North Mine consistent with the model prediction for the upper extent of continuous cracking at the proposed Moranbah South Project. The peer review concluded that subsurface subsidence cracking would be unlikely to result in surface water loss from the alluvium to underlying geological units.

The proponent further stated that the potential for faulting to act as significant vertical groundwater conduits was considered low based upon the characteristics of Bowen Basin faults and observed groundwater inflows at local mining operations (e.g. Moranbah North operated by the proponent). Groundwater associated with minor faulting in Permian coal measures was stated to be observed as minor seepage. The potential for subsurface subsidence cracking to materially change groundwater inflows associated with subsurface subsidence cracking was therefore considered negligible.

4.19.8.4 Cumulative impacts of groundwater extraction

The IESC advised that coal seam gas operations proposed within the project site were not taken into consideration in groundwater model scenarios and that this may result in an inaccurate estimation of cumulative potential groundwater impacts.

In response, the proponent advised that two coal seam gas projects were located in the vicinity of the project site: the Moranbah Gas Project, operational since 2004, and the Bowen Gas Project which is currently subject to an EIS process. The EIS Groundwater Report (EIS Appendix I) described how the groundwater model was designed to fully represent the groundwater impacts of the Moranbah Gas Project (and the Grosvenor Project). Information available from the Bowen Gas Project EIS indicated no significant groundwater impacts west of the Isaac Thrust Fault system in the vicinity of the Moranbah South Project site. The proponent stated that the Moranbah South Project would fully depressurise the target Goonyella Middle coal seam and any future gas extraction in the Goonyella Middle seam, prior to mining, would similarly depressurise the coal seam with the net result that cumulative impacts would be similar to the assessed mining impacts.

Parameters used in the groundwater model

The IESC advised that parameters used in the numerical groundwater model, particularly for hydraulic conductivity, were compiled from limited field data and that additional site specific hydraulic conductivity measurements would improve confidence in groundwater drawdown predictions.

In response, the proponent advised that data collected from the groundwater investigation on the

project site was used to inform the modelling parameters for the EIS groundwater assessment, and that the site-specific data was considered in the context of extensive published groundwater data for adjacent mining activities and knowledge of the geological and hydrogeological setting of the project. The proponent stated that numerical modelling was commonly employed as a method to set hydraulic conductivity values and that this approach had been successfully applied to numerous groundwater assessments for coal mining projects throughout the Bowen Basin. The method used to determine hydraulic conductivities, and the values adopted for the groundwater model, as presented in the EIS, were considered acceptable by DNRM.

DNRM and EHP have reviewed and accepted the responses provided by the proponent to the above key conclusions of the IESC and consider that the amended EIS has adequately addressed the matters of raised by the IESC.

4.19.8.5 Specific IESC advice

The specific advice provided by the IESC in response to questions asked in the referral generally related to the key conclusions. However, the proponent provided a response (Appendix J of the Response to Submissions) to each issue raised and DNRM and EHP also considered the specific advice and proponent response in determining that the amended EIS has adequately addressed the matters of concern. Significant additional matters considered are as follows.

The IESC noted that groundwater levels in the alluvium and Tertiary Basalt on the project site would take between 500 and 650 years to recover to 80% of simulated pre-mining levels. Chapters 8.5 and 8.10 of the EIS Groundwater Report (EIS Appendix I) provided a full discussion of the recovery of groundwater in the Quaternary and Tertiary units. The proponent clarified that the model predicted rates of groundwater recovery within these units represented only a small proportion of direct rainfall (0.1 to 0.2%) and did not reflect likely recharge from surface water flows.

The IESC noted that up to 44m of drawdown was predicted in the Isaac River and Grosvenor Creek alluvium over the life of the proposal and that an understanding of the degree of groundwater and surface water connectivity along the Isaac River and its tributaries (including potential temporal and spatial variations) would allow the full extent of impacts to be realised and managed. Chapter 11.4.1 of the EIS stated that the groundwater model predicted a maximum drawdown of 2.3m within the alluvium. The drawdown referred to by the IESC was the estimated cumulative total potential drawdown over the operational mine life. Recovery of groundwater in the alluvium was expected to occur primarily from surface flows rather than rainfall.

The IESC advice stated that the proposed drainage and regrading works to remediate pooling of water following subsidence would be likely to increase turbidity and sedimentation in receiving waterways, despite the implementation of sediment and erosion control measures, until the newly created channels were stabilised and well vegetated. The proponent asserted that the minor nature of these drainage works would generate negligible sediment loads that would be extremely unlikely to degrade the highly turbid, sediment laden character of the receiving waters within this catchment.

The IESC advice indicated that additional groundwater monitoring and revisions to the groundwater model should be required. A groundwater monitoring program would be established to confirm the impacts and accuracy of model predictions as required by conditions of the EA. The proponent proposed that further modelling would only be warranted in the event of a significant change in the project or where monitoring showed unexpected impacts, and noted that DNRM had accepted the groundwater model. DNRM requested that, at the next review of the model, the appropriateness of the no flow boundaries used in the model be reconsidered and that all representative monitoring data from all bores be used.

The IESC advice indicated that additional subsidence monitoring should be required to improve confidence in predictions for post subsidence channel stabilisation in the Isaac River and tributaries. Assessment of subsidence impacts on natural features and the proposed mitigation and management measures were supported by operational experience at other comparable longwall mining operations, and particularly the proponent's Moranbah North Mine. Chapter 12 of the EIS included commitments to ongoing subsidence monitoring to validate the predictions for post-subsidence channel stabilisation in the Isaac River and tributaries. The proponent provided a review of the impacts of subsidence at Moranbah North Mine on stream flow and geomorphology in Appendix E of the Response to Submissions which demonstrated the geomorphic response of the Isaac River to subsidence across a range of flow events and provided a detailed description of methods used to mitigate subsidence effects.

The IESC recommended that the proponent's ongoing exploration program should include collection of hydrogeological information for use in future iterations of the groundwater model. The proponent stated that the groundwater monitoring program would comply with state requirements for collection of hydrogeological data. Groundwater levels would be monitored across the existing monitoring network which spans areas of minor faulting and would allow the identification of significant changes in groundwater elevation over faulted areas as mining progressed.

The IESC advice stated that there was limited on-site monitoring of seasonal groundwater fluctuation and insufficient assessment of recharge to substantiate assertions by the proponent that the drawdown in shallow aquifers may be within the range of natural groundwater fluctuation and that seasonal runoff and flow events would provide significant recharge to the alluvium that would offset the predicted dewatering impacts. The IESC recommended that mitigation measures should address the impact of groundwater drawdown during periods of natural low groundwater level. In response, the proponent presented further information on the depth and characteristics of sand in the Isaac River and stated that there is unlikely to be a significant barrier to surface water infiltration and downward movement of water within these high permeability materials, the underlying alluvial sands were likely to be saturated, and regular surface water flows and the relatively small magnitude of predicted drawdown within the alluvium supported the EIS assertion that significant net change in alluvial groundwater levels would be unlikely.

The IESC suggested that the upper 95th percentile confidence limit flood discharge rate for the 1:1000 year ARI rainfall event be calculated and used to protect mine landforms and infrastructure. Chapter A1.4 of the EIS Surface Water Report (EIS Appendix J) presented a flood frequency analysis based on the complete dataset (43 years of data) from the most relevant gauging station. The proponent maintained that the dataset used was adequate and consistent with other gauging stations within the Bowen Basin and noted that conservative modelling assumptions were applied to the flood analysis data to arrive at the design discharges used to predict flood extents, depths and velocities. The mine infrastructure area and DREA would be located above the 1000 year ARI flood level from the Isaac River.

The IESC advice stated that it was unclear whether mine-affected water dams had been designed to accommodate wetter rainfall conditions. In response, the proponent referred to Table 5.2 of the EIS Water Balance Report (EIS Appendix K) which showed the maximum predicted storage volume generated by the climate dataset for the past 123 years, and that proposed dam storage capacities for the project provided significant storage capacity above the maximum predicted storage volume. Chapter 5.3.2 of the EIS Water Balance Report (EIS Appendix K) provided a summary of the mine water storage inventory over the life of the mine, based on a range of summary statistics including the 1, 10, 50, 90 and 99th percentiles.

The IESC indicated that discharges of leachate from the DREA containing elevated metal concentrations that may impact on water quality within the Isaac River. The proponent stated that the significant excess mine water storage capacity, extremely low potential for discharge, and marginally elevated pore water metal concentrations present would result in negligible risk to surface water or other environmental values.

The IESC advice stated that groundwater drawdown, alterations to river flow regimes, and the potential connectivity between groundwater and surface water, introduced the risk of impact to groundwater dependent ecosystems associated with the alluvium along the Isaac River and Grosvenor Creek. In response, the proponent referred to advice provided in relation to drawdown and recharge of the alluvium and to Chapters 9.6.5, 9.6.6, and 9.7 of the EIS which described potential impacts to groundwater dependent ecosystems and riparian vegetation and the proposed management measures to protect these values.

The IESC advice argued that kinetic leachate tests had not been undertaken for a sufficient period of time to define long-term leachate quality from the DREA. In response, the proponent stated that kinetic leachate tests had been conducted over a period of 12 weeks, following solid phase and static leachate testing, and referred to the site specific geochemistry assessment and consideration of geochemical data collected by the proponent at its adjoining Grosvenor Project and neighbouring Moranbah North Mine. Furthermore, the containment of runoff from active waste areas within the mine water management system, design for no discharge, and conditions of any EA for the project designed to protect downstream water quality and environmental values from project and cumulative impacts, would minimise any risk associated with DREA leachate.

The IESC recommended further sampling for stygofauna in the bores within the Tertiary Basalt where

two individuals of a harpacticoid copepod had been found. The proponent advised that the terms of reference for the EIS required only a desktop assessment and pilot study to assess the potential for stygofauna to be present and that the EIS concluded that there would be no significant impact on stygofauna or stygofaunal habitat based on the predicted impacts on groundwater.

The IESC recommended monitoring of aquatic ecological values, particularly macroinvertebrate and fish community richness, to improve understanding of the spatial and temporal variability of baseline data. In response, the proponent advised that monitoring of aquatic ecosystems would be undertaken as part of the Receiving Environment Monitoring Plan, required by the Queensland government model mining conditions.

4.19.9 Conclusions and recommendations

The EIS used adequate studies, survey methodology, and survey effort to assess potential impacts on MNES, including potential impacts on listed threatened species and communities (section 18 and 18A of the controlling provisions) and potential impacts on water resources (sections 24D and 24E of the controlling provisions). Appendix 3 of this assessment report contains listed threatened ecological communities and species information for MNES that are likely to be impacted by the proposed project. The following recommendations capture some outstanding issues relating to MNES.

Recommendations

- *The Department of the Environment stated that commitments outlined by the proponent in terms of managing impacts of subsidence would need to include adaptive management in any monitoring and management plans measures to be developed in order to reflect uncertainties in any future changes to the longwall layout and subsidence impacts to MNES additional to those described in the EIS.*
- *The proponent would need to finalise the biodiversity offset strategy consistent with the EPBC Act offsets policy and offset assessment guide. This would include field surveys to confirm that the natural grassland TEC, king bluegrass and squatter pigeon habitat are present at the proposed offset properties and to identify that the condition and quantity of the proposed properties are sufficient to offset the residual impact to 343ha of natural grassland TEC, 105ha of high value king bluegrass habitat and 483ha of squatter pigeon habitat.*
- *Although no significant residual impacts were identified to habitat resulting from crack rehabilitation and remedial drainage works (as identified in the EIS), EHP recommends that the person taking the action must not clear more than:*
 - *11ha of brigalow TEC from the project area*
 - *48ha of high value D. setosum habitat from the project area*
 - *2ha of high value ornamental snake habitat from the project area*
 - *19ha of high value squatter pigeon habitat from the project area.*
- *Although no mitigation measures were proposed by the proponent for the ornamental snake, EHP considers the general mitigation measures of weed and pest animal control would be of benefit to improve ecological conditions for the species to continue to exist in the project site.*
- *In order to achieve the best possible conservation outcomes for the survival of MNES on the project area, it is advised that the proponent should communicate the presence of MNES to background landholders with the purpose of involving them and encouraging management of these matters in a manner not inconsistent with the conservation advice, recovery plan and threat abatement plans relevant to MNES. Further information is found on the TEC and species information for MNES in Appendix 3 of this assessment report.*

5 Recommendations about the suitability of the project

In this EIS process the detailed information compiled by Anglo American Metallurgical Coal Pty Ltd about the proposed Moranbah South Project and the potential impacts of the proposed project on the identified environmental values have been scrutinised by representatives of federal, state and local government, industry and members of the public through an open, public review process. The proponent has also met the EIS process requirements including notification, responding to comments and submissions as required by Chapter 3 of the EP Act.

The EIS has complied with the terms of reference and has outlined a range of mitigation measures to avoid, minimise or offset adverse environmental impacts. While the majority of issues were covered satisfactorily in the EIS and in the proponent’s responses to the submissions and revised documents, a number of issues have not been fully resolved. These have been clearly outlined under each section of this EIS assessment report. This report requires that these outstanding matters be addressed prior to the project proceeding.

6 Recommendations for conditions for any approval

6.1 Environmental Protection Act 1994 (EP Act)

As required by section 59(d) of the EP Act, this report includes recommended draft EA conditions in Appendix 2. EHP’s model mining conditions (EHP, 2013) and the model conditions for regulated structures (EHP, 2013) were considered in the development of the recommended EA conditions. All recommended conditions are considered necessary and desirable for the regulation of identified and potential environmental impacts identified in this assessment. The recommended conditions are not considered complete or finalised until the all outstanding matters have been adequately addressed by the proponent.

6.2 Approvals under other legislation

A number of other approvals for the project, other than those under the EP Act, have been identified in section 3.2 of this report. Where possible, advice and recommendations have been made concerning key matters regulated by these approvals have been identified and assessed. Specific conditions for these approvals would be developed during the relevant application and assessment processes under the relevant legislation. Recommendations for specific conditions for transport, as provided by TMR, in relation to road and rail issues are provided in Appendix 1.

7 Approved by

Lindsay Delzoppo

Signature

Lindsay Delzoppo
 Director, Statewide Environmental Assessments
 Department of Environment and Heritage Protection

4 August 2014

Date

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 Ph. (07) 3330 5598
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Figures

FIGURE 3 MINE LAYOUT PLAN

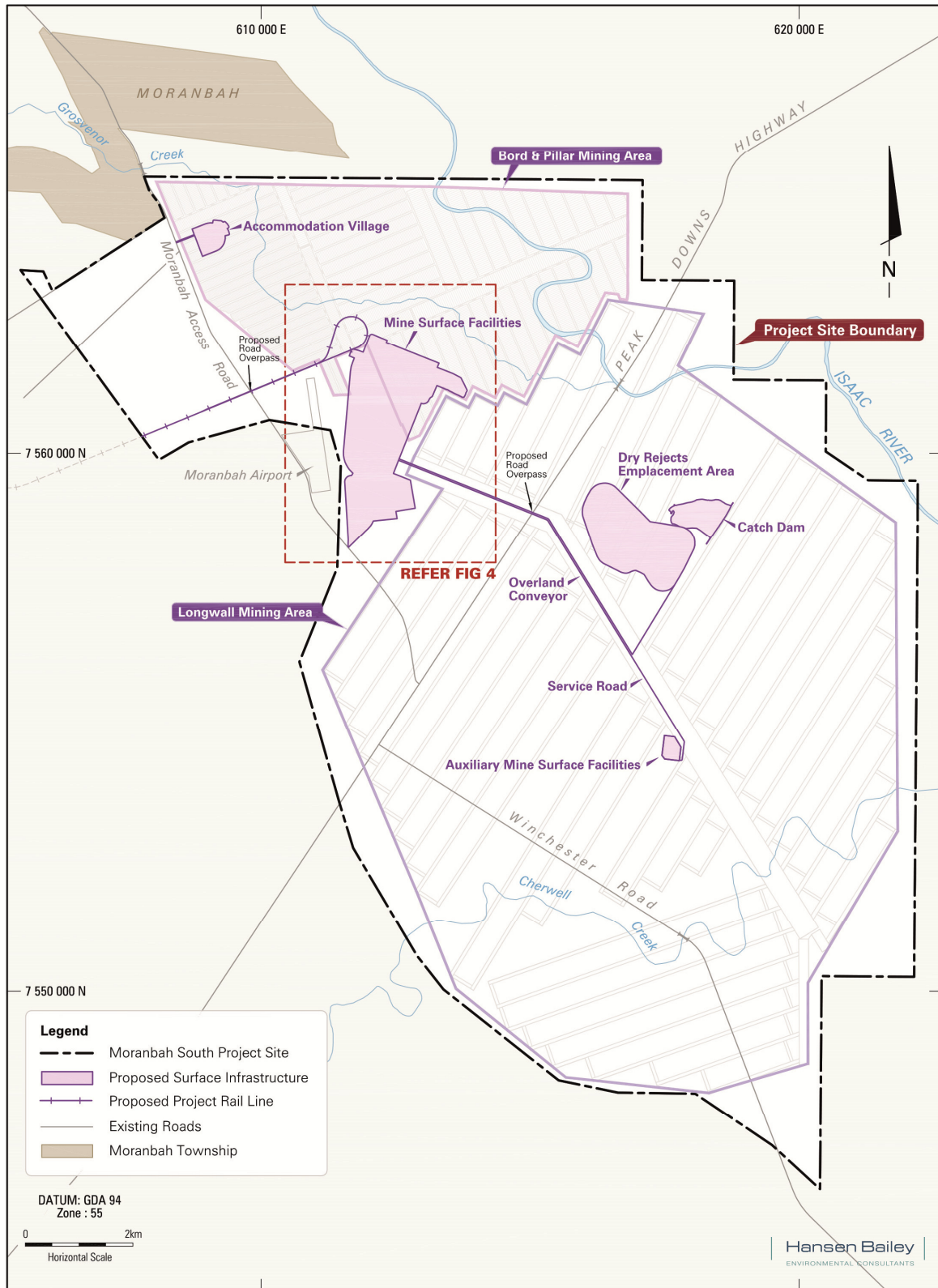


Figure 1 Moranbah South Project location and mine layout (Source: EIS Figure 3)

FIGURE 4 MINE SURFACE FACILITIES

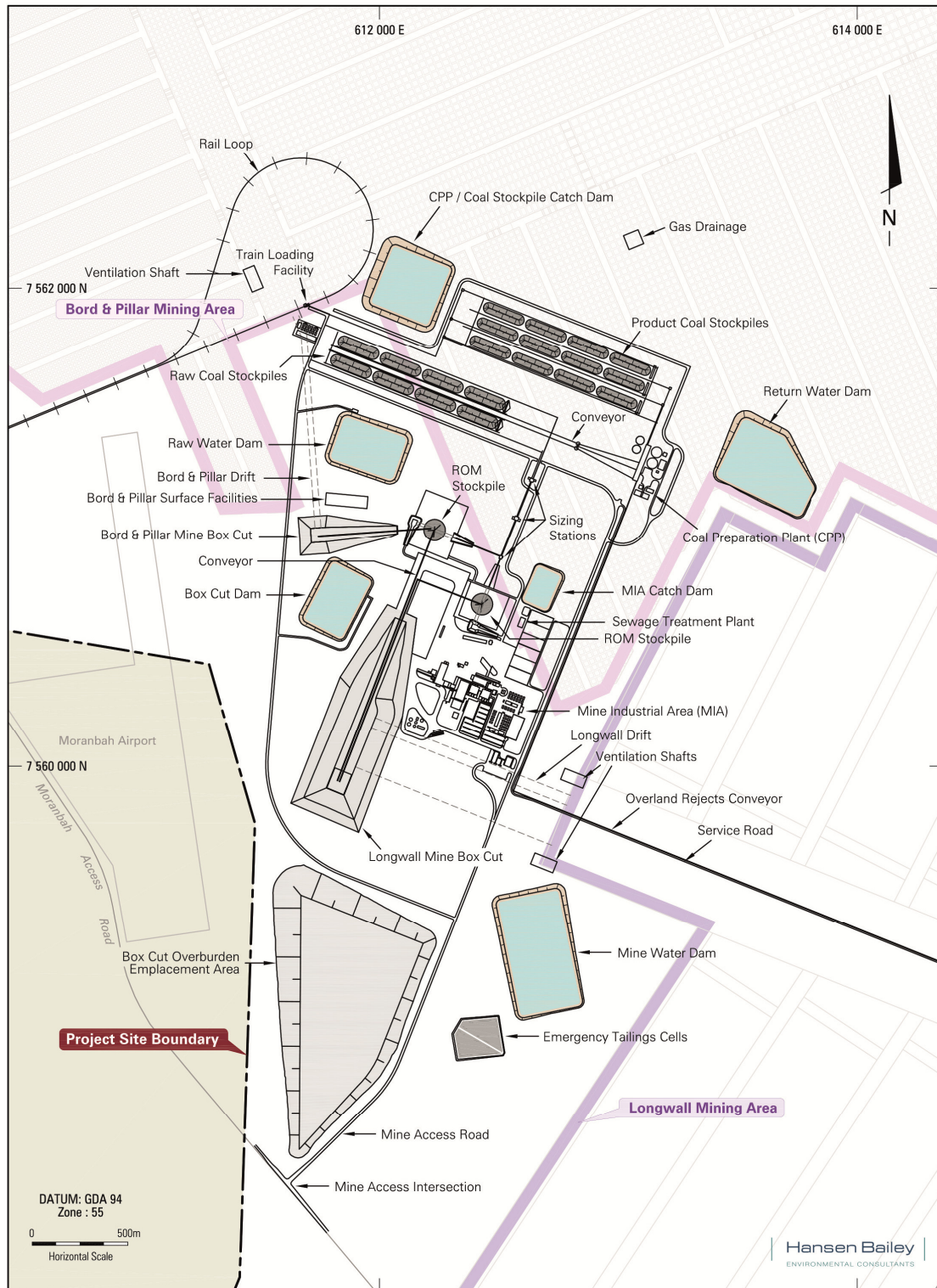


Figure 2 Mine surface facilities (Source: EIS Figure 4)

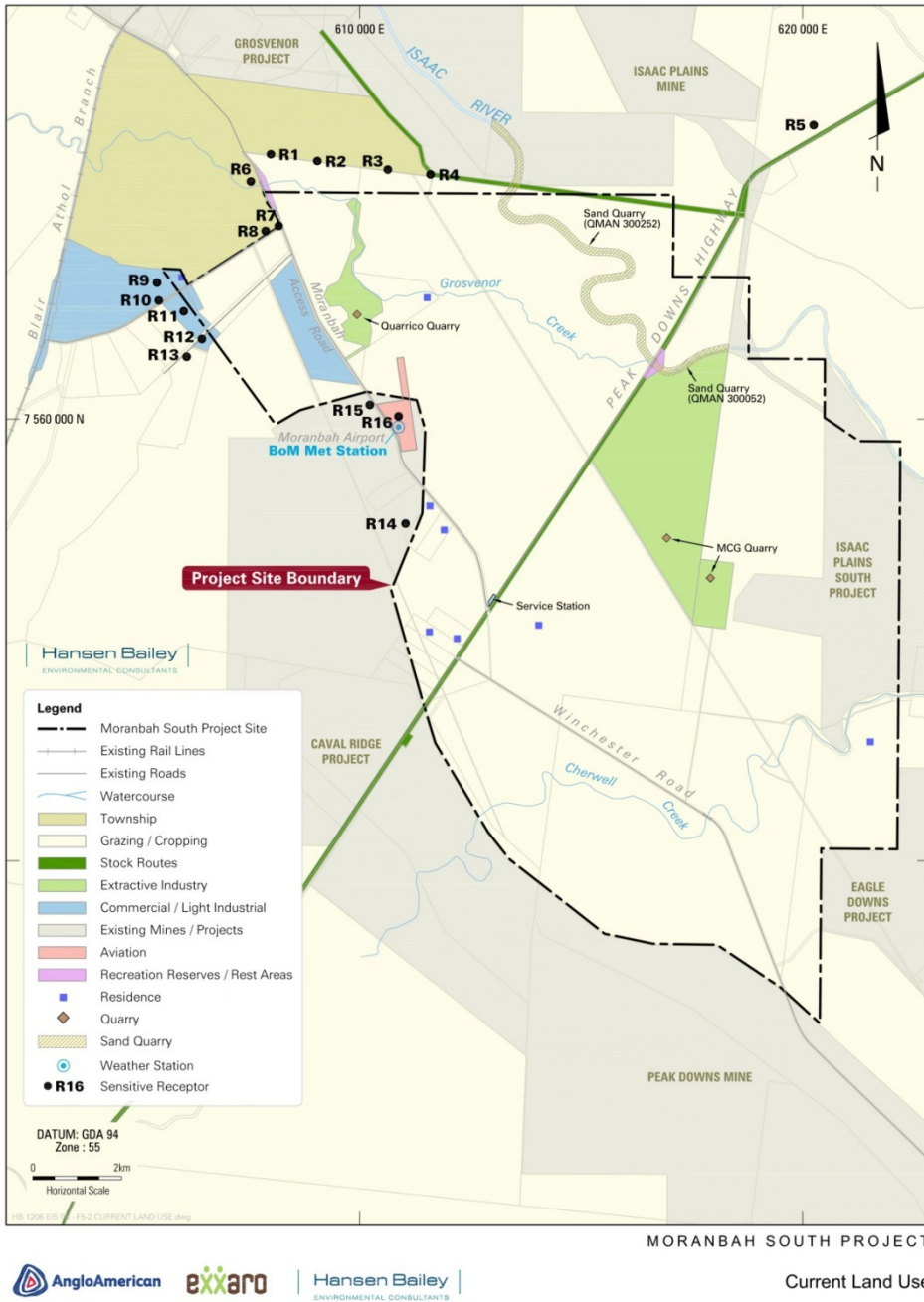
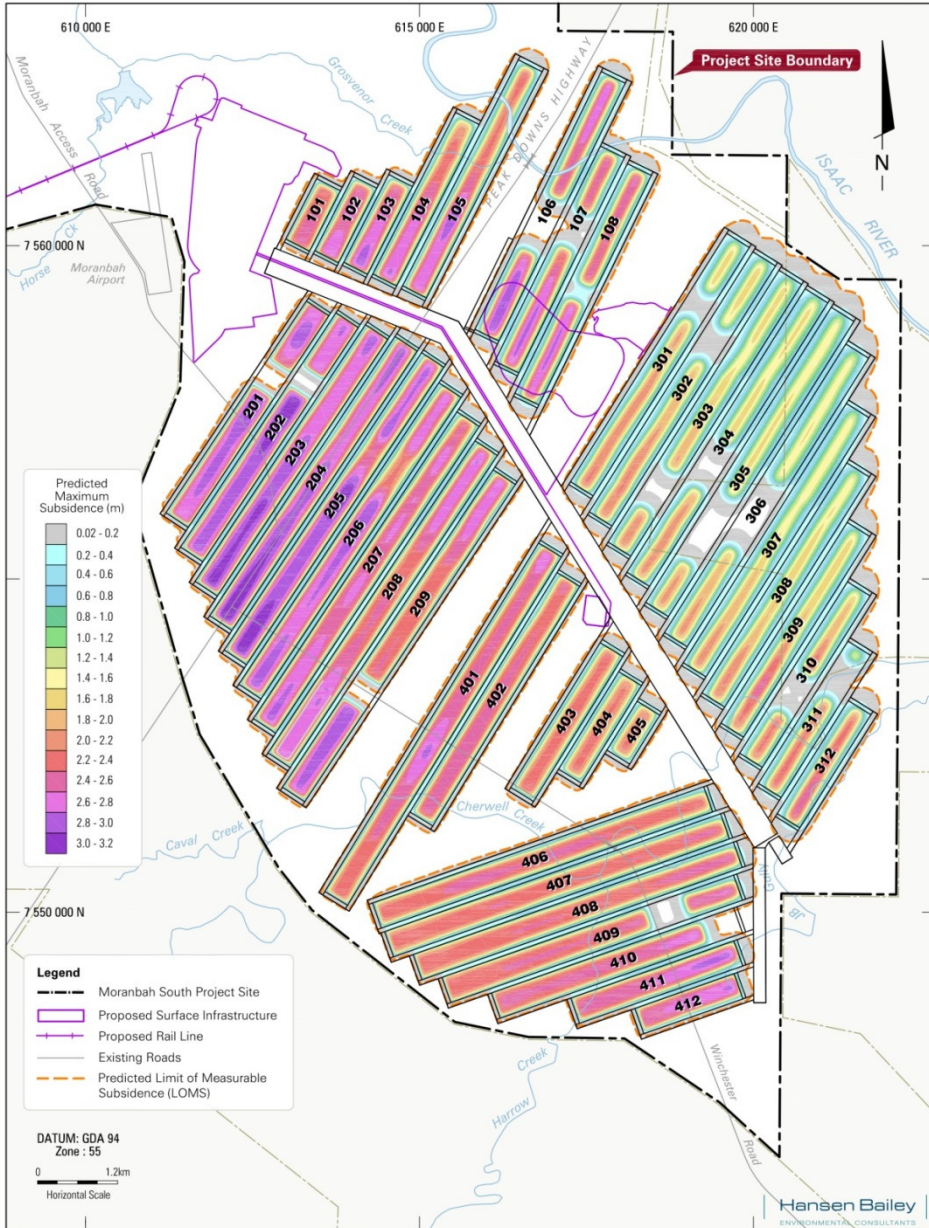


FIGURE 5-2

Figure 3 Surrounding land use (Source: EIS Figure 5-2)



MORANBAH SOUTH PROJECT

Predicted Maximum Vertical Subsidence

FIGURE 6-2

Figure 4 Predicted maximum vertical subsidence (Source: EIS Figure 6-2)

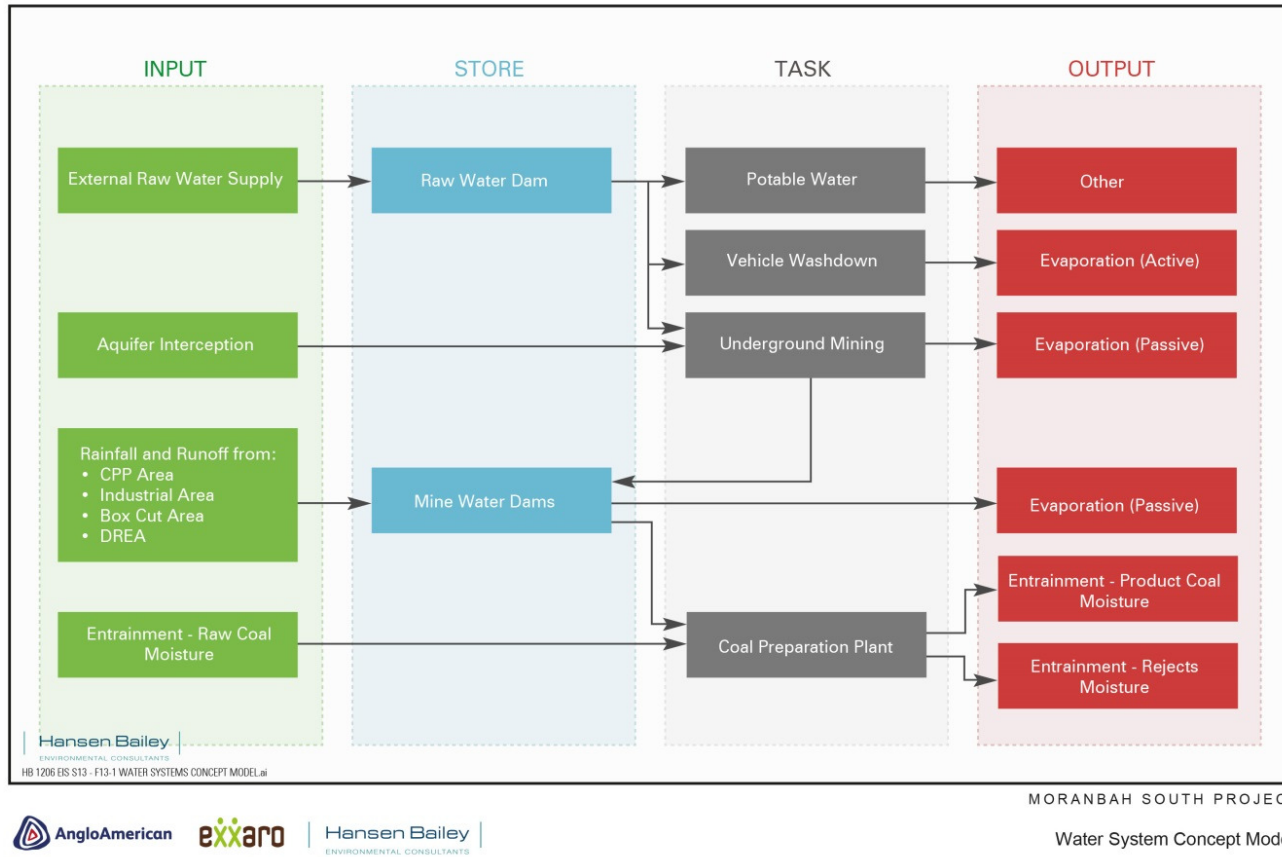


FIGURE 13-1

Figure 5 Conceptual water management system (Source: EIS Figure 13-1)

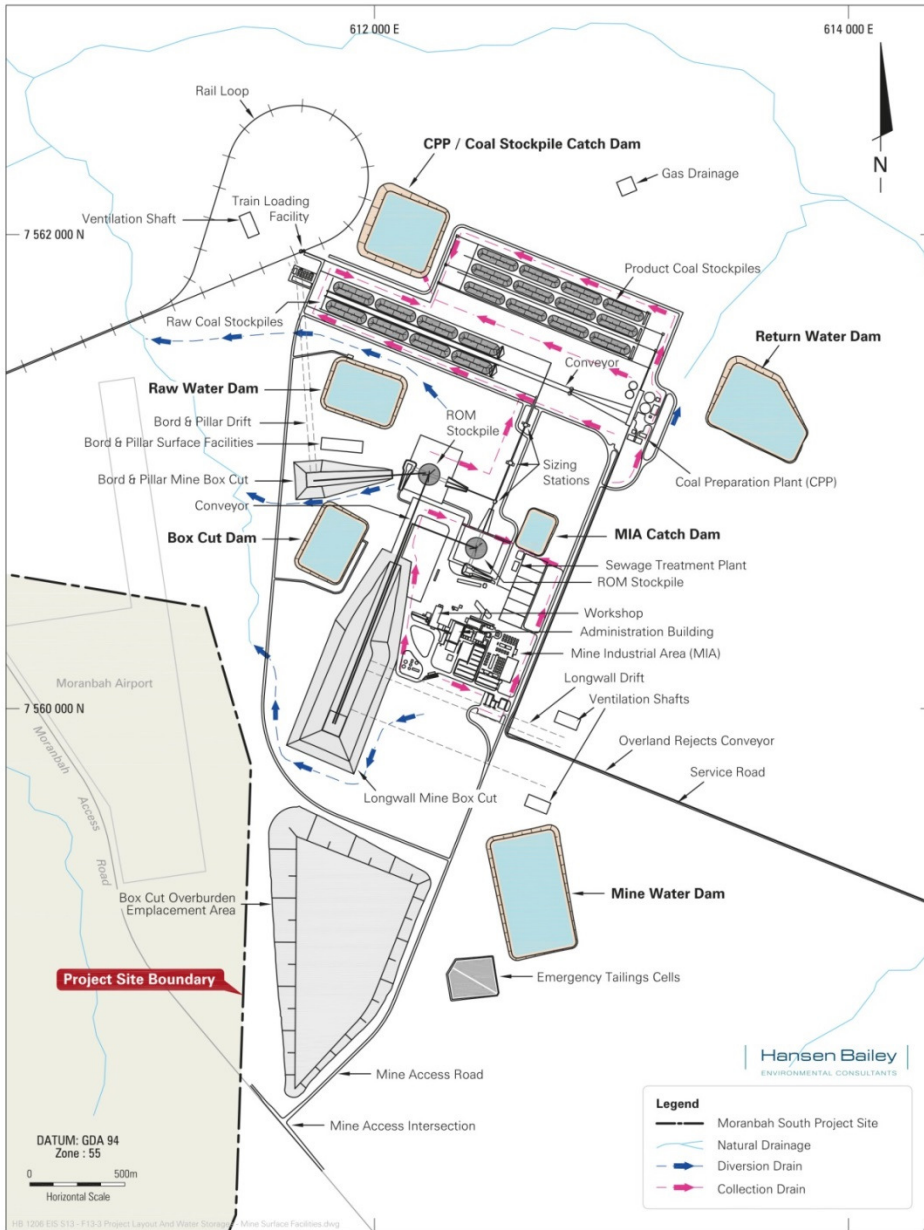
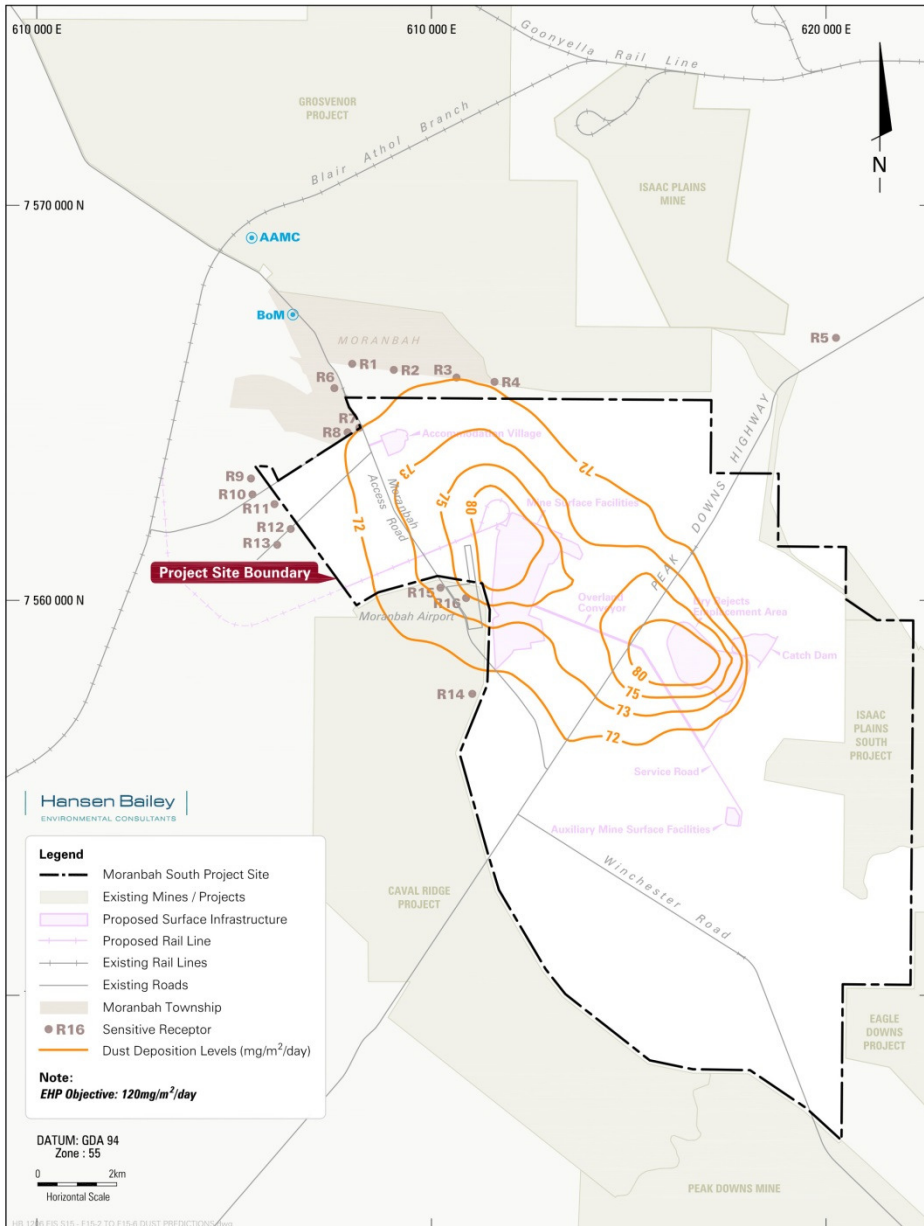


FIGURE 13-3

Figure 6 Conceptual stormwater drainage (Source: EIS Figure 13-3)



MORANBAH SOUTH PROJECT
Predicted Annual Average
Ground-Level Concentrations for Dust Deposition
(including Background)

FIGURE 15-6

Figure 7 Predicted annual average ground-level concentrations for dust deposition (Source: EIS Figure 15-6)

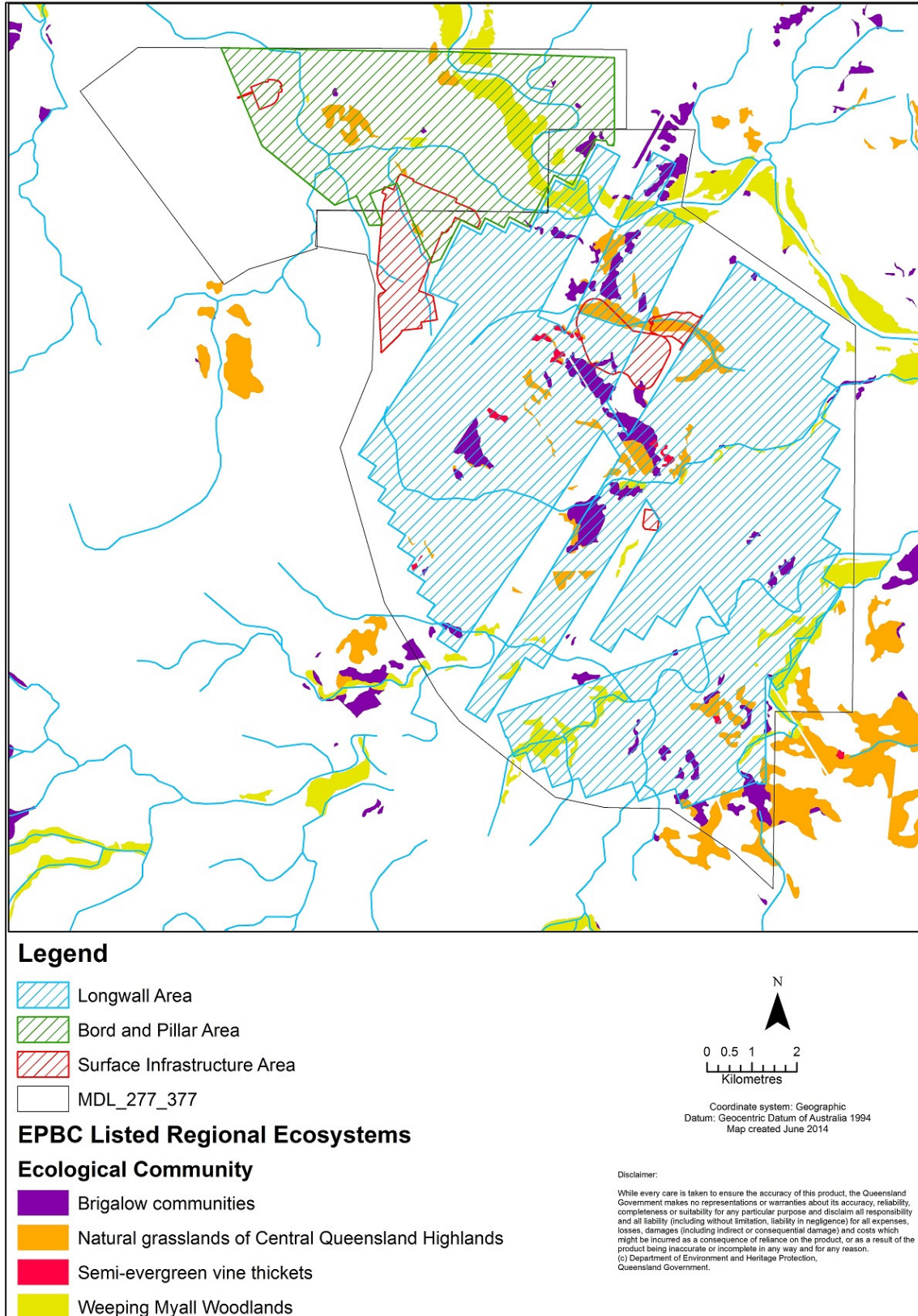


Figure 8 Overview of EPBC Act listed threatened ecological communities in the general area of the proposed project (Source: EHP)
Figures shows proposed surface infrastructure and underground mining in relation to the communities, but boundaries showing outline of the MDLs, underground mining and surface infrastructure areas are indicative only.

Appendix 1—Recommended conditions proposed by the Department of Transport and Main Roads

1. Post-assessment contact with the Department of Transport and Main Roads

Once the proponent has received approvals to proceed with the Moranbah South Project, the proponent shall contact the Manager, Project Planning & Corridor Management of TMR Mackay/Whitsunday Regional Office, no later than nine months prior to the commencement of any project construction works to discuss the preparation of the finalised road impact assessment (RIA), road-use management plan (RMP) and traffic management plan (TMP).

2. Updated road impact assessment and road use management plan

When additional information regarding the final design of the project is available, the proponent shall undertake the following no later than six months prior to the commencement of any project construction works:

- a) Provide an up to date (RIA) that includes details of the latest project and background traffic generation and confirms earlier assumptions that development traffic operation and pavement impacts are within acceptable limits. The RIA is to be developed in accordance with the Guidelines for Assessment of Road Impacts of Development (2006) in consultation with the Manager, Project Planning & Corridor Management of TMR Mackay/Whitsunday Regional Office.
- b) Submit the updated RIA to the Manager, Project Planning & Corridor Management of TMR Mackay/Whitsunday Office for review and approval.
- c) Prepare a road-use management plan (RMP) for all use of state-controlled roads for each phase of the project, in accordance with TMR's Guide to Preparing a Road Use Management Plan (provided to proponent). The RMP must receive TMR's approval prior to its implementation and must include:
 - latest traffic generation (vehicle numbers, etc.)
 - finalised assessment of impacts on safety and efficiency at intersections, on road links and on pavements, etc.
 - updated impact mitigation strategies such as any road maintenance or any necessary improvements.

3. Updated traffic management plan

Three months prior to the commencement of any project construction works, the proponent shall prepare detailed drawings and TMPs for all construction and other activities in state-controlled road corridors to demonstrate how these road works will be safely undertaken.

The proponent shall implement the traffic management plan during construction and commissioning of the project and construction of all access road intersection/s and other works to be undertaken within a SCR corridor.

The TMP shall incorporate a provision that, prior to commencing any program of oversize/over-mass transport movements that may be required for the construction of the project, the proponent will consult with TMR, the Queensland Police Service and the Mackay/Whitsunday Regional Council.

The proponent shall obtain the necessary permits for any excess mass or over-dimensional loads associated with the project as required under the Transport Operations (Road Use Management) Act (Qld) 1995.

4. Undertaking road impact mitigation strategies and provision of new infrastructure

At least six months prior to commencement of construction the proponent shall present detailed drawings of any required roadworks and traffic management plans for review and approval by TMR and take account of the reviews. The proponent shall undertake any required roadworks and road-use management strategies detailed in the RMP and TMP.

Detailed drawings are to include the overland conveyor and service road proposed to cross under the Peak Downs Highway as well as the required side track. Note that the department requires side tracks of higher order state roads be designed as two way and accommodate the largest vehicle expected to use the road. The side track is also to match the design speed of the existing road unless

it can be demonstrated the side track will be in operation for less than one month.

5. Infrastructure agreements – advice only

To formalise arrangements about transport infrastructure works, contributions and road-use management strategies detailed and required under the approved RIA and RMP, the proponent must enter into an infrastructure agreement with TMR.

The infrastructure agreement/s should identify all required works and contributions, and incorporate the following:

- a) Project-specific works and contributions required to upgrade impacted road infrastructure and vehicular access to project sites as a result of the proponent's use of state-controlled and local roads by project traffic.
- b) Project-specific contributions towards the cost of maintenance and rehabilitation to mitigate road or pavement impacts on state-controlled and local road infrastructure.
- c) Infrastructure works and contributions associated with shared (cumulative) use of state-controlled and local road infrastructure by other projects subject to an EIS.
- d) Performance criteria that detail protocols for consultation about reviewing and updating of project-related traffic assessments and impact mitigation measures that are based on actual traffic volume and impacts, should previously advised project details, traffic volumes and/or impacts change.
- e) The proponent's undertaking to fulfil all commitments as detailed in the 'table for listing RMP commitments' (table provided to proponent).
- f) Any infrastructure agreement between the proponent, TMR and the relevant LGA should be concluded three months prior to commencement of project construction, or as otherwise agreed in writing between the proponent, TMR and the relevant LGA.

6. Rail-related conditions

The proponent will consult with Aurizon during the detailed design phase of the project to determine any additional dust mitigation requirements relating to the transportation of coal. The proponent shall document and implement any required strategies required by Aurizon.

----- END recommended TMR conditions.

Appendix 2—Recommended draft conditions for the Moranbah South Project environmental authority (resource activities)

Recommended Draft Conditions for the EIS Assessment Report

Environmental Protection Act 1994

Moranbah South Project

THESE CONDITIONS ARE SUBJECT TO CHANGE FOLLOWING THE APPLICATION FOR AND ASSESSMENT OF AN APPLICATION FOR AN ENVIRONMENTAL AUTHORITY

Schedule A - General

- A1** This environmental authority authorises environmental harm referred to in the conditions. Where there is no condition or this environmental authority is silent on a matter, the lack of a condition or silence does not authorise environmental harm.

Scope of approval

- A2** This environmental authority authorises the extraction of no more than 18 million tonnes of run-of-mine (ROM) coal per annum.
- A3** In carrying out the mining activity authorised by this environmental authority, the holder of this environmental authority must comply with **Figure 1 – Moranbah South Coal Mine: Project Layout** of this environmental authority.
- A4** The holder of this environmental authority must:
- install all measures, plant and equipment necessary to ensure compliance with the conditions of this environmental authority;
 - maintain such measures, plant and equipment in a proper and efficient condition;
 - operate such measures, plant and equipment in a proper and efficient manner; and
 - ensure all instruments and devices used for the measurement or monitoring of any parameter under any condition of this environmental authority are properly calibrated.

Monitoring

- A5** Except where specified otherwise in another condition of this environmental authority, all monitoring records or reports required by this environmental authority must be kept for a period of not less than 5 years.
- A6** Upon request from the administering authority, copies of monitoring records and reports should be made available and provided to the administering authority's nominated office within 10 business days or an alternative timeframe agreed between the administering authority and the holder.

- A7** Any management or monitoring plans, systems or programs required to be developed and implemented by a condition of this environmental authority should be reviewed for effectiveness in minimising the likelihood of environmental harm on an annual basis, and amended promptly if required, unless a particular review date and amendment program is specified in the plan, system or program.

Financial assurance

- A8** The activity must not be carried out until the holder of this environmental authority has given financial assurance to the administering authority as security for compliance with this environmental authority and any costs or expenses, or likely costs or expenses, mentioned in section 298 of the Environmental Protection Act 1994.
- A9** The amount of financial assurance must be reviewed by the holder of this environmental authority when a plan of operations is amended or replaced or the authority is amended.

Risk management

- A10** The holder of this environmental authority must develop and implement a risk management system for mining activities which mirrors the content requirement of the Standard for Risk Management (ISO 31000:2009), or the latest edition of an Australian standard for risk management, to the extent relevant to environmental management, by <<Insert date 3 months from date of issue>>.

Notification of emergencies, incidents and exceptions

- A11** The holder of this environmental authority must notify the administering authority by written notification within 24 hours, after becoming aware of any emergency or incident which results in the release of contaminants not in accordance, or reasonably expected to be not in accordance with, the conditions of this environmental authority.
- A12** Within 10 business days following the initial notification of an emergency or incident, or receipt of monitoring results, whichever is the latter, further written advice must be provided to the administering authority, including the following:
- a) results and interpretation of any samples taken and analysed;
 - b) outcomes of actions taken at the time to prevent or minimise unlawful environmental harm; and
 - c) proposed actions to prevent a recurrence of the emergency or incident.

Complaints

- A13** The holder of this environmental authority must record all environmental complaints received about the mining activities including:
- a) name, address and contact number of the complainant;
 - b) time and date of complaint;
 - c) reasons for the complaint;
 - d) investigations undertaken;
 - e) conclusions formed;
 - f) actions taken to resolve the complaint;

- g) any abatement measures implemented; and
- h) person responsible for resolving the complaint.

A14 The holder of this environmental authority must, when requested by the administering authority, undertake relevant specified monitoring within a reasonable timeframe nominated or agreed to by the administering authority to investigate any complaint of environmental harm. The results of the investigation (including an analysis and interpretation of the monitoring results) and abatement measures, where implemented, must be provided to the administering authority within 10 business days of completion of the investigation, or no later than 10 business days after the end of the timeframe nominated by the administering authority to undertake the investigation.

Third-party reporting

A15 The holder of this environmental authority must:

- a) within 1 year of the commencement of this environmental authority, obtain from an appropriately qualified person a report on compliance with the conditions of this environmental authority;
- b) obtain further such reports at regular intervals, not exceeding 3 yearly intervals, from the completion of the report referred to above; and
- c) provide each report to the administering authority within 90 days of its completion.

A16 Where a condition of this environmental authority requires compliance with a standard, policy or guideline published externally to this environmental authority and the standard is amended or changed subsequent to the issue of this environmental authority, the holder of this environmental authority must:

- a) comply with the amended or changed standard, policy or guideline within 2 years of the amendment or change was made, unless a different period is specified in the amended standard or relevant legislation; and
- b) until compliance with the amended or changed standard, policy or guideline is achieved, continue to remain in compliance with the corresponding provision that was current immediately prior to the relevant amendment or change.

Schedule B - Air

Dust and particulate matter monitoring

B1 The proponent shall ensure that all reasonable and feasible avoidance and mitigation measures are employed so that the dust and particulate matter emissions generated by the mining activities do not cause exceedances of the following levels when measured at any sensitive or commercial place:

- a) Dust deposition of 120 milligrams per square metre per day, averaged over 1 month, when monitored in accordance with the most recent version of Australian Standard *AS3580.10.1 Methods for sampling and analysis of ambient air—Determination of particulate matter—Deposited matter – Gravimetric method*.

- b) A concentration of particulate matter with an aerodynamic diameter of less than 10 micrometres (PM₁₀) suspended in the atmosphere of 50 micrograms per cubic metre over a 24-hour averaging time, for no more than 5 exceedances recorded each year, when monitored in accordance with the most recent version of either:
 - i) *Australian Standard AS3580.9.6 Methods for sampling and analysis of ambient air—Determination of suspended particulate matter—PM₁₀ high volume sampler with size-selective inlet – Gravimetric method; or*
 - ii) *Australian Standard AS3580.9.9 Methods for sampling and analysis of ambient air—Determination of suspended particulate matter—PM₁₀ low volume sampler—Gravimetric method.*
- c) A concentration of particulate matter with an aerodynamic diameter of less than 2.5 micrometres (PM_{2.5}) suspended in the atmosphere of 25 micrograms per cubic metre over a 24-hour averaging time, when monitored in accordance with the most recent version of *AS/NZS3580.9.10 Methods for sampling and analysis of ambient air—Determination of suspended particulate matter—PM (sub)2.5(/sub) low volume sampler—Gravimetric method.*
- d) A concentration of particulate matter suspended in the atmosphere of 90 micrograms per cubic metre over a 1 year averaging time, when monitored in accordance with the most recent version of *AS/NZS3580.9.3:2003 Methods for sampling and analysis of ambient air—Determination of suspended particulate matter—Total suspended particulate matter (TSP)—High volume sampler gravimetric method.*

Schedule C - Waste management

- C1** Unless otherwise permitted by the conditions of this environmental authority or with prior approval from the administering authority and in accordance with a relevant standard operating procedure, waste must not be burnt.
- C2** The holder of this environmental authority may burn vegetation cleared in the course of carrying out extraction activities provided the activity does not cause environmental harm at any sensitive place or commercial place.

Tailings disposal

- C3** Tailings must be managed in accordance with procedures contained within the current plan of operations. These procedures must include provisions for:
 - a) containment of tailings;
 - b) the management of seepage and leachates both during operation and the foreseeable future;
 - c) the control of fugitive emissions to air;
 - d) a program of progressive sampling and characterisation to identify acid producing potential and metal concentrations of tailings;
 - e) maintaining records of the relative locations of any other waste stored within the tailings;
 - f) rehabilitation strategy; and

- g) monitoring of rehabilitation, research and/or trials to verify the requirements and methods for decommissioning and final rehabilitation of tailings, including the prevention and management of acid mine drainage, erosion minimisation and establishment of vegetation cover.

Dry rejects emplacement area (DREA) certification and operation

- C4** The authorised DREA used for the disposal of mining waste is located within the control points defined in **Table C1 - Location of DREA** and as depicted in **Attachment 1 – Figure 1**.

Table C1 - Location of the dry reject emplacement area (DREA)

Name of regulated dam	Easting (GDA94)	Northing (GDA94)
Dry reject emplacement area (DREA)	615970	7558909
	616375	7559445
	617229	7558728
	617890	7558603
	618057	7558264
	617685	7557546
	617257	7557533
	617116	7557740
	616774	7557764
	616291	7558008

Note:

1. Staging of the DREA (construction and operation) is to be outlined within the relevant Plan of Operations.

- C5** A design plan(s) for the authorised DREA (**Table C1 – Location of DREA** and **Attachment 1 – Figure 1**) must be prepared by a suitably qualified and experienced person and include performance indicators that address the following:

- a) during operations, the DREA will be operated with minimal or no potential for adverse environmental harm resulting from collapse of any component of the facility;
- b) the potential for significant impacts* due to leachate will be minimal or non-existent;
- c) drainage structures, erosion protection and storage are provided to manage seasonal and rare rainfall events (i.e. those events greater than 1 in 100 ARI) cause minimal or no environmental harm; and
- d) decommissioning and rehabilitation strategies demonstrate consistency with the conditions of this environmental authority.

*Note: A significant impact is considered to be where the generation of leachate results in the exceedance of:

- i) groundwater quality contaminant trigger levels or release limits as per Schedule E of this environmental authority; and / or

- ii) surface water quality trigger levels or release limits specified for RP2 as per Schedule F of this environmental authority.

C6 Construction of the authorised DREA (**Table C1 – Location of DREA** and **Attachment 1 – Figure 1**) must not commence unless:

- a) the environmental authority holder has submitted to the administering authority two (2) copies of a design plan(s) as per condition **C5**;
- b) certification from a suitably qualified and experienced person that the design of the DREA will deliver the performance stated in that design plan(s) and that it will be compliant in all other aspects with this environmental authority;
- c) at least twenty (20) business days has passed since the receipt of those documents by the administering authority; and
- d) the administering authority notifies the environmental authority holder that a design plan(s) and certification have been accepted.

C7 The authorised DREA (**Table C1 – Location of DREA** and **Attachment 1 – Figure 1**) must be constructed and maintained in accordance with certified design plans submitted to the administering authority.

DREA operational plan

C8 An operational plan must be developed and maintained for the DREA. The operational plan must include but not be limited to:

- a) description of landform development stages of the DREA;
 - b) placement technique for spoil and waste material from the coal handling and processing plant on the mine site;
 - c) management of any containment structures within the DREA designed to contain materials from the coal handling and processing plant on the mine site;
 - d) demonstration of how operations of the DREA are consistent with the accepted design plan for the facility; and
 - e) decommissioning and rehabilitation strategies for the DREA that demonstrate consistency with conditions of this environmental authority.
-

Schedule D - Noise

Noise Limits

- D1** The holder of this environmental authority must ensure that noise generated by the mining activities approved under this EA does not cause the criteria in **Table D1 – Noise limits** to be exceeded at any sensitive place.

Table D1 – Noise limits

Sensitive place						
Noise level dB(A) measured as:	Monday to Saturday			Sundays and public holidays		
	7am to 6pm	6pm to 10pm	10pm to 7am	9am to 6pm	6pm to 10pm	10pm to 9am
L _{Aeq} , adj, 15 mins	45	36	35	36	36	35
L _{Amax} (10-15 events/night)	N/A	N/A	47	N/A	N/A	47
Commercial place						
Noise level dB(A) measured as:	Monday to Saturday			Sundays and public holidays		
	7am to 6pm	6pm to10pm	10pm to7am	7am to 6pm	6pm to 10pm	10pm to 7am
L _{Aeq} , adj, 15 mins	47	43	35	47	43	35
Industrial place ¹						
Noise level dB(A) measured as:	Monday to Saturday			Sundays and public holidays		
	7am to 6pm	6pm to10pm	10pm to7am	7am to 6pm	6pm to 10pm	10pm to 7am
L _{Aeq} , adj, 15 mins	60	60	55	60	60	55

Note:

¹Moranbah Airport and adjacent industrial areas

Airblast overpressure nuisance

- D2** The holder of this environmental authority must ensure that blasting does not cause the limits for peak particle velocity and air blast overpressure in **Table D2 – Blasting noise limits** to be exceeded at a sensitive place or commercial place.

Table D2 – Blasting noise limits

Blasting noise limits	Blasting noise limits at sensitive or commercial places	
	7am to 6pm (daylight hours)	6pm to 7am (non-daylight hours)
Airblast overpressure	115 dB (Linear) Peak for 9 out of 10 consecutive blasts initiated; and not greater than 120 dB (Linear) Peak for any single blast	No blasting to occur.
Ground vibration peak particle velocity	5mm/second peak particle velocity for 9 out of 10 consecutive blasts and not greater than 10 mm/second peak particle velocity at any time.	No blasting to occur.

Monitoring and reporting

D3 Noise monitoring and recording must include the following descriptor characteristics and matters:

- a) LAN,T (where N equals the statistical levels of 1, 10 and 90 and T = 15 mins);
- b) background noise LA90;
- c) the level and frequency of occurrence of impulsive or tonal noise and any adjustment and penalties to statistical levels;
- d) atmospheric conditions including temperature, relative humidity and wind speed and directions;
- e) effects due to any extraneous factors such as traffic noise;
- f) location, date and time of monitoring; and
- g) if the complaint concerns low frequency noise, Max LpLIN,T and one third octave band measurements in dB(LIN) for centre frequencies in the 10 – 200 Hz range.

D4 The holder of this environmental authority must develop and implement a blast monitoring program to monitor compliance with **Table D2 – Blasting noise limits** for:

- a) at least 100% of all blasts undertaken on this site in each at the nearest sensitive place or commercial place; and
- b) all blasts conducted during any time period specified by the administering authority at the nearest sensitive place or commercial place.

*Note: The blasting monitoring requirements as per condition **D4 a)** may be reviewed after two (2) years of mining operations. However, this review is subject to the proximity of blasting activities to sensitive receptors.*

Schedule E - Groundwater

Contaminant release

E1 The holder of this environmental authority must not release contaminants to groundwater.

Monitoring and reporting

E2 All determinations of groundwater quality and biological monitoring must be performed by an appropriately qualified person.

E3 Groundwater quality and levels must be monitored at the locations and frequencies defined in **Table – E1 Groundwater monitoring locations and frequency** and illustrated in **Attachment 1 - Figure 2 – Groundwater monitoring bores** of this environmental authority for the quality characteristics identified in **Table E2 - Groundwater quality triggers and limits**.

Table E1 – Groundwater monitoring locations and frequency for the mine site

¹ Monitoring point	Location		² Surface RL (m)	Geological unit	Monitoring frequency
	Easting (GDA94 – Zone 54)	Northing (GDA94 – Zone 54)			
Monitoring bores					
MB01	610570	7562897	212.37	Tertiary Basalts & Sediments	⁶ SWL - Monthly for the first 12 months of operation and quarterly thereafter Quality - quarterly
MB02	611777	7562388	216.92	Permian ³ MCM	
MB03	613610	7650388	245.64	Tertiary Basalts & Sediments	
MB04	613961	7562355	209.27	Alluvium	
MB05	615206	7563212	209.24	Alluvium	
MB06	616017	7561336	206.69	Tertiary Basalts & Sediments	
MB07	615613	7560398	232.18	Tertiary Basalts & Sediments	
MB08b	615638	7559628	228.93	Permian ⁴ FCCM	
MB09b	618366	7558118	213.18	Permian FCCM	
MB09c	618366	7558118	213.12	Tertiary Basalts & Sediments	
MB11	611617	7558367	243.56	Permian MCM	
MB12	613627	7557429	241.23	Tertiary Basalts & Sediments	
MB14	615195	7551070	224.59	Permian FCCM	
MB16	620083	7547608	223.76	Permian MCM	

¹ Monitoring point	Location		² Surface RL (m)	Geological unit	Monitoring frequency
	Easting (GDA94 – Zone 54)	Northing (GDA94 – Zone 54)			
	Monitoring bores				
	Vibrating wire piezometers				
MB08	615638	7559628	228.43	Permian MCM (⁵ GM seam)	Daily data collected and downloaded monthly
MB09	618366	7558118	212.68		
MB13	615195	7551070	224.24		
MB15	620083	7547608	223.26		

Note:

¹Monitoring is not required where a bore has been removed as a direct result of the mining activity.

However, the proponent must establish replacement monitoring bores prior to the removal of each bore.

²RL means Reduced Level and must be measured to the nearest 5cm from the top of the bore casing.

³MCM means Moranbah Coal Measures

⁴FCCM means Fort Cooper Coal Measures

⁵GM means Goonyella Middle

⁶SWL means Standing Water Level.

Table E2 –Groundwater quality trigger levels

Parameter	Contaminant triggers (80 th or 90 th percentile)			Contaminant limit (99 th percentile)		
	Alluvium	Tertiary Basalt & Sediments	Permian Coal Measures	Alluvium	Tertiary Basalt & Sediments	Permian Coal Measures
Major anions and cations						
Calcium (mg/L)	TBA	TBA	TBA	TBA	TBA	TBA
Magnesium (mg/L)	TBA	TBA	TBA	TBA	TBA	TBA
Potassium (mg/L)	TBA	TBA	TBA	TBA	TBA	TBA
Sodium (mg/L)	TBA	TBA	TBA	TBA	TBA	TBA
Chloride (mg/L)	TBA	TBA	TBA	TBA	TBA	TBA
Sulphate (mg/L)	TBA	TBA	TBA	TBA	TBA	TBA
Dissolved Metals						
Aluminium (µg/L)	TBA	TBA	TBA	TBA	TBA	TBA
Arsenic (µg/L)	TBA	TBA	TBA	TBA	TBA	TBA
Barium (µg/L)	TBA	TBA	TBA	TBA	TBA	TBA
Chromium (Total) (µg/L)	TBA	TBA	TBA	TBA	TBA	TBA
Copper (µg/L)	TBA	TBA	TBA	TBA	TBA	TBA

Parameter	Contaminant triggers (80 th or 90 th percentile)			Contaminant limit (99 th percentile)		
	Alluvium	Tertiary Basalt & Sediments	Permian Coal Measures	Alluvium	Tertiary Basalt & Sediments	Permian Coal Measures
Iron (µg/L)	TBA	TBA	TBA	TBA	TBA	TBA
Lead (µg/L)	TBA	TBA	TBA	TBA	TBA	TBA
Manganese (µg/L)	TBA	TBA	TBA	TBA	TBA	TBA
Molybdenum (µg/L)	TBA	TBA	TBA	TBA	TBA	TBA
Nickel (µg/L)	TBA	TBA	TBA	TBA	TBA	TBA
Selenium (µg/L)	TBA	TBA	TBA	TBA	TBA	TBA
Strontium (µg/L)	TBA	TBA	TBA	TBA	TBA	TBA
Uranium (µg/L)	TBA	TBA	TBA	TBA	TBA	TBA
Zinc (µg/L)	TBA	TBA	TBA	TBA	TBA	TBA
Nutrients						
Ammonia (µg/L)	TBA	TBA	TBA	TBA	TBA	TBA
Nitrate (µg/L)	TBA	TBA	TBA	TBA	TBA	TBA
Nitrite (µg/L)	TBA	TBA	TBA	TBA	TBA	TBA
Physico-chemical						
pH	TBA	TBA	TBA	TBA	TBA	TBA
Electrical Conductivity (µS/cm)	TBA	TBA	TBA	TBA	TBA	TBA
Total Dissolved Solids (mg/L)	TBA	TBA	TBA	TBA	TBA	TBA

Note: Fields marked **TBA** must be submitted to the administering authority for approval by <insert date 3 years after EA approval>, or before the commencement of mining activities, whichever is earlier.

E4 Groundwater levels when measured at the monitoring locations specified in **Table E1 - Groundwater monitoring locations and frequency** must not exceed the groundwater level trigger change thresholds specified in **Table E3 - Groundwater level monitoring** below.

Table E3 - Groundwater level monitoring

Monitoring location	Level trigger threshold
Boreholes	
MB01	TBA
MB02	TBA
MB03	TBA
MB04	TBA
MB05	TBA
MB06	TBA
MB07	TBA
MB08b	TBA
MB09b	TBA
MB09c	TBA
MB11	TBA
MB12	TBA
MB14	TBA
MB16	TBA
Vibrating wire piezometers	
MB08	TBA
MB09	TBA
MB13	TBA
MB15	TBA

Note: Fields marked **TBA** must be submitted to the administering authority for approval by <insert date 3 year after EA approval>, or before the commencement of mining activities, whichever is earlier.

Exceedance investigation

- E5** If quality characteristics of groundwater from compliance bores identified in **Table E1 - Groundwater monitoring locations and frequency** exceed any of the trigger levels stated in **Table E2 - Groundwater quality triggers and limits** or exceed any of the groundwater level trigger threshold stated in **Table E3 - Groundwater level monitoring**, the holder of this environmental authority must compare the compliance monitoring bore results to the reference bore results and complete an investigation in accordance with the ANZECC and ARMCANZ 2000.

- E6** Results of monitoring of groundwater from compliance bores identified in **Table E1 - Groundwater monitoring locations and frequency** must not exceed any of the limits defined in **Table E2 - Groundwater quality triggers and limits**.

Bore construction and maintenance and decommissioning

- E7** The construction, maintenance and management of groundwater bores (including groundwater monitoring bores) must be undertaken in a manner that prevents or minimises impacts to the environment and ensures the integrity of the bores to obtain accurate monitoring.

Schedule F – Water (Fitzroy model conditions)

Contaminant release

- F1** Contaminants that will, or have the potential to cause environmental harm must not be released directly or indirectly to any waters as a result of the authorised mining activities, except as permitted under the conditions of this environmental authority.
- F2** Unless otherwise permitted under the conditions of this environmental authority, the release of mine affected water to waters must only occur from the release points specified in **Table F1 - Mine affected water release points, sources and receiving waters** and depicted in **Figure TBA** attached to this environmental authority.
- Note: the *holder* must provide the administering authority as soon as practicable a map representing the proposed release points and any other monitoring locations relevant to those release points.
- F3** The release of mine affected water to internal water management infrastructure installed and operated in accordance with a water management plan that complies with condition **F26** is permitted.

Table F1 - Mine affected water release points, sources and receiving waters

Release point (RP)	Easting (GDA94)	Northing (GDA94)	Mine affected water source and location	Monitoring point	Receiving waters description
RP 1	615316	7562370	DREA catch dam pipeline	End of pipe	Isaac River
RP 2	617906	7561518	CPP/coal stockpile catch dam pipeline	End of pipe	Isaac River

- F4** The release of mine affected water to waters in accordance with condition **F2** must not exceed the release limits stated in **Table F2 - Mine affected water release limits** when measured at the monitoring points specified in **Table F1 - Mine affected water release points, sources and receiving waters** for each quality characteristic.

Table F2 - Mine affected water release limits

Quality characteristic	Release limits	Monitoring frequency	Comment
Electrical conductivity (µS/cm)	As per Table F4 - Mine affected water release during flow events.	Daily during release (the first sample must be taken within 2 hours of commencement of release)	
pH (pH Unit)	6.5 (minimum) 9.0 (maximum)	Daily during release (the first sample must be taken within 2 hours of commencement of release)	
Turbidity (NTU)	TBA	Daily during release* (first sample within 2 hours of commencement of release)	Turbidity is required to assess ecosystems impacts and can provide instantaneous results.

Note: Fields marked 'TBA' must be submitted to the administering authority for approval by <insert date 3 years after EA approval>, or before the commencement of mining activities, whichever is earlier.

F5 The release of mine affected water to waters from the release points must be monitored at the locations specified in **Table F1 - Mine affected water release points, sources and receiving waters** for each quality characteristic and at the frequency specified in **Table F2 - Mine affected water release limits** and **Table F3 - Release contaminant trigger investigation levels, potential contaminants**.

Note: the administering authority will take into consideration any extenuating circumstances prior to determining an appropriate enforcement response in the event condition F5 is contravened due to a temporary lack of safe or practical access. The administering authority expects the environmental authority holder to take all reasonable and practicable measures to maintain safe and practical access to designated monitoring locations.

Table F3 - Release contaminant trigger investigation levels, potential contaminants

Quality characteristic	Trigger levels (µg/L)	Comment on trigger level	Monitoring frequency
Aluminium	55	For aquatic ecosystem protection, based on SMD guideline	Commencement of release and thereafter weekly during release
Arsenic	13	For aquatic ecosystem protection, based on SMD guideline	
Cadmium	0.2	For aquatic ecosystem protection, based on SMD	

Quality characteristic	Trigger levels (µg/L)	Comment on trigger level	Monitoring frequency
		<i>guideline</i>	
Chromium	1	<i>For aquatic ecosystem protection, based on SMD guideline</i>	
Copper	2	<i>For aquatic ecosystem protection, based on LOR for ICPMS</i>	
Iron	300	<i>For aquatic ecosystem protection, based on low reliability guideline</i>	
Lead	4	<i>For aquatic ecosystem protection, based on SMD guideline</i>	
Mercury	0.2	<i>For aquatic ecosystem protection, based on LOR for CV FIMS</i>	
Nickel	11	<i>For aquatic ecosystem protection, based on SMD guideline</i>	
Zinc	8	<i>For aquatic ecosystem protection, based on SMD guideline</i>	
Boron	370	<i>For aquatic ecosystem protection, based on SMD guideline</i>	
Cobalt	1.4	<i>For aquatic ecosystem protection, based on low reliability guideline</i>	
Manganese	1900	<i>For aquatic ecosystem protection, based on SMD guideline</i>	
Molybdenum	34	<i>For aquatic ecosystem protection, based on low reliability guideline</i>	
Selenium	10	<i>For aquatic ecosystem protection, based on LOR for ICPMS</i>	
Silver	1	<i>For aquatic ecosystem protection, based on LOR for ICPMS</i>	
Uranium	1	<i>For aquatic ecosystem protection, based on LOR for ICPMS</i>	
Vanadium	10	<i>For aquatic ecosystem protection, based on LOR for ICPMS</i>	
Ammonia	900	<i>For aquatic ecosystem protection, based on SMD</i>	

Quality characteristic	Trigger levels (µg/L)	Comment on trigger level	Monitoring frequency
		<i>guideline</i>	
Nitrate	1100	<i>For aquatic ecosystem protection, based on ambient Qld WQ Guidelines (2006) for TN</i>	
Petroleum hydrocarbons (C6-C9)	20		
Petroleum hydrocarbons (C10-C36)	100		
Fluoride (total)	2000	<i>Protection of livestock and short term irrigation guideline</i>	
Sodium	TBA		
Suspended solids	TBA		
Sulphate (SO4 ²⁻) (mg/L)	TBA	<i>Drinking water environmental values from NHMRC 2006 guidelines OR ANZECC</i>	

Note:

- All metals and metalloids must be measured as total (unfiltered) and dissolved (filtered). Trigger levels for metal/metalloids apply if dissolved results exceed trigger.
- The quality characteristics required to be monitored as per **Table F3 - Release contaminant trigger investigation levels, potential contaminants** can be reviewed once the results of 2 years monitoring data is available, or if sufficient data is available to adequately demonstrate negligible environmental risk, and it may be determined that a reduced monitoring frequency is appropriate or that certain quality characteristics can be removed from **Table F3 - Release contaminant trigger investigation levels, potential contaminants** by amendment.
- SMD – slightly moderately disturbed level of protection, guideline refers ANZECC & ARMCANZ (2000).
- LOR – typical reporting for method stated. ICPMS/CV FIMS – analytical method required to achieve LOR.
- Fields marked 'TBA' must be submitted to the administering authority for approval by <insert date 3 years after EA approval>, or before the commencement of mining activities, whichever is earlier.

F6 If quality characteristics of the release exceed any of the trigger levels specified in **Table F3 - Release contaminant trigger investigation levels, potential contaminants** during a release event, the environmental authority holder must compare the downstream results in the receiving waters to the trigger values specified in **Table F3 - Release contaminant trigger investigation levels, potential contaminants** and:

- where the trigger values are not exceeded then no action is to be taken; or
- where the downstream results exceed the trigger values specified **Table F3 - Release contaminant trigger investigation levels, potential contaminants** for any quality characteristic, compare the results of the downstream site to the data from background monitoring sites and
 - if the result is less than the background monitoring site data, then no action is to be taken; or
 - if the result is greater than the background monitoring site data, complete an investigation into the potential for environmental harm and provide a written

report to the administering authority within 90 days of receiving the result, outlining:

- (i) details of the investigations carried out; and
- (ii) actions taken to prevent environmental harm.

Note: Where an exceedance of a trigger level has occurred and is being investigated, in accordance with F6 b) 2) of this condition, no further reporting is required for subsequent trigger events for that quality characteristic.

- F7** If an exceedance in accordance with condition **F6 b) 2)** is identified, the holder of the environmental authority must notify the administering authority in writing within 24 hours of receiving the result.

Mine affected water release events

- F8** The holder must ensure a stream flow gauging station/s is installed, operated and maintained to determine and record stream flows at the locations and flow recording frequency specified in **Table F3 - Release contaminant trigger investigation levels, potential contaminants**.
- F9** Notwithstanding any other condition of this environmental authority, the release of mine affected water to waters in accordance with condition F2 must only take place during periods of natural flow in accordance with the receiving water flow criteria for discharge specified in **Table F4 - Mine affected water release during flow events** for the release point(s) specified in **Table F1 - Mine affected water release points, sources and receiving waters**.
- F10** The release of mine affected water to waters in accordance with condition F2 must not exceed the Maximum Release Rate (for all combined release point flows) for each receiving water flow criterion for discharge specified in **Table F4 - Mine affected water release during flow events** when measured at the monitoring points specified in **Table F1 - Mine affected water release points, sources and receiving waters**.

Table F4 - Mine affected water release during flow events

Receiving waters/ stream	Release point (RP)	Gauging station	Gauging Station latitude (decimal degree, GDA94)	Gauging station longitude (decimal degree, GDA94)	Receiving water flow recording frequency	Receiving water flow criteria for discharge (m ³ /s)	Maximum release rate (for all combined RP flows) (m ³ /s)	Electrical conductivity (EC; µS/cm) and Sulphate (SO ₄ ²⁻ ; mg/L) release limits
Isaac River	RP1 RP2	Goonyella Gauging Station	21.855517	147.972263	Continuous (minimum daily)	Low flow <5	No release	N/A
						Medium flow >5	Low release < 0.15	EC: <3,500 Sulphate <1,800
						High flow > 20	< 0.260	EC <7,500 Sulphate <2,600
						Very high flow > 50	< 1	EC <5,000 Sulphate <9,900

F11 The daily quantity of mine affected water released from each release point must be measured and recorded.

F12 Releases to waters must be undertaken so as not to cause erosion of the bed and banks of the receiving waters, or cause a material build-up of sediment in such waters.

Notification of release event

F13 The environmental authority holder must notify the administering authority as soon as practicable and no later than 24 hours after commencing to release mine affected water to the receiving environment. Notification must include the submission of written advice to the administering authority of the following information:

- a) release commencement date / time;
- b) details regarding the compliance of the release with the conditions of **Schedule F – Water (Fitzroy model conditions)** of this environmental authority (that is, contaminant limits, natural flow, discharge volume);
- c) release point/s;
- d) release rate;
- e) release salinity; and
- f) receiving water/s including the natural flow rate.

Note: Notification to the administering authority must be addressed to the Manager and Project Manager of the local administering authority via email or facsimile.

F14 The environmental authority holder must notify the administering authority as soon as practicable and nominally no later than 24 hours after cessation of a release event of the

cessation of a release notified under condition **F13** and within 28 days provide the following information in writing:

- a) release cessation date / time;
- b) natural flow rate in receiving water;
- c) volume of water released;
- d) details regarding the compliance of the release with the conditions of **Schedule F – Water (Fitzroy model conditions)** of this environmental authority (i.e. contaminant limits, natural flow, discharge volume);
- e) all in-situ water quality monitoring results; and
- f) any other matters pertinent to the water release event.

Note: Successive or intermittent releases occurring within 24 hours of the cessation of any individual release can be considered part of a single release event and do not require individual notification for the purpose of compliance with conditions F13 and F14, provided the relevant details of the release are included within the notification provided in accordance with conditions F13 and F14.

Notification of release event exceedance

F15 If the release limits defined in **Table F2 - Mine affected water release limits** are exceeded, the holder of the environmental authority must notify the administering authority within 24 hours of receiving the results.

F16 The environmental authority holder must, within 28 days of a release that is not compliant with the conditions of this environmental authority, provide a report to the administering authority detailing:

- a) the reason for the release;
- b) the location of the release;
- c) the total volume of the release and which (if any) part of this volume was non-compliant;
- d) the total duration of the release and which (if any) part of this period was non-compliant;
- e) all water quality monitoring results (including all laboratory analyses);
- f) identification of any environmental harm as a result of the non-compliance
- g) all calculations; and
- h) any other matters pertinent to the water release event.

Receiving environment monitoring and contaminant trigger levels

F17 The quality of the receiving waters must be monitored at the locations specified in **Table F6 - Receiving water upstream background sites and down stream monitoring points** for each quality characteristic and at the monitoring frequency stated in **Table F5 - Receiving waters contaminant trigger levels**.

Table F5 - Receiving waters contaminant trigger levels

Quality characteristic	Trigger level	Monitoring frequency
pH	6.5 – 9.0	Daily during the release
Electrical conductivity (µS/cm)	500	

Suspended solids (mg/L)	TBA	
Sulphate (SO ₄ ²⁻) (mg/L)	250	

Note: Fields marked 'TBA' must be submitted to the administering authority for approval by <insert date 3 years after EA approval>, or before the commencement of mining activities, whichever is earlier.

Table F6 - Receiving water upstream background sites and down stream monitoring points

Monitoring points	Receiving waters location description	Easting (GDA94)	Northing (GDA94)
Downstream monitoring points			
Monitoring point 1	Isaac River at Deverill Gauging Station, 38,260 metres downstream of RP1, and 34,801 metres downstream of RP2	642646	7547616
Monitoring point 2	Isaac River at downstream mining lease boundary, 4,319 metres downstream of RP1, and 861 metres downstream of RP2	618783	7561591
Upstream background monitoring points			
Monitoring point 3	Isaac River downstream of the confluence with Billy's Gully, 2,436 metres upstream of RP1, and 5,892 metres upstream of RP2	615688	7563770
Monitoring point 4	Isaac River upstream of the confluence with Grosvenor Creek, 5,203 metres upstream of RP1, and 8,662 metres upstream of RP2	613267	7564713

F18 If quality characteristics of the receiving water at the downstream monitoring points exceed any of the trigger levels specified in **Table F5 - Receiving waters contaminant trigger levels** during a release event the environmental authority holder must compare the downstream results to the upstream results in the receiving waters and:

- a) where the downstream result is the same or a lower value than the upstream value for the quality characteristic then no action is to be taken; or

- b) where the downstream results exceed the upstream results complete an investigation into the potential for environmental harm and provide a written report to the administering authority in the next annual return, outlining:
 - 1) details of the investigations carried out; and
 - 2) actions taken to prevent environmental harm.

Note: Where an exceedance of a trigger level has occurred and is being investigated, in accordance with F18 b) of this condition, no further reporting is required for subsequent trigger events for that quality characteristic.

- F19** All determinations of water quality and biological monitoring must be performed by an appropriately qualified person.

Receiving environment monitoring program (REMP)

- F20** The environmental authority holder must develop and implement a receiving environment monitoring program (REMP) to monitor, identify and describe any adverse impacts to surface water environmental values, quality and flows due to the authorised mining activity. This must include monitoring the effects of the mine on the receiving environment periodically (under natural flow conditions) and while mine affected water is being discharged from the site. For the purposes of the REMP, the receiving environment is the waters of the Isaac River and connected or surrounding waterways within 10 km downstream of the release. The REMP should encompass any sensitive receiving waters or environmental values downstream of the authorised mining activity that will potentially be directly affected by an authorised release of mine affected water.
- F21** A REMP Design Document that addresses the requirements of the REMP must be prepared and made available to the administering authority upon request.
- F22** A report outlining the findings of the REMP, including all monitoring results and interpretations must be prepared annually and made available on request to the administering authority. This must include an assessment of background reference water quality, the condition of downstream water quality compared against water quality objectives, and the suitability of current discharge limits to protect downstream environmental values.

Water reuse

- F23** Mine affected water may be piped or trucked or transferred by some other means that does not contravene the conditions of this environmental authority and deposited into artificial water storage structures, such as farm dams or tanks, or used directly at properties owned by the environmental authority holder or a third party (with the consent of the third party).

Annual water monitoring reporting

- F24** The following information must be recorded in relation to all water monitoring required under the conditions of this environmental authority and submitted to the administering authority in the specified format:
 - a) the date on which the sample was taken;
 - b) the time at which the sample was taken;
 - c) the monitoring point at which the sample was taken;
 - d) the measured or estimated daily quantity of mine affected water released from all release points;
 - e) the release flow rate at the time of sampling for each release point;
 - f) the results of all monitoring and details of any exceedances of the conditions of this environmental authority; and

- g) water quality monitoring data must be provided to the administering authority in the specified electronic format upon request.

Water management plan

F25 A water management plan must be developed by an appropriately qualified person and implemented.

Stormwater and water sediment controls

F26 An Erosion and Sediment Control Plan must be developed by an appropriately qualified person and implemented for all stages of the mining activities on the site to minimise erosion and the release of sediment to receiving waters and contamination of stormwater.

F27 Stormwater, other than mine affected water, is permitted to be released to waters from:

- a) erosion and sediment control structures that are installed and operated in accordance with the Erosion and Sediment Control Plan required by condition **F27**.
- b) water management infrastructure that is installed and operated, in accordance with a water management plan that complies with condition **F26**, for the purpose of ensuring water does not become mine affected water.

Schedule G – Sewage treatment

G1 The only contaminant permitted to be released to land is treated sewage effluent in compliance with the release limits stated in **Table G1 - Contaminant release limits to land**.

Table G1 - Contaminant release limits to land

Contaminant	Unit	Release limit	Limit type	Frequency
5 day biochemical oxygen demand (BOD)	mg/L	20	Maximum	Monthly
Total suspended solids	mg/L	30	Maximum	Monthly
Nitrogen	mg/L	30	Maximum	Monthly
Phosphorus	mg/L	15	Maximum	Monthly
E-coli	Organisms/100ml	1000	Maximum	Monthly
pH	pH units	6.0 – 9.0.	Range	Monthly

G2 Treated sewage effluent may only be released to land in accordance with the conditions of this approval at the following locations:

- a) within the nominated area(s) identified in << **Figure TBA**>> (sewage treatment plant and effluent disposal)
- b) other land for the purpose of dust suppression and/or firefighting.

Note: Fields marked 'TBA' must be submitted to the administering authority as soon as practicable, but before the commencement of sewage treatment.

- G3** The application of treated effluent to land must be carried out in a manner such that:
- vegetation is not damaged;
 - there is no surface ponding of effluent; and
 - there is no run-off of effluent.
- G4** If areas irrigated with effluent are accessible to employees or the general public, prominent signage must be provided advising that effluent is present and care should be taken to avoid consuming or otherwise coming into unprotected contact with the effluent.
- G5** All sewage effluent released to land must be monitored at the frequency and for the parameters specified in **Table G1 - Contaminant release limits to land**.
- G6** The daily volume of effluent release to land must be measured and records kept of the volumes of effluent released.
- G7** When circumstances prevent the irrigation or beneficial reuse of treated sewage effluent such as during or following rain events, waters must be directed to a wet weather storage or alternative measures must be taken to store/lawfully dispose of effluent.
- G8** A minimum area of << TBA >> of land, excluding any necessary buffer zones, must be utilised for the irrigation and/or beneficial reuse of treated sewage effluent.
- Note: Fields marked 'TBA' must be submitted to the administering authority as soon as practicable, but before the commencement of sewage treatment.
- G9** Treated sewage effluent must only be supplied to another person or organisation that has a written plan detailing how the user of the treated sewage effluent will comply with their general environmental duty under section 319 of the *Environmental Protection Act 1994* whilst using the treated sewage effluent.

Schedule H - Land and rehabilitation

- H1** Land disturbed by mining must be rehabilitated in accordance with **Table H1 - Rehabilitation requirements**.

Table H1 - Rehabilitation requirements

Mine domain	Mine feature name	Rehabilitation goal	Rehabilitation objectives	Indicators	Completion criteria
Domain 1 – Mine infrastructure	<ul style="list-style-type: none"> • Mine surface facilities • Auxiliary mine surface facilities • Accommodation village • Internal service roads • Overland conveyor • Mine rail infrastructure • Minor surface facilities above underground mining area 	Long-term safety	TBA	TBA	TBA
		Non-polluting	TBA	TBA	TBA
		Stable landform	TBA	TBA	TBA
		Sustainable land use	TBA	TBA	TBA

Mine domain	Mine feature name	Rehabilitation goal	Rehabilitation objectives	Indicators	Completion criteria
Domain 2 – Mine waste storage facilities	<ul style="list-style-type: none"> • DREA • DREA Catch Dam 	Long-term safety	TBA	TBA	TBA
		Non-polluting	TBA	TBA	TBA
		Stable landform	TBA	TBA	TBA
		Sustainable land use	TBA	TBA	TBA
Domain 3 – Subsidence area:	Areas within the limit of measureable subsidence	Long-term safety	TBA	TBA	TBA
		Non-polluting	TBA	TBA	TBA
		Stable landform	TBA	TBA	TBA
		Sustainable land use	TBA	TBA	functionality of regional ecosystems and groundwater-dependent ecosystems returned pre-development condition(s).

Note: Fields marked 'TBA' must be submitted to the administering authority for approval as soon as practicable.

H2 Rehabilitation must commence progressively in accordance with the plan of operations.

H3 Active and rehabilitated areas of the DREA are not to be subject to subsidence caused by mining.

Contaminated land

H4 Before applying for surrender of a mining lease, the holder must (if applicable) provide to the administering authority a site investigation report under the Act, in relation to any part of the mining lease which has been used for notifiable activities or which the holder is aware is likely to be contaminated land, and also carry out any further work that is required as a result of that report to ensure that the land is suitable for its final land use.

H5 Before applying for progressive rehabilitation certification for an area, the holder must (if applicable) provide to the administering authority a site investigation report under the Act, in relation to any part of the area the subject of the application which has been used for notifiable activities or which the holder is aware is likely to be contaminated land, and also carry out any further work that is required as a result of that report to ensure that the land is suitable for its final land use under condition H1.

H6 Minimise the potential for contamination of land by hazardous contaminants.

Chemicals and flammable or combustible liquids

H7 All explosives, hazardous chemicals, corrosive substances, toxic substances, gases and dangerous goods should be stored and handled in accordance with the current Australian standard where such is applicable. Flammable and combustible liquids, including petroleum products, should be stored and handled in accordance with the latest edition of *AS1940—The storage and handling of flammable and combustible liquids*. Where no relevant Australian standard exists store such materials within an effective on-site containment system.

Biodiversity offsets

Note: An analysis of the likely extent and duration of the significant residual impact on matters of state environmental significance (outlined under Schedule 2 of the Environmental Offsets Regulation 2014) likely to result from the whole project is to be provided to the administering agency before the issue of the approval.

H8 The holder of this environmental authority must provide an environmental offset for the following likely significant residual impacts in accordance with Table H2 and any unforeseen impacts on matters of state environmental significance in accordance with the requirements of the *Environmental Offsets Act 2014* (including deemed conditions), the Environmental Offsets Regulation 2014 and the Queensland Environmental Offsets Policy 2014.

Table H2 – Impacts on MSES

Matter of state environmental significance	Likely extent (ha) and duration (years) of impact
TBA	TBA
TBA	TBA
TBA	TBA

Note: Fields marked 'TBA' must be submitted to the administering authority for approval as soon as practicable.

H9 (Remove if the environmental authority will not be delivered in stages.) The holder of this environmental authority may deliver condition H8 in stages for each of the following stages of the <<insert a reference to the activities authorised under the EA in Table H3>>:

Table H 3– Staged delivery of offsets

Stage	Approved activities to be delivered for each stage
1	TBA
2	TBA
3	TBA

H10 (Remove if the environmental authority will not be delivered in stages) The authority holder must provide the department no less than three months before the commencement of each stage under condition H9, an analysis of the following impacts:

- a) the anticipated extent of impact on the matters of state environmental significance for the stage; and

- b) 2. the actually extent of impact on matters of State environmental significance resulting from the previous stages.

H11 (*Remove if the environmental authority will not be delivered in stages*) The analysis of impacts must be agreed to by the department before the notice of election for that stage is provided to the department under section 18 of the *Environmental Offsets Act 2014*.

Note: Section 2.1.4 Environmental Offsets Policy (Staged offset delivery) provides guidance on debiting and crediting offsets where actual on-ground impacts differ from the anticipated impacts.

Schedule I - Structures

Assessment of consequence category

- I1** The consequence category of any structure must be assessed by a suitably qualified and experienced person in accordance with the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635)* at the following times:
- a) prior to the design and construction of the structure, if it is not an existing structure; or
 - b) if it is an existing structure, prior to the adoption of this schedule; or
 - c) prior to any change in its purpose or the nature of its stored contents.
- I2** A consequence assessment report and certification must be prepared for each structure assessed and the report may include a consequence assessment for more than one structure.
- I3** Certification must be provided by the suitably qualified and experienced person who undertook the assessment, in the form set out in the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635)*.

Design and construction¹ of a regulated structure

- I4** All regulated structures must be designed by, and constructed² under the supervision of, a suitably qualified and experienced person in accordance with the requirements of the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635)*.
- I5** Construction of a regulated structure is prohibited unless the holder has submitted a consequence category assessment report and certification to the administering authority has been certified by a suitably qualified and experienced person for the design and design plan and the associated operating procedures in compliance with the relevant condition of this authority.
- I6** Certification must be provided by the suitably qualified and experienced person who oversees the preparation of the design plan in the form set out in the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635)*, and must be recorded in the Regulated Dams/Levees register.
- I7** Regulated structures must:

¹ Construction of a dam includes modification of an existing dam— refer to the definitions schedule of this EA.

² Certification of design and construction may be undertaken by different persons.

- a) be designed and constructed in accordance with and conform to the requirements of the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635)*;
- b) be designed and constructed with due consideration given to ensuring that the design integrity would not be compromised on account of:
 - i) floodwaters from entering the regulated dam from any watercourse or drainage line; and
 - ii) wall failure due to erosion by floodwaters arising from any watercourse or drainage line.
- c) have the floor and sides of the dam designed and constructed to prevent or minimise the passage of the wetting front and any entrained contaminants through either the floor or sides of the dam during the operational life of the dam and for any period of decommissioning and rehabilitation of the dam.

I8 Certification by the suitably qualified and experienced person who supervises the construction must be submitted to the administering authority on the completion of construction of the regulated structure, and state that:

- a) the 'as constructed' drawings and specifications meet the original intent of the design plan for that regulated structure;
- b) construction of the regulated structure is in accordance with the design plan.

Operation of a regulated structure

I9 Operation of a regulated structure, except for an existing structure, is prohibited unless:

- a) the holder of this environmental authority has submitted to the administering authority:
 - i) one paper copy and one electronic copy of the design plan and certification of the 'design plan' in accordance with condition **I6**;
 - ii) a set of 'as constructed' drawings and specifications;
 - iii) certification of those 'as constructed drawings and specifications' in accordance with condition **I8**; and
 - iv) where the regulated structure is to be managed as part of an integrated containment system for the purpose of sharing the DSA volume across the system, a copy of the certified system design plan;
- b) the requirements of this environmental authority relating to the construction of the regulated structure have been met;
- c) the holder has entered the details required under this environmental authority into a Register of Regulated Dams; and
- d) there is a current operational plan for the regulated structure.

I10 Each regulated structure must be maintained and operated, for the duration of its operational life until decommissioned and rehabilitated, in a manner that is consistent with the current operational plan and, if applicable, the current design plan and associated certified 'as constructed' drawings.

Mandatory reporting level

I11 Conditions **I11 to I15** inclusive only apply to Regulated Structures which have not been certified as low consequence category for 'failure to contain – overtopping'.

- I 12 The Mandatory Reporting Level (the MRL) must be marked on a regulated dam in such a way that during routine inspections of that dam, it is clearly observable.
- I 13 The holder of this environmental authority must, as soon as practical and within forty-eight (48) hours of becoming aware, notify the administering authority when the level of the contents of a regulated dam reaches the MRL.
- I 14 The holder of this environmental authority must, immediately on becoming aware that the MRL has been reached, act to prevent the occurrence of any unauthorised discharge from the regulated dam.
- I 15 The holder of this environmental authority must record any changes to the MRL in the Register of Regulated Structures.

Design storage allowance

- I 16 The holder of this environmental authority must assess the performance of each regulated dam or linked containment system over the preceding November to May period based on actual observations of the available storage in each regulated dam or linked containment system taken prior to 1 July of each year.
- I 17 By 1 November of each year, storage capacity must be available in each regulated dam (or network of linked containment systems with a shared DSA volume), to meet the Design Storage Allowance (DSA) volume for the dam (or network of linked containment systems).
- I 18 The holder of this environmental authority must, as soon as possible and within forty-eight (48) hours of becoming aware that the regulated dam (or network of linked containment systems) will not have the available storage to meet the DSA volume on 1 November of any year, notify the administering authority.
- I 19 The holder of this environmental authority must, immediately on becoming aware that a regulated dam (or network of linked containment systems) will not have the available storage to meet the DSA volume on 1 November of any year, act to prevent the occurrence of any unauthorised discharge from the regulated dam or linked containment systems.

Annual Inspection

- I 20 Each regulated structure must be inspected each calendar year by a suitably qualified and experienced person.
- I 21 At each annual inspection, the condition and adequacy of all components of the regulated structure must be assessed and a suitably qualified and experienced person must prepare an annual inspection report containing details of the assessment and include recommended actions to ensure the integrity of the regulated structure.
- I 22 The suitably qualified and experienced person who prepared the annual inspection report must certify the report in accordance with the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635)*.
- I 23 The holder of this environmental authority must:
 - a) Within 20 business days of receipt of the annual inspection report, provide to the administering authority:
 - i) The recommendations section of the annual inspection report; and
 - ii) If applicable, any actions undertaken in response to those recommendations; and

- b) If, following receipt of the recommendations and (if applicable) actions, the administering authority requests a full copy of the annual inspection report from the holder, provide this to the administering authority within 10 business days of receipt of the request.

Transfer arrangements

- I 24** The holder of this environmental authority must provide a copy of any reports, documentation and certifications prepared under this authority, including but not limited to any Register of Regulated Structures, consequence assessment, design plan and other supporting documentation, to a new holder on transfer of this authority.

Decommissioning and rehabilitation

- I 25** Dams must not be abandoned but must be either:
 - a) decommissioned and rehabilitated to achieve compliance with condition (I26); or
 - b) be left in-situ for a beneficial use(s) provided that:
 - i) it no longer contains contaminants that will migrate into the environment; and
 - ii) it contains water of a quality that is demonstrated to be suitable for its intended beneficial use(s); and
 - iii) the administering authority, the holder of this environmental authority and the landholder agree in writing that the dam will be used by the landholder following the cessation of the environmentally relevant activity(ies).
- I 26** After decommissioning, all significantly disturbed land caused by the carrying out of the environmentally relevant activity(ies) must be rehabilitated to meet the following final acceptance criteria:
 - a) the landform is safe for humans and fauna;
 - b) the landform is stable with no subsidence or erosion gullies for at least three (3) years;
 - c) any contaminated land (e.g. contaminated soils) is remediated and rehabilitated;
 - d) not allowing for acid mine drainage;
 - e) there is no ongoing contamination to waters (including groundwater);
 - f) rehabilitation is undertaken in a manner such that any actual or potential acid sulfate soils on the area of significant disturbance are treated to prevent or minimise environmental harm in accordance with the *Instructions for the treatment and management of acid sulfate soils* (2001);
 - g) all significantly disturbed land is reinstated to the pre-disturbed soil suitability class;
 - h) for land that was not cultivated by the landholder:
 - i) groundcover, that is not a declared pest species is established and self-sustaining;
 - ii) vegetation of similar species richness and species diversity to pre-selected analogue sites is established and self-sustaining; and
 - iii) the maintenance requirements for rehabilitated land is no greater than that required for the land prior to its disturbance caused by carrying out the petroleum activity(ies); and

- iv) for land that is to be cultivated by the landholder, cover crop is revegetated, unless the landholder will be preparing the site for cropping within 3 months of petroleum activities being completed.

Register of Regulated Dams

- I 27 A Register of Regulated Dams must be established and maintained by the holder for each regulated dam.
 - I 28 The holder must provisionally enter the required information in the Register of Regulated Dams when a design plan for a regulated dam is submitted to the administering authority.
 - I 29 The holder must make a final entry of the required information in the Register of Regulated Dams once compliance with condition I9 has been achieved.
 - I 30 The holder must ensure that the information contained in the Register of Regulated Dams is current and complete on any given day.
 - I 31 All entries in the Register of Regulated Dams must be approved by the chief executive officer for the holder of this authority, or their delegate, as being accurate and correct.
 - I 32 The holder must, at the same time as providing the annual return, supply to the administering authority a copy of the records contained in the Register of Regulated Dams, in the electronic format required by the administering authority.
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Schedule J – Department interest: subsidence

- J1 Subsidence is authorised within the subsidence impact area identified in **Attachment 1 - Figure 3 – Predicted subsidence impact area**.
- J2 A subsidence management plan must be developed and certified by an appropriately qualified person and implemented by the holder of this environmental authority prior to the commencement of activities that result in subsidence.
- J3 The subsidence management plan must:
 - a) provide for the proper and effective management of the actual and potential environmental impacts resulting from the mining activity authorised by this environmental authority and to ensure compliance with the conditions of this environmental authority;
 - b) include baseline data;
 - c) describe the proposed impacts of subsidence on any land, watercourse and floodplain including but not limited to:
 - i) physical condition of surface drainage:
 - erosion;
 - areas susceptible to higher levels of erosion such as watercourse confluences;
 - incision processes;
 - stream widening;
 - tension cracking;

- lowering of bed and banks;
- creation of instream waterholes;
- changes to local drainage patterns;
- ii) overland flow:
 - capture of overland flow by subsided long-wall panels;
 - increased overbank flows due to lowering of high bank of watercourses;
 - the portion of local and large scale catchment likely to be captured by subsided long-wall panels and the associated impacts on downstream users;
- iii) water quality:
 - surface water;
 - groundwater;
- iv) matters of state environmental significance;
- v) infrastructure: detail of existing infrastructure (pipelines, railway, powerlines and haul roads) should be identified where there is a potential impact from effects of land subsidence;
- d) describe cumulative impacts on watercourses, diversions or catchments;
- e) describe impacts on groundwater;
- f) quantify the area of on ground impacts to regional ecosystems and matters of state environmental significance;
- g) detail mitigation measures that would be applied , how these mitigation measures will be implemented, and the extent and nature of any residual impacts once the mitigation measures have been applied and how any residual impacts would be managed. and
- h) include a program for monitoring and review of the effectiveness of the subsidence management plan.

Guidance material has been provided in **Attachment 2** of this EA to assist with the preparation of the subsidence management plan.

J4 The subsidence management plan must be reviewed each calendar year and a report prepared on 1 July each year and certified by an appropriately qualified person. The report must:

- a) assess the plan against the requirements under condition J3;
- b) include actions to ensure actual and potential environmental impacts are effectively managed for the coming year; and
- c) identify any amendments made to the subsidence management plan following the review.

J5 The holder of this environmental authority must attach a written response and proposed actions to the review report required by condition **J4**. The response must detail the actions taken and/or proposed to be taken in order to ensure continuing compliance with this environmental authority.

J6 The review report required by condition **J4** and the written response to the review report

required by condition **J5** must be submitted to the administering authority upon request.

J7 Annual inspection of subsidence

The holder of this environmental authority must arrange for each subsided longwall panel to be inspected annually by an appropriately qualified person, in accordance with conditions **J8** through to **J10** inclusive.

If the appropriately qualified person deems and records under **J9** that a subsided long wall no longer has an associated environmental risk, the long wall panel does not need to be reinspected in the future annual inspections under condition **J7 to J9**.

J8 The annual inspection must be conducted between 1 April and 1 November each year.

J9 At each annual inspection, the condition of each subsided longwall panel must be assessed by an appropriately qualified person. The inspection must include assessments of the surface drainage and geotechnical stability of the surface area above the subsided longwall panel and the adequacy of the works with respect to the subsidence management plan.

J10 For each inspection required under condition **J9**, copies of a report certified by the an appropriately qualified person, including any recommendations to ensure the integrity of each subsided longwall panel, must be provided to the administering authority upon request.

----- END recommended draft EA conditions.

Definitions

Words and phrases used throughout this environmental authority are defined below. Where a definition for a term used in this environmental authority is not provided within this environmental authority, but is provided in the *Environmental Protection Act 1994* or subordinate legislation, the definition in the *Environmental Protection Act 1994* or subordinate legislation must be used.

‘acid rock drainage’ means any contaminated discharge emanating from a mining activity formed through a series of chemical and biological reactions, when geological strata is disturbed and exposed to oxygen and moisture.

‘airblast overpressure’ means energy transmitted from the blast site within the atmosphere in the form of pressure waves. The maximum excess pressure in this wave, above ambient pressure is the peak airblast overpressure measured in decibels linear (dBL).

‘appropriately qualified person’ means a person who has professional qualifications, training, skills or experience relevant to the nominated subject matter and can give authoritative assessment, advice and analysis on performance relating to the subject matter using the relevant protocols, standards, methods or literature.

‘background’, with reference to the water schedule means the average of samples taken prior to the commencement of mining from the same waterway that the current sample has been taken.

‘certification’, **‘certifying’** or **‘certified’** by an appropriately qualified and experienced person in relation to a design plan or an annual report regarding dams/structures, means that a statutory declaration has been made by that person and, when taken together with any attached or appended documents referenced in that declaration, all of the following aspects are addressed and are sufficient to allow an independent audit at any time:

- a) exactly what is being certified and the precise nature of that certification;
- b) the relevant legislative, regulatory and technical criteria on which the certification has been based;
- c) the relevant data and facts on which the certification has been based, the source of that material, and the efforts made to obtain all relevant data and facts; and
- d) the reasoning on which the certification has been based using the relevant data and facts, and the relevant criteria.

‘blasting’ means the use of explosive materials to fracture:

- a) rock, coal and other minerals for later recovery; or
- b) structural components or other items to facilitate removal from a site or for reuse.

‘chemical’ means:

- a) an agricultural chemical product or veterinary chemical product within the meaning of the *Agricultural and Veterinary Chemicals Code Act 1994* (Commonwealth); or
- b) a dangerous good under the Australian Code for the Transport of Dangerous Goods by Road and Rail approved by the Australian Transport Council; or
- c) a lead hazardous substance within the meaning of the Workplace Health and Safety Regulation 1997;
- d) a drug or poison in the Standard for the Uniform Scheduling of Drugs and Poisons prepared by the Australian Health Ministers’ Advisory Council and published by the Commonwealth; or

- e) any substance used as, or intended for use as:
- (i) a pesticide, insecticide, fungicide, herbicide, rodenticide, nematocide, miticide, fumigant or related product; or
 - (ii) a surface active agent, including, for example, soap or related detergent; or
 - (iii) a paint solvent, pigment, dye, printing ink, industrial polish, adhesive, sealant, food additive, bleach, sanitiser, disinfectant, or biocide; or
 - (iv) a fertiliser for agricultural, horticultural or garden use; or
 - (v) a substance used for, or intended for use for mineral processing or treatment of metal, pulp and paper, textile, timber, water or wastewater; or
 - (vi) manufacture of plastic or synthetic rubber.

‘commercial place’ means a workplace used as an office or for business or commercial purposes, which is not part of the mining activity and does not include employees’ accommodation or public roads.

‘construction’ or **‘constructed’** in relation to a regulated structure includes building a new regulated structure and lifting or otherwise modifying an existing regulated structure, but does not include investigations and testing necessary for the purpose of preparing a design plan.

‘disturbance’ of land includes:

- a) compacting, removing, covering, exposing or stockpiling of earth;
- b) removal or destruction of vegetation or topsoil or both to an extent where the land has been made susceptible to erosion;
- c) carrying out mining within a watercourse, waterway, wetland or lake;
- d) the submersion of areas by tailings or hazardous contaminant storage and dam/structure walls;
- e) temporary infrastructure, including any infrastructure (roads, tracks, bridges, culverts, dam/structures, bores, buildings, fixed machinery, hardstand areas, airstrips, helipads etc) which is to be removed after the mining activity has ceased; or
- f) releasing of contaminants into the soil, or underlying geological strata.

However, the following areas are not included when calculating areas of ‘disturbance’:

- a) areas off lease (e.g. roads or tracks which provide access to the mining lease);
- b) areas previously disturbed which have achieved the rehabilitation outcomes;
- c) by agreement with the administering authority, areas previously disturbed which have not achieved the rehabilitation objective(s) due to circumstances beyond the control of the mine operator (such as climatic conditions);
- d) areas under permanent infrastructure. Permanent infrastructure includes any infrastructure (roads, tracks, bridges, culverts, dam/structures, bores, buildings, fixed machinery, hardstand areas, airstrips, helipads etc) which is to be left by agreement with the landowner.
- e) disturbance that pre-existed the grant of the tenure.

‘EC’ means electrical conductivity.

‘effluent’ treated waste water released from sewage treatment plants.

'hazard category' means a category, either low significant or high, into which a dam is assessed as a result of the application of tables and other criteria in 'Manual for Assessing Hazard Categories and Hydraulic Performance of Dams'.

'infrastructure' means water storage dams, levees,, roads and tracks, buildings and other structures built for the purpose of the mining activity.

'land' in the 'land schedule' of this document means land excluding waters and the atmosphere, that is, the term has a different meaning from the term as defined in the *Environmental Protection Act 1994*. For the purposes of the *Acts Interpretation Act 1954*, it is expressly noted that the term 'land' in this environmental authority relates to physical land and not to interests in land.

'land use' –means the selected post mining use of the land, which is planned to occur after the cessation of mining operations.

'leachate' means a liquid that has passed through or emerged from, or is likely to have passed through or emerged from, a material stored, processed or disposed of at the operational land which contains soluble, suspended or miscible contaminants likely to have been derived from the said material.

'licensed place' means the mining activities carried out at the mining tenements detailed in Table # (page #) of this environmental authority.

'm' means metres.

'mine affected water':

- a) means the following types of water:
 - i) pit water, tailings dam water, processing plant water;
 - ii) water contaminated by a mining activity which would have been an environmentally relevant activity under Schedule 2 of the Environmental Protection Regulation 2008 if it had not formed part of the mining activity;
 - iii) rainfall runoff which has been in contact with any areas disturbed by mining activities which have not yet been rehabilitated, excluding rainfall runoff discharging through release points associated with erosion and sediment control structures that have been installed in accordance with the standards and requirements of an Erosion and Sediment Control Plan to manage such runoff, provided that this water has not been mixed with pit water, tailings dam water, processing plant water or workshop water;
 - iv) groundwater which has been in contact with any areas disturbed by mining activities which have not yet been rehabilitated;
 - v) groundwater from the mine's dewatering activities;
 - vi) a mix of mine affected water (under any of paragraphs i)-v) and other water.

- b) does not include surface water runoff which, to the extent that it has been in contact with areas disturbed by mining activities that have not yet been completely rehabilitated, has only been in contact with:
 - i) land that has been rehabilitated to a stable landform and either capped or revegetated in accordance with the acceptance criteria set out in the environmental authority but only still awaiting maintenance and monitoring of the rehabilitation over a specified period of time to demonstrate rehabilitation success; or
 - ii) land that has partially been rehabilitated and monitoring demonstrates the relevant part of the landform with which the water has been in contact does not cause environmental harm to waters or groundwater, for example:

- a. areas that are been capped and have monitoring data demonstrating hazardous material adequately contained with the site;
- b. evidence provided through monitoring that the relevant surface water would have met the water quality parameters for mine affected water release limits in this environmental authority, if those parameters had been applicable to the surface water runoff; or

iii) both.

'measures' includes any measures to prevent or minimise environmental impacts of the mining activity such as bunds, silt fences, diversion drains, capping, and containment systems.

'NATA' means National Association of Testing Authorities, Australia.

'natural flow' means the flow of water through waters caused by nature.

'non polluting' means having no adverse impacts upon the receiving environment.

'peak particle velocity (ppv)' means a measure of ground vibration magnitude which is the maximum rate of change of ground displacement with time, usually measured in millimetres/second (mm/s).

'protected area' means – a protected area under the *Nature Conservation Act 1992*; or

- a) a marine park under the *Marine Parks Act 1992*; or
- b) a World Heritage Area.

'receiving environment' in relation to an activity that causes or may cause environmental harm, means the part of the environment to which the harm is, or may be, caused. The receiving environment includes (but is not limited to):

- a) a watercourse;
- b) groundwater; and
- c) an area of land that is not specified in Schedule # – Table # (Authorised Activities) of this environmental authority.

The term does not include land that is specified in Schedule # – Table # (Authorised Activities) of this environmental authority.

'receiving waters' means the waters into which this environmental authority authorises releases of mine affected water.

'rehabilitation' the process of reshaping and revegetating land to restore it to a stable landform

'release event' means a surface water discharge from mine affected water storages or contaminated areas on the licensed place.

'RL' means reduced level, relative to mean sea level as distinct from depths to water.

'representative' means a sample set which covers the variance in monitoring or other data either due to natural changes or operational phases of the mining activities.

'saline drainage' The movement of waters, contaminated with salts, as a result of the mining activity.

'sensitive place' means:

- a) a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises; or
- b) a motel, hotel or hostel; or

- c) an educational institution; or
- d) a medical centre or hospital; or
- e) a protected area under the *Nature Conservation Act 1992*, the *Marine Parks Act 1992* or a World Heritage Area; or
- f) a public park or gardens.

Note: The definition of 'sensitive place' and 'commercial place' is based on Schedule 1 of EPP Noise. That is, a sensitive place is inside or outside on a dwelling, library & educational institution, childcare or kindergarten, school or playground, hospital, surgery or other medical institution, commercial & retail activity, protected area or an area identified under a conservation plan under *Nature Conservation Act 1992* as a critical habitat or an area of major interest, marine park under *Marine Parks Act 2004*, park or garden that is outside of the mining lease and open to the public for the use other than for sport or organised entertainment. A commercial place is inside or outside a commercial or retail activity.

A mining camp (i.e., accommodation and ancillary facilities for mine employees or contractors or both, associated with the mine the subject of the environmental authority) is not a sensitive place for that mine or mining project, whether or not the mining camp is located within a mining tenement that is part of the mining project the subject of the environmental authority. For example, the mining camp might be located on neighbouring land owned or leased by the same company as one of the holders of the environmental authority for the mining project, or a related company. Accommodation for mine employees or contractors is a sensitive place if the land is held by a mining company or related company, and if occupation is restricted to the employees, contractors and their families for the particular mine or mines which are held by the same company or a related company.

For example, a township (occupied by the mine employees, contractors and their families for multiple mines that are held by different companies) would be a sensitive place, even if part or all of the township is constructed on land owned by one or more of the companies.

'the Act' means the *Environmental Protection Act 1994*.

' μ S/cm' means micro siemens per centimetre.

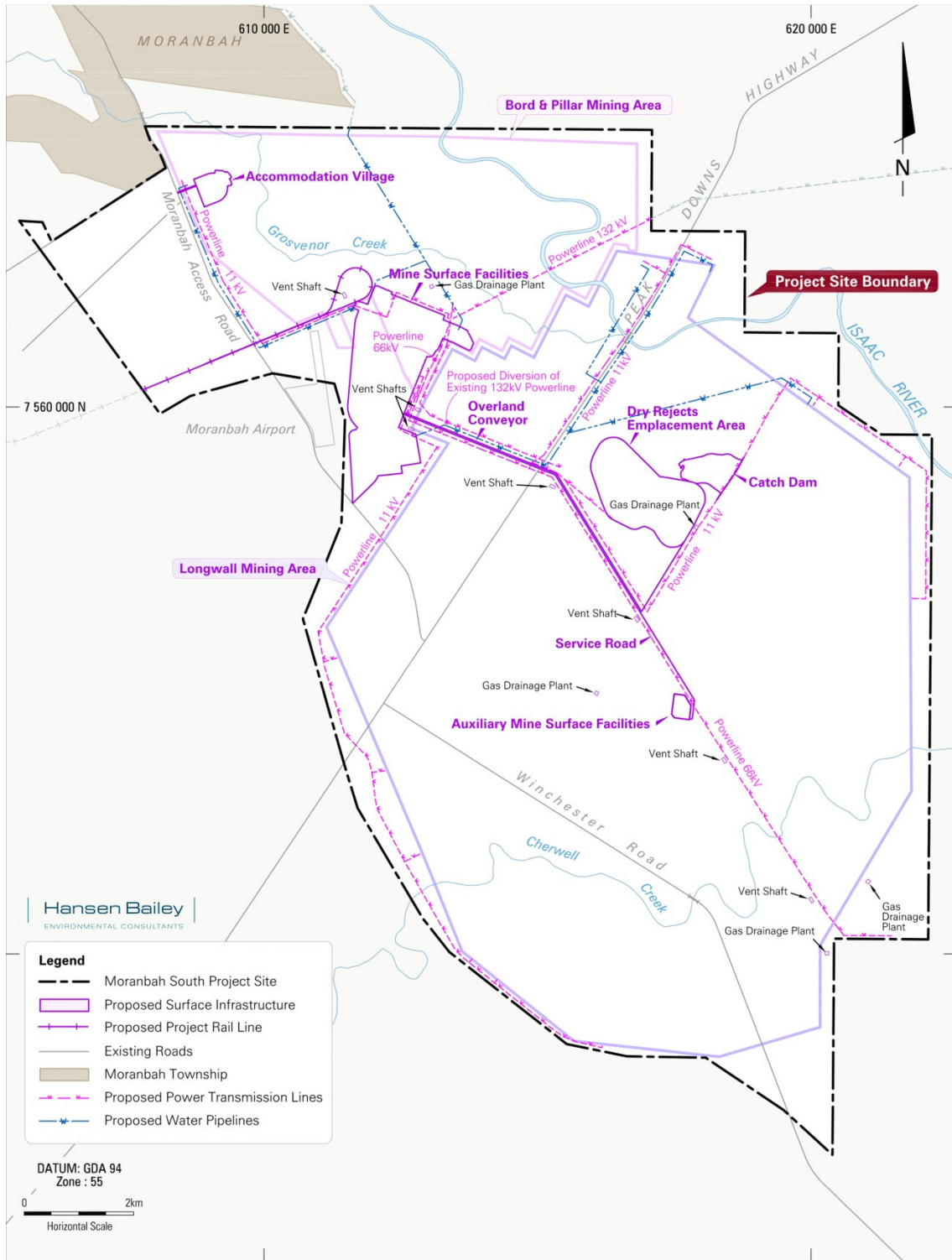
'watercourse' has the same meaning given in the *Water Act 2000*.

'water quality' means the chemical, physical and biological condition of water.

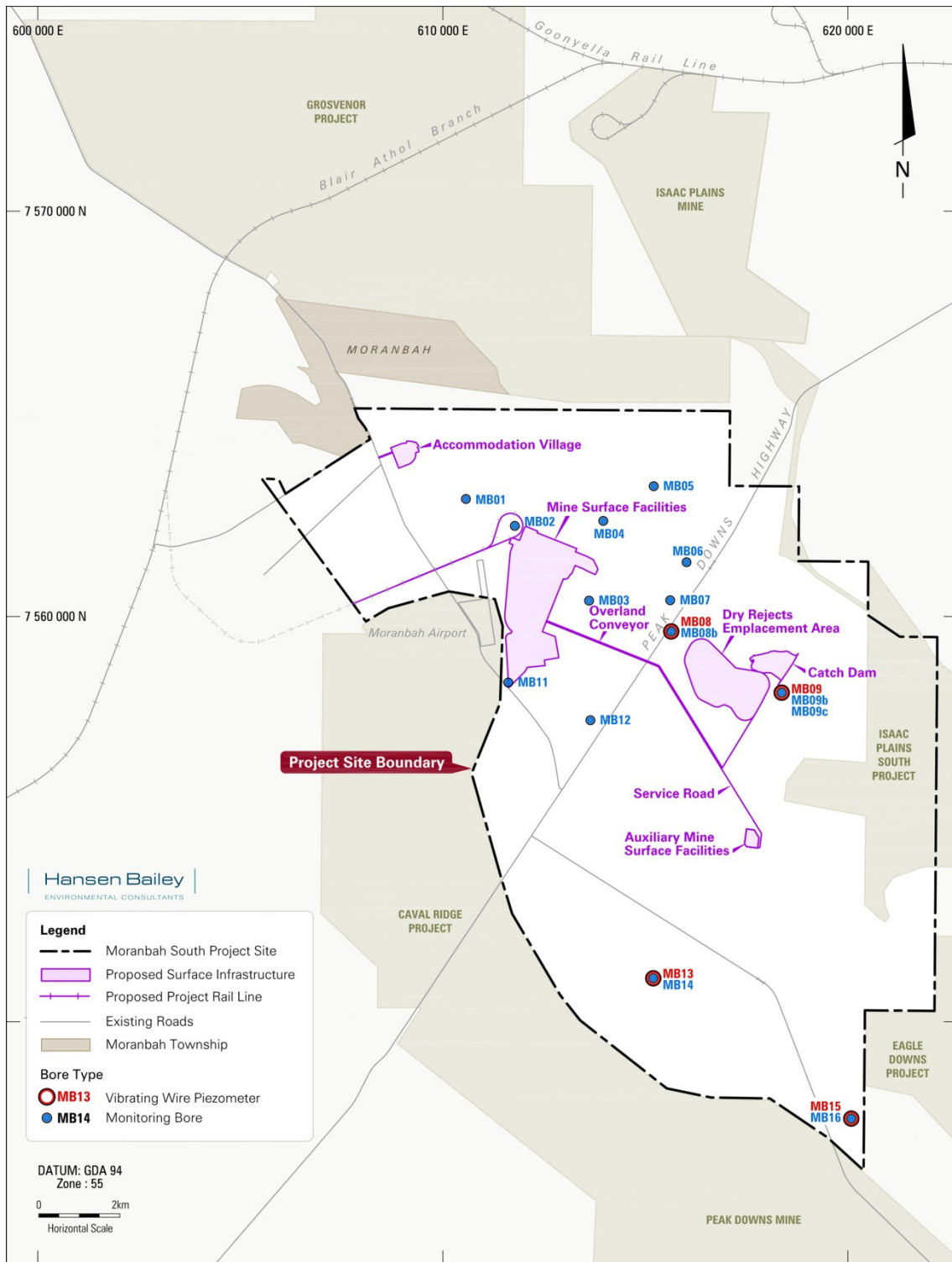
'waters' includes river, stream, lake, lagoon, pond, swamp, wetland, unconfined surface water, unconfined natural or artificial watercourse, bed and bank of any waters, dams, non-tidal or tidal waters (including the sea), storm water channel, storm water drain, and groundwater and any part thereof.

----- END of definitions

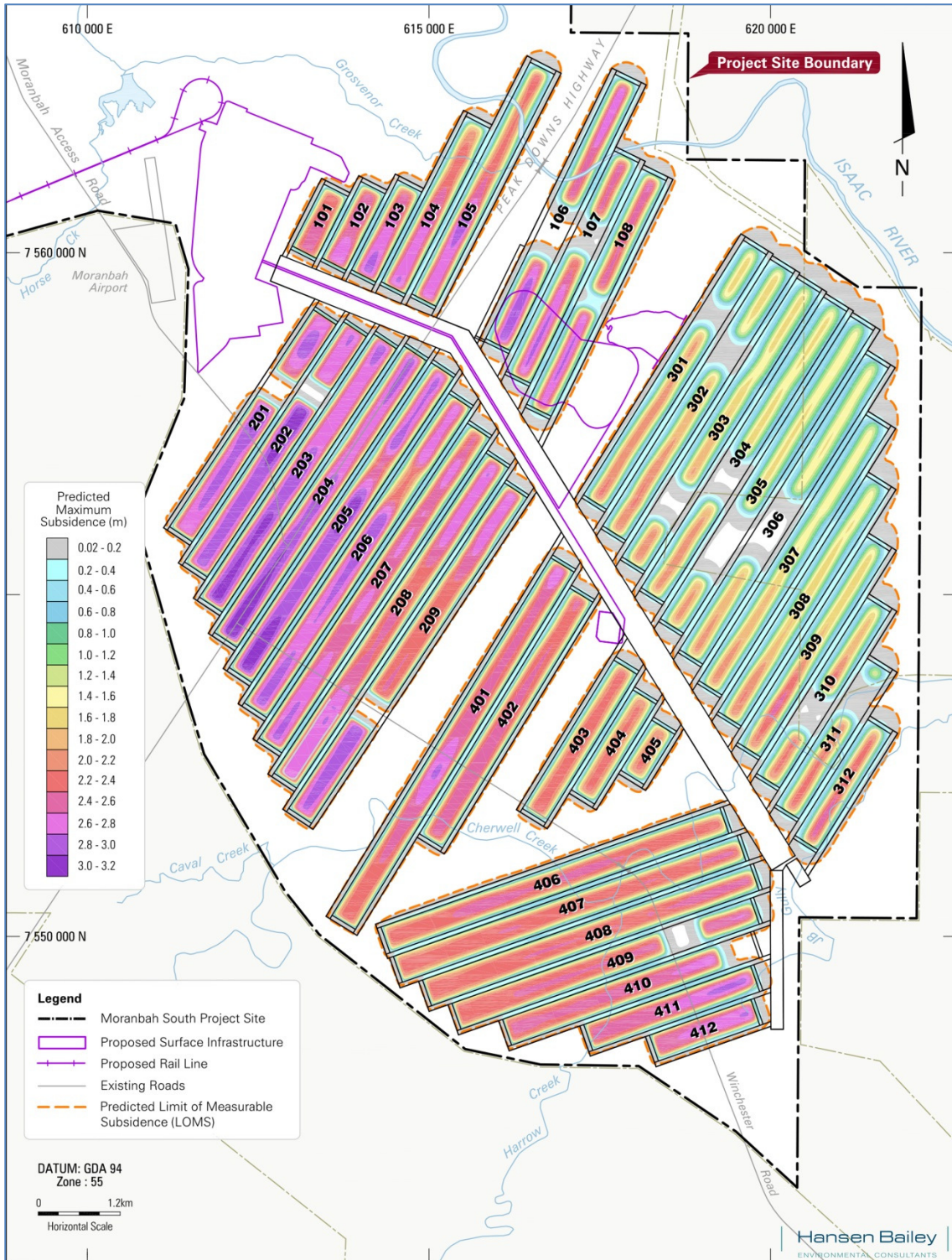
Attachment 1 –EA Figures



EA Figure 1 – Moranbah South Coal Mine: Project Layout (Source: EIS Figure 4-25)



EA Figure 2 – Groundwater monitoring bores (Source: EIS; Figure 11-1)



EA Figure 3 – Predicted subsidence impact area (Source: EIS Figure 6-2)

----- END of EA figures

Attachment 2: Subsidence guidance material

When to use

This appendix is to be used by the Environmental Authority (EA) holders in the preparation of a subsidence management plan (SMP) where a watercourse, as defined under the *Water Act 2000*, is to be impacted as a result of underground longwall mining. For a feature to be defined as a watercourse under Chapter 1, Part 2 of the *Water Act 2000*, the feature must possess particular characteristics. Watercourse determinations are regularly undertaken across Central Queensland by authorised departmental officers as it is the determining factor in the requirement for approvals under the *Water Act 2000*.

In addition, this appendix is to be used by the Department when providing advice and assessing subsidence management plans submitted by EA holders or proposed EA holders.

Purpose

The purpose of this appendix is to detail the information to be provided in a SMP and the legislative basis of the requirement for approval. The SMP forms the major reference document regarding subsidence impacts on watercourses as a result of underground longwall mining and is required to accompany proposals for watercourse subsidence.

The objective of the SMP is to ensure that the impacts of subsidence are properly managed. Where surface subsidence intersects a watercourse, it is important for the situation to be managed effectively to ensure no long-term maintenance is required within the watercourse, and to ensure that naturally occurring processes are not impaired.

A SMP should include the following information:

- location of proposed longwall panels and modelled subsidence effects on the watercourse
- pre-subsidence management of watercourses proposed to be subsided
- monitoring methods pre and post-subsidence to detect and document any impacts on watercourses
- post-subsidence management of impacted watercourses through remediation and rehabilitation
- agreed outcome for proposed future landscape between the Department and the EA holder.

Governing legislation

Historically, subsidence on mining leases has been managed under two separate Government Departments; the Environmental Protection Agency (EPA) and Natural Resources and Water (NRW). Under the former EPA, subsidence within mining leases was conditional to the EA holder's EA, however the impact on watercourses was not specifically addressed.

Now Departments are as one, regulation can be coordinated such as watercourse subsidence is authorised under specific conditions included in an EA issued under the *Environmental Protection Act 1994*. Works undertaken within the bed and banks of a watercourse aimed at mitigating or remediating any physical impacts pre or post-subsidence are also authorised under the conditions of the EA. This guideline has been developed to assist the Department and EA holders in undertaking a single collaborative process in the assessment and authorisation of proposals regarding subsidence of watercourses.

Environmental impact associated with mining activities is regulated under the *Environmental Protection Act 1994*. While this legislation does not identify longwall mining as a specific mining activity, it provides a definition of a 'mining activity' and 'environmental harm'. The process of longwall mining and resultant subsidence is governed by the legislation and authorised under a EA holder's EA.

The holder or holders of a mining tenement issued under the *Mineral Resources Act 1989* must hold an EA for the mining activities to be carried out on the tenement. When applying for an EA, a number of environmental management documents must be in place describing the proposed project and the management of any environmental impacts.

A Plan of Operations describes the actions and programs required to achieve compliance with the conditions of an EA. All activities carried out on a mining lease must be carried out in accordance with

the submitted Plan of Operations. A Plan of Operations describes an action program for complying with the conditions of the associated EA, contains a plan showing where all activities are to be carried out on the land, and includes a rehabilitation program for land disturbed or proposed to be disturbed.

Whilst management of subsidence will be included in the Plan of Operations, the subsidence management plan is a stand-alone document authorised under the conditions of the EA.

Background

Throughout the Bowen Basin, economically viable coal deposits frequently extend beneath watercourses. Consequently, underground mining operations targeting the associated coal seams often also extend beneath watercourses. Underground mining is not a new concept in the extraction of coal throughout the Bowen Basin. This form of mining is preferred when economical constraints reduce the feasibility of mining using open cut methods. Whilst coal deposits located beneath watercourses contribute to total extractable coal, more importantly, extraction of this coal facilitates underground mining activities to continue along a coal seam uninterrupted across both sides of a watercourse. This provides for a more cost effective extraction of coal that might otherwise be uneconomic to mine.

Technological improvements in underground mining methods have provided the ability to extract coal in areas previously inaccessible for mining. Modern day underground coal mining operations commonly utilise longwall mining techniques which allow extraction of more of the coal seam. Longwall mining allows access to the coal seam via a shaft, a decline or a highwall portal and system of underground workings, without the need to remove overburden. This technique is used to extract the coal seam via a series of “panels”, which can be hundreds of metres wide and kilometres in length. As the coal shearer removes the coal in the seam along the length of a panel, the overlying strata is collapsed behind, filling the void (goaf) left by the extracted coal. The collapse and settlement of the overlying strata can extend to the land surface above, resulting in localised lowering of the surface profile, and depressions in the landscape (commonly referred to as subsidence troughs).

Where a watercourse is located above a longwall panel, extraction of the coal seam causes subsidence of the panel can have a number of impacts on the watercourse. Some of these impacts include:

- lowering of bed and banks
- creation of in-stream waterholes
- changes to local drainage patterns
- incision processes
- stream widening
- erosion
- increased overbank flows due to lowering of the high banks
- tension cracking through both shallow and deeper underlying strata (including aquifers)
- root shear and loss of riparian vegetation
- changes to water quality (surface water and groundwater).

The degree of subsidence is generally a function of thickness of coal extracted, depth of overburden, strata type and panel width. The point of maximum subsidence generally occurs along the centreline of an extracted panel, whilst the pillar zones located between panels remain at natural surface level. Experience gained through widespread adoption of longwall mining processes in the Bowen Basin has seen advancement in the modelling and ability to predict the likely impacts of a subsidence event. This technology has also facilitated improved design and implementation of mitigation measures (engineered structures and associated earthworks) and highlighted potential short and long-term maintenance issues which may require specific management intervention.

Subsidence management plan

The objective of the SMP is to ensure that the impacts of subsidence are properly managed. Where surface subsidence intersects a watercourse, effective management is required to ensure no long-term maintenance is required within the watercourse, and to ensure that naturally occurring processes

are not unduly impaired. Consideration must be given for potential impacts on erosion, groundwater and surface water as a result of a proposed subsidence event.

A subsidence management plan must address the following issues:

1. *Description of pre subsidence situation & survey*

- i) A general description of the area pre subsidence including photographic record should be provided.
- ii) Survey of cross-section and longitudinal profiles should be undertaken on all watercourses with potential to be impacted through subsidence. Permanent transects should be detailed within the proposed subsidence management plan. Surveys should include the confluence with any other watercourses in the impacted area as well as any infrastructure spanning the watercourse. Surface drainage patterns should be investigated to determine current paths of water movement through the landscape. This path of water movement should be maintained where possible post-subsidence.

2. *Predicted subsidence*

The degree of anticipated subsidence should be provided, including the length of watercourse to be impacted and the average depth of subsidence across individual panels. The predicted subsidence should be modelled to indicate the change in surface elevations expected. The volumes of water expected to be captured within the bed of the watercourse due to creation of waterholes should be provided. Consequences of any lowering of the high banks of the watercourse should be discussed, including impacts associated with greater floodplain interaction and potential for creation of new channels.

3. *Infrastructure*

Prior to mining, the anticipated impacts from subsidence should be determined on all infrastructure located within or above the watercourse to be subsided along with measures to be implemented to mitigate any impacts. Priority should be given to infrastructure which provides services to external parties (other mines, towns, industry). Measures for dealing with any interruption to such services should be outlined. Relocation of infrastructure may be necessary should the proposed subsidence pose sufficient risk.

4. *Preventative works*

Where preventative measures are required to ensure the stability of the bed and banks of the watercourse (establishment of pile fields, exclusion of cattle, bentonite treatment) these should be discussed in the subsidence management plan, including supporting evidence outlining the legitimacy of such works. These works may be required where self-repair by natural processes will not provide adequate remediation of impacted areas. Where there is potential for root shear to result in significant loss of riparian vegetation, mitigation measures may be required.

5. *Engineered structures*

Engineered works may be required to maintain the stability and function of a watercourse impacted by subsidence. These works are often constructed prior to subsidence occurring within the watercourse. Such works can include timber pile fields, rock revetment, reshaping of existing stream banks, and river bed treatment to prevent increased ingress of surface water into underground aquifers. Where subsidence mitigation measures require engineered structures be installed, the design, monitoring and maintenance of these structures should be detailed in the subsidence management plan. The plan should detail the purpose of each structure and any consequences should the structure fail to be installed. Appropriate design plans including the location of each structure will be required. As a minimum, fourth and fifth order watercourse will require the installation of engineered structures. Works undertaken within the bed and banks of a watercourse aimed at mitigating or remediating any physical impacts pre or post-subsidence are authorised under the conditions of the Environmental Authority. Where a separate report has been produced for engineered structures, this should be included as an appendix to the subsidence management plan.

6. *Erosion*

The subsidence management plan should detail the current watercourse condition to be impacted by subsidence. Identification of erosion zones which are likely to be exacerbated through tension cracking should be stabilised using appropriate methods. Such areas may include reaches with elevated rates of bed and bank erosion, access tracks and areas with poor quality, sparsely populated riparian vegetation. Sufficient riparian vegetation should be established prior to subsidence to assist with initial stabilisation of the bed and banks. Removal of grazing animals to allow establishment or recovery of riparian vegetation may be required for an extended period prior to subsidence.

7. *Groundwater*

Where groundwater aquifers exist beneath the mine plan area, investigations should be undertaken regarding the potential for impacts on these aquifers as a result of subsidence. The subsidence management plan should discuss these aquifers, any anticipated impacts on each aquifer and proposed measures for mitigating these impacts. Any anticipated movement of surface water into underlying aquifers should be discussed, as this can result in loss of surface water from the system and impacts on water quality in these aquifers. Geotechnical assessment across the bed and banks of the watercourse should be undertaken to provide an indication of potential permeability issues related to sub-surface cracking and interaction with local groundwater tables. Monitoring bores should be established in each aquifer prior to subsidence and monitored for a period of time sufficient for obtaining background water levels and trends. Monitoring of these bores should continue post-subsidence to aid the detection of impacted aquifers.

8. *Surface water*

i) *Baseline monitoring*

The subsidence management plan should detail baseline condition monitoring of all watercourses likely to be impacted through subsidence. The preferred monitoring assessment technique for stream condition in the Bowen Basin is the Index of Diversion Condition. This methodology was established as a result of the Australian Coal Association Research Program (ACARP) Project C9068. Monitoring of watercourses should extend a minimum of 1km upstream and downstream of the proposed area to be impacted and should include a geomorphic assessment of the entire reach. Where a baseline monitoring assessment has been undertaken as part of an Environmental Impact Statement (EIS) process, this may be considered sufficient provided there has been no subsequent modification or interference to the watercourse. The condition of riparian vegetation should also be detailed.

ii) *Cumulative impacts on watercourses*

With an increasing number of mines being established in close proximity to watercourses, an EA holder utilising longwall mining methods may be requested to investigate the cumulative impact of these activities on the watercourse.

Monitoring and reporting requirements

The following criteria have been developed to provide detailed direction regarding monitoring and reporting requirements associated with subsidence of watercourses.

These criteria are outlined in a four step approach:

- monitoring
- assessment
- reporting
- mitigation

Monitoring

Representative sites need to be identified that allow the impacts of subsidence to be assessed in a particular watercourse with particular attention to the following:

- Sites must be located at all pillar zones intersecting a watercourse or tributary.

- Sites must include representative locations at the interface of natural ground level and observed changes in surface elevation from subsidence within a watercourse.
- Control sites beyond proposed mining extents should be established to verify pre-mining conditions. In watercourses, the sites should extend a minimum of 1km both upstream and downstream of the subsidence reach.
- Assessment of watercourse condition: Specific monitoring assessment techniques for watercourse condition should include but not be limited to the Index of Diversion Condition, as outlined in the ACARP Project C9068.
- Vegetation and ecological condition assessments should form part of the baseline dataset.
- Rainfall monitoring should be undertaken within areas proposed to be impacted by subsidence. In addition, flow event monitoring should occur in watercourses proposed to be impacted by subsidence. The type of monitoring devices and locations to be installed should be detailed in the subsidence management plan.
- Where preventative works are undertaken pre-subsidence, subsequent monitoring assessments should include the integrity and effectiveness of these works in reducing the impact of subsidence within the watercourse.
- Surveys must include cross-sectional area and bed slope throughout all monitored reaches of impacted watercourses.
- Annual aerial photography and Digital Terrain Mapping is required to verify predicted subsidence surface profiles, and to identify potential short and long-term erosion issues resulting from subsidence of watercourses.
- Surveys pre-subsidence should quantify the following features within watercourses:
 - pool/riffle sequences
 - bed controls
 - entry points of other watercourses and localised tributaries
 - existing bed and bank scour points
 - infrastructure located within the watercourse.
- Surveys post-subsidence should quantify any changes to the pre-mining conditions including:
 - erosion or deposition processes that have occurred as a result of subsidence,
 - migration of head cut erosion within watercourses and tributaries,
 - localised changes to stream bed slope,
 - localised widening of channels,
 - destabilisation of stream bed and banks including fracturing and incision,
 - localised changes to bank heights
 - size of subsidence void created within the watercourse.
- The subsidence monitoring program for groundwater must include the following information:
 - Sites must include representative locations at the interface of natural ground surface and observed changes in surface elevation from subsidence.
 - Monitoring bores should be established in each aquifer at each monitoring site.
 - Monitoring must include both water level measurements and water quality sampling in accordance with the following:
 - water level measurement to be taken quarterly
 - water quality field conductivity measurement to be taken 6 monthly
 - full chemical analysis of water samples to be taken annually.

Frequency of Monitoring

A proposed timeframe should be provided by the EA holder in relation to the monitoring outlined in the subsidence management plan. The Department, upon review of the proposed subsidence management plan will determine a suitable monitoring timeframe based on the information provided. Monitoring requirements will depend on a number of factors, including the stream order of the watercourse proposed to be impacted. As a guide:

Stream Order 1, 2 and 3

Monitoring must be undertaken at the following intervals:

- immediately prior to subsidence,
- within two (2) months of the initial subsidence,
- following a rainfall event of **1 in 2 year** ARI for the duration equal to the time of concentration for the catchment at the location of the subsidence.
- following a peak flow event of greater than a **1 in 2 year** ARI and
- annually.

Stream Order 4 and higher

Monitoring (including surveys) must be undertaken at the following intervals:

- immediately prior to subsidence,
- within two (2) months of the initial subsidence,
- following a rainfall event of **1 in 5 year** ARI for the duration equal to the time of concentration for the catchment at the location of the subsidence.
- following a peak flow event of greater than a **1 in 5 year** ARI, and
- annually.

Cumulative Impacts

Where subsidence is proposed in a subsidence management plan, and the watercourse has already been subsided upstream or downstream, the monitoring assessment must determine not only the localised impacts on the watercourse resulting from the proposed subsidence, but also any cumulative impacts on the watercourse as a result of all other subsidence events.

Assessment

The design and assessment of engineered structures should be performed by a Registered Professional Engineer of Queensland (RPEQ). All other assessments should be performed by suitably qualified and experienced persons in the fields that they are assessing.

- The results of all monitoring activities should be reviewed by an appropriately qualified person and detailed in the associated monitoring report.
- Recommendations should be made after assessment of the results regarding any specific treatment, remediation works, or engineered structures required post-subsidence to achieve stability in the watercourse.

Reporting

An annual report will be requested by the administering authority post-subsidence. The report should detail mining activities and all monitoring and rehabilitation activities as outlined within the subsidence management plan. The reporting date will be determined in consultation with the administering authority.

- A monitoring report should contain the results of all monitoring activities, the assessment of these results, and recommendations for any remedial works required. The report should comment on the following:
 - watercourse condition and geomorphic processes
 - the condition of vegetation in riparian zones

- examination of pillar zones in watercourses with particular attention to potential for tension cracking
- the creation of in-stream waterholes
- any impacts on groundwater.
- Where preventative works were undertaken pre-subsidence, subsequent monitoring assessments should include assessment of the integrity and effectiveness of these works in mitigating the impacts of subsidence.
- An annual report in the form of two (2) hard copies and one electronic copy shall be furnished to the administering authority. The report should in addition to addressing specific monitoring requirements provide comment on:
 - the current state of the groundwater and surface water resources
 - any impacts on these features
 - any remedial works required to be undertaken including a timetable for implementation
 - commitment from the EA holder to addressing the recommendations in the report.

Mitigation

Where recommendations are made regarding specific treatment, remediation works, or engineered structures required post-subsidence to achieve stability in the watercourse, the EA holder must ensure this work is undertaken.

Rehabilitation

The holder of the EA, if directed by the administering authority, will carry out additional remedial works deemed necessary to minimise the impacts of subsidence on the physical integrity of the watercourse.

Relinquishment

Relinquishment of monitoring and rehabilitation responsibilities conditional under a EA holder's EA can only occur after the subsidence and approved mitigation and rehabilitation measures have been subjected to a suitable range of rainfall and flow events, and are deemed by the administering authority to be in a stable and functional condition. Any request for relinquishment will be negotiated with the administering authority and will require a submission containing monitoring data demonstrating stability and functionally in the watercourse over a suitable range of rainfall and flow events.

Acknowledgement

In 2007, BMA and Anglo Coal instigated discussions with the Department into a proposed assessment on the cumulative impacts of longwall mining beneath the Isaac River in Central Queensland. A final report was produced by Alluvium Consulting in July 2009 documenting the outcomes of the study. The Department greatly acknowledges the findings from this report and the assistance provided in the development of this guideline.

R Lucas, J Crerar, R Hardie, J Merritt and B Kirsch, 2009. Isaac River Cumulative Impact Assessment of Mining Developments. Report by Alluvium Consulting. ACARP for Diversion assessment guideline ex C9068

----- END of subsidence guidance material

Appendix 3—Listed threatened ecological communities and species information for MNES

The following profiles for listed threatened ecological communities and species impacted by the project were collated from information provided in the EIS and subsequent EIS Addendum; information provided by specialists from the Queensland Department of Environment and Heritage Protection and the Queensland Herbarium; as well as information provided by the Australian Government Department of the Environment.

This information is prepared for the Commonwealth Environment Minister in order to give appropriate information to help the Commonwealth Environment Minister make informed decisions on the potential impacts of matters of national environmental significance (MNES) for the proposed Moranbah South Project.

Recommendations are provided based on the impacts as identified within the EIS and the assessment of the project by the state. However, the Commonwealth Department of the Environment has not yet completed the assessment of this project and is yet to determine the acceptability of identified impacts to MNES.

LISTED THREATENED ECOLOGICAL COMMUNITIES

Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin

- **EPBC Act listing status:** Endangered
- **Recovery plan:** A recovery plan has not been prepared for this community
- **Conservation advice:** Approved by the Commonwealth Environment Minister on 15/12/08

Description

The natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin threatened ecological community (natural grassland TEC) are native grasslands typically composed of perennial native grasses. The grasslands usually occur on flat ground or gently undulating rises with fine-grained, cracking clay soils that are often deep and dark in colour, although soils may be shallower on ridges or sloping land. The soils are derived from basalt or fine-grained sedimentary rocks, or where this material has been transported to form extensive alluvial plains along ancient and flood-prone watercourses.

The natural grassland TEC is mostly dominated by bluegrass (*Dichanthium sericeum*). Tropical three-awned grasses (*Aristida* species) and panic grasses (*Panicum* species) are also a major part of the grasslands. Drier sites may have more Mitchell grasses (*Astrelba* species). Native perennial grass indicator species for this community are *Aristida leptopoda*, *Astrelba elymoides*, *Astrelba squarrosa*, *Eriochloa crebra*, *Panicum queenslandicum*, *Thellungia advena*, *Aristida latifolia*, *Astrelba lappacea*, *Bothriocloa erianthoides*, *Dichanthium sericeum*, *Panicum decompositum* and *Paspalidium globoideum*. Shrubs are typically sparse. However, in some areas the cover of shrubs, such as sally wattle (*Acacia salicina*) and mimosa (*Acacia farnesiana*), can be more extensive.

These tussock grasslands are considered to be one of the most threatened ecosystems in Australia. They continue to be threatened by conversion of native pastures to improved pastures, cropping and overgrazing by stock. The grasslands provide habitat for threatened species such as king bluegrass (*Dichanthium queenslandicum*).

Distribution

This ecological community occurs entirely within Queensland within the Brigalow Belt North and

Brigalow Belt South Interim Biogeographic Regionalisation for Australia (IBRA) bioregions and within the Fitzroy Basin, Burdekin, South West Qld, Border Rivers Maranoa-Balonne and Desert Channels Natural Resource Management regions. It extends from Collinsville in the north to Carnarvon National Park in the south.

Listing criteria

For a grassland community to qualify as the listed community, it has to contain the following key diagnostics and meet certain condition thresholds:

- The grassland has to occur in one of the following subregions of the northern Brigalow Belt bioregion, namely the Northern Bowen Basin, the Anakie Inlier, the Basalt Downs, the Isaac-Comet Downs, the Nebo-Connors Range and the South Drummond Basin.
- Trees need to be absent or sparse such that the projective foliage cover of trees is less than 10%.
- To be of best quality, the grassland patch size must be at least 1ha, there must be at least 4 perennial native grass indicator species present, the total projective foliage cover of shrubs must be less than 30%, and perennial non-woody introduced species must make up less than 5% of the total perennial projective foliage cover.
- For the ecological community to be present and considered to be of good quality, the patch size needs to be at least 5ha, there needs to be at least 3 perennial native grass indicator species present, the total projective cover of shrubs less than 50%, and the perennial non-woody introduced species must make up less than 30% of the total perennial projective foliage cover.

Conservation advice, priority recovery and threat abatement actions

The priority recovery and threat abatement actions required for the natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin ecological community (as stated in the conservation advice approved by the Commonwealth Environment Minister on 15/12/2008) are identified below:

Habitat loss, disturbance and modification

- Monitor known occurrences to identify key threats or the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.
- Identify occurrences of high conservation priority.
- Undertake survey work in potential habitat to locate remnants.
- Avoid mowing and slashing during peak flowering season from spring to summer.
- Ensure chemicals or other mechanisms used to eradicate weeds do not have a significant adverse impact on the ecological community.
- Ensure road widening and maintenance activities (or other infrastructure or development activities) in areas where the ecological community occurs minimise adverse impacts on known sites.
- Investigate and implement formal conservation arrangements such as the use of covenants, conservation agreements or inclusion in reserve tenure.

Invasive weeds

- Develop and implement management plans for the eradication of weeds such as parthenium (*Parthenium hysterophorus*), parkinsonia (*Parkinsonia aculeata*), prickly acacia (*Acacia nilotica* subsp. *indica*) and buffel grass (*Cenchrus ciliaris*).
- Manage sites to prevent introduction of invasive weeds, which could become a threat to the ecological community, using appropriate methods.
- Observe appropriate state protocols to avoid the spread of weeds. Implement good hygiene measures for mowing and grading equipment and take appropriate steps to avoid dispersing seeds when moving stock.

- Maintaining a good cover of native perennial grasses and spelling the grasslands from grazing are reliable methods of managing the risk of weed invasion.

Trampling, browsing or grazing

- Grazing management should focus on maintaining a good cover of perennial grasses and legumes, especially the most palatable species and carrying vegetation cover through the driest years.
- Develop and implement a stock management plan for roadside verges and travelling stock routes.
- Manage known sites on private property to ensure appropriate cattle and sheep grazing regimes are conducted outside the growing season, i.e. when plants are not fertile.
- Provide and/or promote incentives for good management.
- Where possible, use an intermittent grazing regime in preference to burning. Avoid burning (or grazing or slashing) during peak flowering season (spring to summer).

Animal predation or competition

- Develop and implement management plans for the control of the house mouse (*Mus* sp.).

Survey requirements and survey effort

EPBC survey requirements/techniques

- Sites must be assessed during a good season, within two months of cessation of disturbance (fire/grazing/mowing/slashing) and within two months of effective rainfall.
- Key diagnostic characteristics for recognising the natural grassland TEC:
 - within the distribution of the TEC
 - tree canopy absent or sparse
 - ground layer dominated by perennial native grasses and contains at least three of the indicator native species listed.

Project survey effort

The field survey was undertaken in areas of mapped regional ecosystems (REs) that comprise the natural grassland TEC.

The field survey was undertaken in optimal conditions within two months of effective rainfall. It was impractical to remove grazing from the areas of natural grassland. However, grazing pressure was relatively light and was not expected to unduly affect the results of the assessment.

EHP considers the method and survey effort for natural grasslands to be adequate.

Occurrence within the project area

The natural grassland TEC was represented by the following REs within the project area:

- RE 11.3.21 (*Dichanthium sericeum* and/or *Astrebla* spp. grassland on alluvial plains with cracking clay soils)
- RE 11.4.4 (*Dichanthium* spp., *Astrebla* spp. grassland on Cainozoic clay plains)
- RE 11.8.11 (*Dichanthium sericeum* grassland on Cainozoic igneous rocks)
- RE 11.9.3 (*Dichanthium* spp. and *Astrebla* spp. grassland on fine-grained sedimentary rocks).

Areas of these REs that were field validated for the EIS were considered to be components of the natural grassland TEC. The occurrence of RE 11.4.4 and RE 11.9.3 was limited to a small area of each. Both of these REs were found to be infiltrated by buffel grass and numerous herbaceous weeds due to their small size and large edge to area ratio. These areas were assessed as representative of good quality natural grassland TEC.

The distribution of RE 11.3.21 was restricted to a broad overland drainage corridor in the central

eastern portion of the project site. The majority of this community was found to satisfy the criteria for best quality natural grassland. Infiltration of perennial herbs and grasses was recorded more frequently in the south-eastern and western extent of RE 11.3.21 and these communities were considered to be representative of good quality natural grasslands TEC.

RE 11.8.11 represented approximately 95% of the natural grassland TEC mapped within the project site. RE 11.8.11 was recorded within the central and southern parts of the project site and was found to have variable composition and condition. Shrubby regrowth vegetation and high weed cover were more prevalent in central occurrences located to the south of the Peak Downs highway, on the lower slopes and broad colluvial fan of the low basalt rise that dominate the central portion of the project site. Increased levels of weeds were also observed in patches of RE 11.8.11 in the southern and northern portions of the project site. These areas were considered to be representative of good quality natural grasslands TEC.

Patches of RE 11.8.11 in the central portions of the project site were generally found to have a high level of diversity, low level of weed cover, low woody vegetation cover, and threatened grassland flora species were present. These areas were considered to be representative of best quality natural grasslands TEC.

The total area of natural grassland TEC within the project site was estimated to be approximately 1240ha.

Potential impacts and mitigation measures

The EIS concluded that the natural grassland TEC within the project area could be impacted by:

- clearing for the construction of surface infrastructure including mine surface facilities and the Dry Rejects Emplacement Area (DREA)
- clearing for power line and pipeline construction, and for seismic survey activities
- weed invasion
- erosion and sediment deposition associated with altered surface hydrology
- dust deposition.

Approximately 70% of the surface facilities disturbance would occur in areas that have been previously cleared. Clearing would be carried out in a manner that limits the disturbance to the minimum area possible. The EIS stated that the biggest impacts from subsidence, in the form of cracking and ponding, would likely occur in the north-western and southern areas of the longwall panels where there are minor areas of grassland.

General mitigation measures proposed in the EIS that are relevant to the natural grassland TEC were detailed in Table 14 in section 4.19 of this EIS assessment report. Key mitigation measures proposed by the proponent to address potential impacts to natural grasslands would be the implementation of a pest animal and weeds management plan, a subsidence management plan, rehabilitation management plan and an erosion and sediment control management plan, as well as the collection of king bluegrass and *D. setosum* seed for the purposed of rehabilitation.

Residual impacts

An estimated 343ha of natural grassland TEC would be directly impacted by proposed infrastructure development for the project, mainly for surface facilities and the DREA. EHP's assessment found that of the remaining 892ha of natural grassland TEC located in the project site, 294ha are found within the longwall mining area. However, the proponent concluded in its assessment that of these, only 2ha of natural grassland TEC would be impacted due to surface crack rehabilitation following subsidence. Clearing for power lines, pipelines, and seismic surveys was not included in this estimate as the impact was stated to be minor and temporary, with rehabilitation within one year of disturbance.

EHP accepted the residual impact assessment for the surface infrastructure, and the clarification received in the amended EIS (Appendices J and K) in terms of the likely subsidence impacts from cracking, cracking remediation and drainage remediation (refer to section 4.19.8 of this report for more information). The proponent estimated that, over a period of 27 years, only 2ha of natural grassland TEC would be impacted through rehabilitation of subsidence cracking and stated that

progressive rehabilitation would occur to ensure that there would be no significant residual impacts on natural grasslands as a result of these works.

Offsets

The EIS assessed the potential impacts on the natural grassland TEC against the MNES Significant Impact Guidelines and concluded that the project would result in the clearing of approximately:

- 343ha of natural grassland TEC for the construction of surface infrastructure including the mine surface facilities and DREA.

The proponent proposed a land-based offset and provided information on four potential offset properties which:

- would be located within the Northern Brigalow Belt bioregion (the same bioregion as the project) and would be properties identified in the Galilee Basin Offset Strategy.
- would contain large areas of natural grassland TEC (based on certified Queensland RE mapping).
- were identified through the EPBC Act protected matters search tool as containing king bluegrass or king bluegrass habitat.

The proponent proposed to enter into formal discussions with the owners of the potential offset properties in order to obtain agreement to undertake field surveys once approval under the EPBC Act was obtained for the project. This would enable the biodiversity offset strategy to be finalised and an offset management plan to be prepared for approval by the Commonwealth Environment Minister.

The proponent further stated that the offset management plan would include details of the management methods that would be put in place for the offset properties to achieve appropriate conservation outcomes, such as the management of grazing pressures, pests, weeds and fire. The offset management plan would also describe the agreed monitoring and reporting procedures for the offset properties to ensure regulatory compliance. Refer to section 4.19.5 of this report for more information.

EHP recommendations

- *For the purpose of clearing for infrastructure, the person taking the action must not clear more than 343ha of natural grassland TEC from the project area.*
- *Given that the background land use of most of the project site is grazing and this land use is not controlled by the proponent, it would be advisable for the proponent to reach agreement with the landholders to ensure that the proposed mitigation measures are successful. The management of grazing is a critical determinant of the success of disturbance minimisation, rehabilitation, subsidence management and weed control. The proponent must clearly define how the grazing land use would be managed in line with their mitigation measures. EHP considers that these mitigation measures would be adequate to ensure that the natural grassland TEC outside the surface infrastructure footprint within the non-mining area and subsidence area would be maintained.*

Brigalow (*Acacia harpophylla* dominant and co-dominant)

- **EPBC Act listing status:** Endangered
- **Recovery plan:** A recovery plan has not been prepared for this community
- **Conservation advice:** Approved by the Commonwealth Environment Minister on the 17th December 2013

Description

The Brigalow (*Acacia harpophylla* dominant and co-dominant) threatened ecological community (brigalow TEC) is characterized by the presence of brigalow (*A. harpophylla*) as one of the three most abundance tree species. Brigalow is usually dominant in the tree layer or co-dominant with other species such as *Casuarina cristata* (belah), other species of acacia or species of eucalyptus. Occasionally belah, or species of acacia or eucalyptus, may be more common than brigalow within the broad matrix of brigalow vegetation. The structure of the vegetation ranges from open forest to open woodland. The height of the tree layer varies from about 9m in low rainfall areas (averaging around 500mm per annum) to around 25m in higher rainfall areas (averaging around 750mm per annum). A prominent shrub layer is usually present.

Brigalow flowers spasmodically and seeds generally remain viable for less than a year with germination and establishment requiring good rainfall during what is traditionally the driest time of the year. Brigalow trees sucker easily from their roots and re-sprout after damage as long as the root stocks remain intact. Brigalow and many of the shrub and tree species associated with brigalow are capable of re-sprouting after low to moderate intensity fire damage. Brigalow and belah are tolerant of saline conditions and brigalow is extremely drought tolerant.

Fauna species associated with the brigalow TEC rely on a range of attributes in the vegetation for habitat. These include litter and woody debris on the forest floor (especially important for reptiles), tree hollows and pockets under the bark of large trees (roost sites for various birds and mammals, including bats), and mistletoes and other sources of nectar, seeds and fruit (food for birds including belah seed for the vulnerable glossy black-cockatoo).

Distribution

The brigalow TEC extends from south of Townsville in Queensland to northern New South Wales. In Queensland, the brigalow TEC occurs predominantly within the Brigalow Belt North, Brigalow Belt South and Southeast Queensland bioregions, with smaller amounts in the Mulga Lands bioregion.

The brigalow TEC has undergone a severe decline in extent due to clearing for agricultural use. At the time of listing under the EPBC Act (April 2001), information supporting the nomination estimated an original extent of 7,324,560 hectares (7,020,360ha in Queensland and 304,200ha in New South Wales) with approximately 804,264ha (661.314ha in Queensland and 142,950ha in New South Wales) remaining (approximately 10% of original extent).

Listing criteria

The brigalow TEC is limited to patches that meet the following key diagnostic characteristics and condition thresholds:

The patch must have the following diagnostic characteristics to be considered a brigalow ecological community:

- the presence of *A. harpophylla* as one of the most abundant tree species in the patch. *A. harpophylla* is either dominant in the tree layer, or co-dominant with other species; and
- in the Brigalow Belt, meets the description of one of 16 REs: REs 11.3.1, 11.4.3, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.5.16, 11.9.1, 11.9.6, 11.11.14 and 11.12.21; and/or
- the vegetation in the patch is brigalow regrowth with species composition and structural elements broadly typical of one of the identified REs and at least 15 years since last comprehensively cleared.

With the condition threshold:

- the patch is 0.5ha or more in size; and
- the exotic perennial plants comprise less than 50% of the total vegetation cover of the patch, as assessed over a minimum sample area of 0.5ha, representative of the patch.

Conservation advice, priority recovery and threat abatement actions

There are no threat abatement plans in place for the brigalow TEC.

The priority recovery and threat abatement actions required for the brigalow TEC (based on the conservation advice approved by the Commonwealth Environment Minister on 17/12/2013) are summarised below:

Threat reduction/control

- Protect remnant and regrowth areas and nearby native vegetation including buffer zones and connecting corridors.
- Where clearance is unavoidable, mitigate the severity of impacts by: avoiding higher quality areas, avoiding fragmentation, minimising hydrological disruption, minimising the spread of weeds, and by providing offsets relevant to the location and quality of affected patches.
- Manage areas of brigalow TEC to reduce threats, including through:
 - fire management that considers brigalow conservation, protection and ecological heterogeneity
 - targeted weed control (e.g. spot application of herbicides, rather than aerial spraying) with a particular focus on high biomass exotic grasses (buffel grass, Rhodes grass, green panic grass)
 - coordinated feral animal control (foxes, cats and pigs)
 - avoiding fertiliser application
 - minimising tree thinning and soil disturbance
 - managing grazing pressure
 - encouraging a shrubby understorey.

Land management

- Encourage landholders to balance primary production and the conservation of native flora and fauna within and close to the brigalow TEC through measures such as:
 - managing stocking rates, grazing practices and livestock camp sites to avoid damage to woodland understorey and ground cover
 - leaving trees, or clumps of regrowth, in paddocks to maintain connections between patches of native flora and fauna habitat
 - connecting shade-lines to one another and keeping them as wide as possible (ideally more than 100m)
 - avoiding the application of fertiliser, or the aerial/broadscale spraying of herbicides
 - leaving dead trees standing and allowing dead timber and leaf litter to rot.
- Undertake regeneration of high value regrowth sites and revegetation of degraded sites.
- Increase the area of brigalow TEC managed for conservation.
- Establish adequate buffer zones to protect remnants.
- Develop and implement water management, sediment erosion and pollution control and monitoring plans.

Management for wildlife

- Undertake management actions that help to increase the diversity of species and their abundance with consideration of habitat use at various scales, including:
 - retaining fallen timber and leaf litter for small mammals and reptiles
 - retaining standing dead trees or old trees with hollow limbs for nesting sites for birds, mammals and reptiles
 - re-introducing microhabitat features (e.g. rocks, logs and other woody debris) to disturbed sites
 - discouraging species like noisy miners and introduced predators by maintaining large patches of woodland with complex structure
 - avoiding clearing remnant vegetation; and retaining areas of brigalow regrowth
 - encouraging woodland regeneration close to areas of existing woodland.

Survey requirements and survey effort*EPBC Act survey requirements/techniques*

There are no specific guidelines for survey for the brigalow TEC. However, brigalow is identifiable at all times of the year.

Project survey effort

Field surveys were undertaken in the areas mapped as containing regional ecosystems that comprise the brigalow TEC, using the methods for survey and mapping of regional ecosystems in Neldner *et al.* (2005). Surveys for the brigalow TEC included a total of 18 ecological equivalence assessment sites, two secondary sites, 30 tertiary sites and 52 quaternary sites within REs 11.9.5, 11.8.13, 11.4.9 and 11.4.8.

For the purpose of the assessment of the whole of project impacts, EHP considers that the methods used to estimate the extent of brigalow TEC within the project site were adequate. However, the proponent has not provided adequate data, in terms of spatial data for mapped communities and survey site locations, and photographs, to allow EHP to conclusively accept the revised mapping.

Occurrence within project area

The following remnant and regrowth REs associated with brigalow TEC were identified as occurring within the project area based on published RE mapping (EHP 7 January 2013) and surveys for the EIS:

- RE 11.4.8 (*Eucalyptus cambageana* open forest with *Acacia harpophylla* or *Acacia argyrodendron* on Cainozoic clay plains)
- RE 11.4.9 (*Acacia harpophylla* shrubby open forest with *Terminalia oblongata* on Cainozoic clay plains)
- RE 11.9.5 (*Acacia harpophylla* and/or *Casuarina cristata* shrubby open forest on fine-grained sedimentary rocks)
- RE 11.3.1 *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains
- brigalow regrowth greater than 15 years old.

The brigalow TEC in the project area occurs as fragmented remnants and possibly regrowth, often with a heavily disturbed ground layer due to cattle grazing. Vegetation communities representative of REs 11.3.1, 11.4.8 and 11.4.9 were subject to field validation for the EIS. RE 11.3.1 was recorded from three small patches fringing Cherwell Creek and its tributaries in the south of the project site within the longwall mining area. RE 11.4.8 was only recorded from one area in the southern portion of the project site. RE 11.4.9 occurs throughout the project site as areas of remnant and regrowth vegetation, including heavily degraded areas with high levels of canopy dieback.

The EIS estimated the combined area of brigalow TEC, comprising REs 11.3.1, 11.4.8 and 11.4.9, to

be 425ha (147ha of remnant vegetation and 278ha of high value regrowth). Most sites were described as being in poor condition, with a high ground cover of exotic plant species (e.g. >50% ground cover of the exotic buffel grass). The EIS identified that much of the tree layer in the REs surveyed had severe dieback although no evidence of mechanical or chemical treatment was reported.

The Queensland Herbarium regards tree dieback as a common landscape drought phenomenon and even though it was found widespread across the project area, it may not signify non-remnant status (pers. comm. H. Dillewaard, Queensland Herbarium). The average rainfall in the project site is 610mm per annum indicating that a tree canopy height of over 9m could be expected for remnant brigalow REs (based on typical tree layer height of 9m in areas receiving 500mm annual rainfall). Of the 52 sites surveyed for the EIS, 30 sites had a tree canopy average height of 9m or higher.

Based on the information provided in the EIS, EHP considers that there would probably be a greater proportion of remnant brigalow community within the project site than was shown in the revised RE mapping presented in the EIS, and therefore a greater extent of the brigalow TEC. As a consequence of this discrepancy, EHP requested that the proponent undertakes a review by the Queensland Herbarium in order to verify the proponent's revised RE mapping and field survey data for remnant and regrowth brigalow REs. This would confirm the extent of brigalow TEC based on the extent and condition of the brigalow REs. Until the required information has been submitted and verified by the Queensland Herbarium, the mapping of the brigalow TEC presented in the EIS cannot be accepted by EHP (refer to sections 4.18.2 and 4.18.6 of this assessment report for a more information). At the time of finalising the EIS assessment report, the ground-truthed data has not been officially certified or accepted by the Queensland Herbarium.

Potential impacts and mitigation measures

The project would directly impact on the brigalow TEC through clearing for surface infrastructure. The proposed clearing includes patches of remnant vegetation within the footprint of proposed surface facilities as well as narrow corridors for proposed power lines, pipelines and other linear infrastructure. The EIS stated that clearing of brigalow communities would result in the removal of only the smaller and more isolated patches in the north of the project site in an already highly fragmented area. The widely spaced canopy trees of the majority of vegetation to be disturbed would preclude significant edge effects, given the existing disturbance to ground cover and shrub vegetation from exotic species and cattle grazing.

Underground longwall mining would result in surface subsidence and localised surface tension cracks and ground displacement within the limit of measurable subsidence. The EIS stated that the majority of the subsided area would be unaffected by surface cracking and this was supported by modelling and by subsidence monitoring data from nearby mines (refer to section 4.18.6 of this assessment report). Surface cracks would likely occur within a few weeks of an area being longwall mined and were anticipated to be up to 0.3m wide, although larger cracks could occur in isolated locations. Depending on the thickness of the near surface strata layers, the soil type and mining depth, surface cracking could extend to depths in the order of 5m to 10m. The exact location of surface cracks can only be confirmed through monitoring.

Surface cracking would not necessarily impact on vegetation communities but larger cracks would readily erode if not remediated. Rehabilitation of cracks may impact on vegetation but could be managed to minimise impacts. Brigalow TEC is located within the limit of measurable subsidence and would potentially be affected by subsidence (surface cracking and pooling of water in depressions) and by crack and drainage rehabilitation works.

The proponent estimated that 200–400ha of the project site would be subject to subsidence in any one year and that only small areas would experience subsidence surface cracking and ponding. The EIS stated that this impact would be short term and temporary based on proposed monitoring and rehabilitation. The EIS stated that it would be possible to gain access to areas for subsidence crack repair without any need to clear large trees as the majority of the project site is cleared grazing land, open woodland or grassland. Proposed rehabilitation of surface cracks and drainage would impact on narrow strips (typically 2–3m wide and up to 50m long for crack remediation, and on average 8m wide with variable length for drainage works). The proponent accounted for impacts from subsidence cracking and ponding, and associated remediation actions in Appendices J and K of the Response to Submissions.

The proponent provided a commitment to avoid disturbance to brigalow TEC, where practicable,

when laying out source lines and receiver lines during the seismic survey. Where brigalow TEC could not be avoided, hand clearing would be undertaken with subsequent mechanical works only used if required to make the area safe for personnel and equipment. EHP accepts the EIS assessment that most of the brigalow TEC within the project site is in poor condition and currently exposed to several threats including:

- increased susceptibility to fire due to elevated fuel loads associated with exotic pasture grass infiltration
- predation and trampling caused by livestock and pigs
- reduced ability to contend with exotic flora infiltration due to a large edge to area ratios
- an observed increase in extreme weather events.

The project would directly impact the brigalow TEC through:

- clearing for surface infrastructure
- further fragmentation of remnants and associated species populations
- potential impacts associated with the decline in the viability of remnants due to changes in ecosystem function (e.g. fragmentation and edge effects).

Project activities may further degrade the condition of the brigalow TEC and interfere with ecological function through dust deposition, lighting, noise, spread and invasion of pest flora and fauna species, changes to the fire regime (due to an increase in ground cover fuel load as a result of reduced grazing), and changes to surface water flow associated with subsidence and sedimentation.

Mitigation and management measures proposed in the EIS relevant to the brigalow TEC are listed in Table 17 of section 4.19.4.4 in this report. EHP considers that the methods used to determine the potential disturbance were acceptable and provided a reasonable assessment of the maximum likely impact of the project on the brigalow TEC.

Residual impacts

The proponent estimated that 11 ha of brigalow TEC would be permanently impacted by clearing for construction of surface infrastructure, and mainly for linear infrastructure such as roads and electricity transmission lines.

The subsidence related impacts on the brigalow TEC were detailed and supported by an additional study which predicted additional impacts on brigalow communities of approximately 1 ha relating to crack remediation and 0.09 ha relating to drainage remediation over the proposed 27 year life of the mine.

Impacts from clearing brigalow TEC for seismic surveys was proposed to be limited and temporary through use of hand clearing.

EHP is of the view that the level of impact from the surface infrastructure clearing is acceptable, and that the residual impact following rehabilitation of seismic survey lines, and surface cracking and ponding of water following subsidence, would be minor. Any changes to the mapped extent of brigalow TEC that could result from review of survey data by the Queensland Herbarium would not significantly change the assessed level of potential impact. As the brigalow TEC is already highly fragmented and disturbed, it is unlikely that edge effects resulting from clearing would increase the existing threats to the remnants.

Offsets

The proponent did not propose to offset residual impacts to the brigalow TEC on the basis that the relatively small area proposed to be cleared or disturbed, in conjunction with proposed mitigation measures, would not be a significant impact.

LISTED THREATENED FLORA SPECIES

***Dichanthium queenslandicum* (king bluegrass)**

- **EPBC Act listing status:** Vulnerable (at the time of the EPBC decision; now endangered)
- **Recovery plan:** A recovery plan has not been prepared for this species
- **Conservation advice:** Approved by the Commonwealth Environment Minister on 30/01/2013

Description

The king bluegrass (*Dichanthium queenslandicum*) is a perennial grass, growing to 80cm tall. Its culms are solitary or rarely branched, erect, glabrous, smooth with a single groove, 4-5 noded; with nodes prominently hairy. Leaf sheaths are hirsute with the hairs arising from wart-like projections. Inflorescences are single racemes of paired spikelets to 10cm long. Sessile spikelets are bisexual, dorsally compressed, and straw-coloured to pale mauve. Pedicelled spikelets are male and straw-coloured to pale mauve.

Distribution

King bluegrass occurs within the South Eastern Queensland, Brigalow Belt South, Brigalow Belt north, Central Mackay Coast, Desert Uplands, Mitchell Grass Downs and Einasleigh Upland bioregions.

The distribution of this species overlaps with the following EPBC Act listed threatened ecological communities:

- brigalow (*A. harpophylla* dominant and co-dominant)
- weeping myall woodlands
- natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland
- natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin.

Conservation advice, priority recovery and threat abatement actions

The conservation advice for king bluegrass is very similar to that for natural grasslands. The priority recovery and threat abatement actions required for king bluegrass (based on the conservation advice approved by the Commonwealth Environment Minister) are summarised below:

Habitat loss, disturbance and modification

- Monitor known populations to identify key threats.
- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.
- Identify populations of high conservation priority.
- Ensure there is no disturbance in areas where king bluegrass occurs, excluding necessary actions to manage the conservation of the species/ecological community.
- Investigate formal conservation arrangements, management agreements and covenants on private land, and for crown and private land investigate and/or secure inclusion in reserve tenure if possible.
- Manage other known, potential or emerging threats, including mining practises, grazing, weed invasion and climate change.

Invasive weeds

- Develop and implement a management plan for the control of parthenium and parkinsonia in king

bluegrass habitat.

- Ensure chemicals or other mechanisms used to eradicate weeds do not have a significant adverse impact on king bluegrass.

Trampling, browsing or grazing

- Develop and implement a stock management plan for roadside verges and travelling stock routes.

Conservation information

- Raise awareness of king bluegrass within the local community by, for example, distributing of fact sheets/information brochures or conducting field days in conjunction with known industry or community interest groups.
- Encourage private landholders and land managers to contribute to the implementation of conservation management actions.
- Support recovery of additional sites and/or populations.
- Undertake appropriate seed collection and storage.
- Investigate options for linking or enhancing populations.
- Implement national translocation protocols, if establishing additional populations is considered necessary and feasible.

Survey requirements and survey effort

EPBC survey requirements/techniques

- There are no specific guidelines for survey timing or requirements; however, grasses are best surveyed in the late summer/early autumn following the wet season when grasses are in seed allowing positive identification of species.

Project survey effort

- Field surveys were undertaken in optimal condition following substantial rainfall events over the wet season.
- This species was surveyed using quantification quadrats through laying a 100m fibreglass tape and then having two ecologists walk a 5m wide corridor on both sides of the tape. Where threatened grasses were found to be present, the number of tussocks observed was counted. A total of 70 quantification quadrats were conducted.

EHP considers the survey method and effort to be adequate for this species.

Occurrence in the project site

King bluegrass was recorded within the project site. A total of 70 quantification quadrats were sampled within field-validated natural grassland communities (RE 11.8.11) that were found to support this species. The species was not recorded throughout all natural grassland areas, tending to be concentrated on more elevated areas of the project site above 220m AHD. These elevated grassland habitat areas were considered in the EIS to be high value habitat for king bluegrass covering an area of approximately 415ha within the project site. Due to the variability in density and distribution of the population, the proponent could not determine a firm population estimate.

Potential impacts and mitigation measures

The proposed infrastructure footprint would directly impact on approximately 11 of the 124 locations where king bluegrass was recorded within the 105ha of high value habitat on the project site. The proponent estimated that approximately 100,000 tussocks of this species would be removed out of approximately 1 million predicted to occur on the project site, resulting in an approximate 10% reduction in the population size of king bluegrass in the project site.

Clearing of 105ha of the 415ha of high value habitat mapped for this species is proposed for the construction of surface infrastructure. The potential area of impact on king bluegrass habitat resulting

from ponding and surface cracking and associated remediation works following subsidence was estimated to be approximately 2.2ha of high value habitat over the proposed 27 year mine life. The clearing of this species and its high value habitat would be a long-term and permanent impact. The clearing would likely result in an increase in fragmentation and edge effects for the species. Mitigation and management measures proposed by the proponent are listed in

Table 17 of section 4.19.4.4 in this report. The project site was found to be located within a highly modified grazing landscape where weeds (such as parthenium and buffel grass were abundant), and other introduced plants and some feral predators were present. The project would have the potential to introduce and facilitate the establishment and expansion of populations of pest species. The proponent proposed to develop and implement a pest animal and weed management plan to ensure that such would not threaten EPBC Act listed species and threatened ecological communities.

The proponent also proposed to investigate opportunities to harvest king bluegrass seed for the purpose of rehabilitation.

Residual impacts

The estimated area of residual impact would be 105ha of high value habitat; constituting approximately 100,000 tussocks of king bluegrass. It was concluded in the EIS that the 100,000 tussocks within the high value habitat constitute an important source of king bluegrass population for breeding and/or dispersal of the species. Hence, the proponent concluded that, based on the MNES Significant Impact Guidelines, the proposed project would have the potential to significantly impact on the king bluegrass population in the area. Potential impacts on the king bluegrass within the subsidence area from ponding and cracking and the remediation of these impacts were estimated to be minor with approximately 2.2ha of high value habitat to be impacted over a 27 year mine life.

Offsets

The EIS assessed the potential impacts on king bluegrass against the MNES Significant Impact Guidelines and concluded that the project would result in the clearing of approximately:

- 105ha of high value king bluegrass habitat for the construction of surface infrastructure including the mine surface facilities and DREA.

The proponent proposed a land-based offset and provided information on four potential offset properties which:

- would be located within the Northern Brigalow Belt bioregion (the same bioregion as the project) and would be properties identified in the Galilee Basin Offset Strategy
- would contain large areas of natural grassland TEC (based on published and certified Queensland RE mapping)
- were identified through the EPBC's protected matters search tool as containing king bluegrass or king bluegrass habitat.

Once EPBC approval has been obtained for the project, the proponent stated that it would enter into formal discussions with the owners of the potential offset properties in order to obtain agreement to undertake field surveys. This would enable the biodiversity offset strategy to be finalised and an offset management plan to be prepared, which would require approval from the Commonwealth Environment Minister.

The proponent further stated that the offset management plan would include details of the management methods that would be put in place for the offset properties to achieve appropriate conservation outcomes, such as the management of grazing pressures, pests, weeds and fire. The offset management plan would also describe the agreed monitoring and reporting procedures for the offset properties to ensure regulatory compliance. Refer to section 4.19.5 of this report for more information.

EHP recommendations

- *For the purpose of clearing for infrastructure, the person taking the action must not clear more than 105ha of high value king bluegrass habitat from the project area.*
- *EHP highly commends the proponent's proposed mitigation measure of collecting king bluegrass seeds. This should ideally occur in the areas that would be cleared for surface infrastructure and in areas where drainage and surface cracking remediation would be required.*
- *In order to achieve the best possible conservation outcomes for the survival of king bluegrass on the project area, EHP recommends that the proponent negotiate with the background landholders to ensure that their grazing practises do not compromise the mitigation measures proposed in a manner not inconsistent with EPBC's conservation advice for the king bluegrass (see above).*

***Dichanthium setosum* (bluegrass)**

- **EPBC Act listing status:** Vulnerable
- **Recovery plan:** A recovery plan is not required for this species
- **Conservation advice:** Approved by the Commonwealth Environment Minister on 26 March 2008. The threatened species Scientific Committee agreed that this species was eligible to be retained as vulnerable on 3 June 2010.

Description

Dichanthium setosum is an upright perennial grass less than 1 m tall. It has mostly hairless leaves about 2–3 mm wide. The flowers are densely hairy and clustered together along a stalk in a cylinder shape and appear mostly during summer. The species can form pure swards or occur as scattered clumps.

Distribution

D. setosum occurs in NSW on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes, and in Queensland, it has been reported from the Leichhardt, Morton, North Kennedy and Port Curtis regions.

D. setosum is associated with heavy basaltic black soils and stony red-brown hard-setting loam with clay subsoil and is found in moderately disturbed areas such as cleared woodland, grassy roadside remnants, grazed land and highly disturbed pasture. The extent to which this species tolerates disturbance is unknown.

The distribution of this species overlaps with the following EPBC Act listed TECs:

- semi-evergreen vine thickets of the Brigalow Belt
- the community of native species dependent on natural discharge of groundwater from the Great Artesian Basin
- bluegrass (*Dichanthium spp.*) dominant grasslands of the Brigalow Belt bioregions
- brigalow (*Acacia harpophylla* dominant and co-dominant)
- white box-yellow box-Blakely red gum grassy woodland and derived native grassland
- upland wetlands of the New England Tablelands and the Monaro plateau.

Conservation advice, priority recovery and threat abatement actions

The priority recovery and threat abatement actions required for *D. setosum* (based on the conservation advice approved by the Commonwealth Environment Minister) are summarised below:

Habitat loss, disturbance and modification

- Identify populations of high conservation priority.
- Manage threats to areas of vegetation that contain populations or occurrences of *D. setosum*.
- Ensure chemicals or other mechanisms used to eradicate weeds do not have a significant adverse impact on *D. setosum*.
- Ensure infrastructure or development activities in areas where *D. setosum* occurs do not adversely impact on known populations.
- Investigate formal conservation arrangements such as the use of covenants, conservation agreements or inclusion in reserve tenure.

Invasive weeds

- Develop and implement a management plan for the control of introduced grasses, such as coolatai, African lovegrass and lippia.

Trampling, browsing or grazing

- Develop and implement a stock management plan for roadside verges and travelling stock routes.

Fire

- Develop and implement a suitable fire management strategy for *D. setosum*.
- Identify appropriate intensity and interval of fire to promote seed germination.
- Provide maps of known occurrences to rural fire services and seek inclusion of mitigation measures in bush fire risk management plans, risk registers and/or operation maps.

Conservation information

- Raise awareness of *D. setosum* within the local community, particularly among landholders.

Survey requirements and survey effort*EPBC survey requirements/techniques*

There are no specific guidelines for survey timing or requirements for *D. setosum*. However, grasses are best surveyed in the late summer/early autumn following the wet season when in seed allowing positive identification of species.

Project survey effort

Field surveys were undertaken in optimal conditions following substantial rainfall events over the wet season.

The species occurrence and density was surveyed using quantification quadrats through laying a 100m fibreglass tape and then having two ecologists walk a 5m wide corridor on both sides of the tape. Where threatened grasses were found to be present, the number of tussocks observed was counted. A total of 70 quantification quadrats were conducted.

EHP considers the survey methods and effort to be adequate for this species.

Occurrence within the project site

The EIS stated that *D. setosum* occurred as isolated tussocks and small clumps in natural grassland areas; usually in association with king bluegrass and in natural grassland >230m Australian height datum. The proponent estimated that the project site supports a population of at least 2000 tussocks of *D. setosum*. Similar to the king bluegrass, the EIS was not able to provide a firm population estimate for this species due to the patchy distribution and density of this species and the size of the natural grassland community on the project site. 310ha of high value habitat were mapped for this species in the project site.

EHP considers the population of *D. setosum* within the project site to be important due its size and location in the northern part of the known distribution of the species.

Potential impacts and mitigation measures

Mitigation and management measures proposed by the proponent are listed in Table 17 of section 4.19.4.4 in this report.

Design of surface facilities was undertaken by the proponent to minimise direct disturbance to bluegrass habitat. Additionally, the location of linear infrastructure was sited so as to avoid as many tussocks as possible. The EIS identified that the proposed infrastructure footprints would directly impact on one of the 36 known locations of *D. setosum* in the project site along a proposed conveyor and service road corridor just south of Peak Downs Highway in the centre of the project site. Clearing of 48ha (within which only one tussock of *D. setosum* was located) was proposed to accommodate surface infrastructure. Potential impacts on *D. setosum* within the subsidence area from ponding and cracking and the remediation of these impacts were estimated to be approximately 2.2ha of high value habitat over the proposed 27 year mine life.

Residual impacts

The proposed project would impact on 48ha of high value *D. setosum* habitat through clearing for infrastructure and on 2.2ha of high value habitat as a result of surface crack and drainage remediation following subsidence. The clearing for infrastructure would directly impact only one of the 36 known locations of *D. setosum* within the project site and the habitat that would be affected contained a very low density of the species.

The proponent did not consider the likely impact on the population of *D. setosum* to be a significant impact having regard to the MNES Significant Impact Guidelines.

EHP accepts the conclusion drawn in the EIS that the residual impact to *D. setosum* habitat would not likely constitute a significant impact.

Offsets

No offsets were proposed for the removal of high value *D. setosum* habitat within the project area.

EHP recommendations

- *EHP considers that the proponent's proposed mitigation measures of implementing a weed management plan would be adequate.*
- *In order to achieve the best possible conservation outcomes for the survival of *D. setosum* on the project area, EHP recommends that the proponent negotiate with the background landholders to ensure that their grazing practises do not compromise the mitigation measures proposed in a manner not inconsistent with EPBC's conservation advice for *D. setosum* (see above).*

LISTED THREATENED FAUNA SPECIES

***Rostratula australis* (Australian painted snipe)**

- **EPBC Act listing status:** Vulnerable (at the time of the EPBC decision; now endangered)
- **Recovery plan:** A recovery plan has not been prepared for this species
- **Conservation advice:** Approved by the Commonwealth Environment Minister on 30/05/2013

Description

The Australian painted snipe is a stocky wading bird around 220–250mm in length with a long pinkish bill. The adult female, more colourful than the male, has a chestnut-coloured head, with white around the eye and a white crown stripe, and metallic green back and wings, barred with black and chestnut. There is a pale stripe extending from the shoulder into a V down its upper back. The adult male is similar to the female, but smaller and duller with buff spots on the wings.

Distribution

The Australian painted snipe (*Rostratula australis*) is usually found in shallow inland wetlands, either freshwater or brackish, that are either permanently or temporarily filled. It is a cryptic bird that is hard to see and often overlooked. Usually only single birds are seen, though larger groups of up to 30 have been recorded. It nests on the ground amongst tall reed-like vegetation near water, and feeds near the water's edge and on mudflats, taking invertebrates, such as insects and worms, and seeds.

Although the Australian painted snipe can occur across Australia, the areas of most sensitivity to the species are those wetlands where the birds frequently occur and are known to breed. It has always only occurred in limited numbers in Australia, but substantial declines in numbers have been noted since European settlement, in particular, over the last 30–50 years.

Conservation advice, priority recovery and threat abatement actions

The priority recovery and threat abatement actions required for the Australian painted snipe (based on the conservation advice approved by the Commonwealth Environment Minister) are summarised below:

Habitat loss, disturbance and modification

- Develop management guidelines for breeding and non-breeding habitat.
- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.
- Ensure there is no disturbance in areas where the species is known to breed, excluding necessary actions to manage the conservation of the species.
- Control access routes to suitably constrain public access to existing and future breeding sites on public land.
- Control and manage access to habitat on private land and other land tenure.
- Minimise adverse impacts from land use at known sites.
- Manage any changes to hydrology that may result in changes to water table levels, run-off, salinity, algal blooms, sedimentation or pollution.
- Manage any disruptions to water flows.
- Investigate formal conservation arrangements, management agreements and covenants on private land, and for crown and private land investigate/secure inclusion in reserve tenure if possible.
- Manage any other known, potential or emerging threats including inappropriate fire regimes and

coastal port/infrastructure development.

Invasive weeds

- Implement the Parkinsonia Strategic Plan (Commonwealth of Australia, 2000).
- Identify and remove weeds in wetland areas that could become a threat to the Australian painted snipe, using appropriate methods.
- Ensure chemicals or other mechanisms used to eradicate weeds do not have a significant adverse impact on the Australian painted snipe.

Trampling, browsing or grazing

- Develop and implement a stock management plan for roadside verges and travelling stock routes which include swamps, marshes or wetlands.
- If livestock grazing occurs in known Australian painted snipe habitats, encourage land owners/managers to use an appropriate management regime and density that does not detrimentally affect Australian painted snipe nesting.
- If appropriate, manage total grazing pressure at important breeding sites through exclusion fencing or other barriers.

Animal predation or competition

- Implement the national threat abatement plans for the European red fox (*Vulpes vulpes*) and feral cats (*Felis catus*) to control the adverse impacts of these pest species.

Fire

- Develop and implement a suitable fire management strategy for the habitat of the Australian painted snipe.

Conservation information

- Raise awareness of the Australian painted snipe within the local community and the importance of reporting observations to BirdLife Australia, using fact sheets and/or brochures.
- Advertise and encourage use of Australian painted snipe survey techniques and survey forms.
- Organise field days with industry and interest groups to raise awareness and share information on the species. These groups may include natural resource management groups, catchment management authorities, Indigenous groups, conservation organisations, local and state governments, and private landholders.
- Engage with private landholders and land managers responsible for the land on which populations occur and encourage these key stakeholders to contribute to the implementation of conservation management actions.
- Raise awareness of banded individuals to increase the likelihood of re-sighting and reporting.
- Facilitate the exchange of information between interested parties, including sightings, research and management approaches.

Survey requirements and survey effort

EPBC survey requirements/techniques

- Area searches or transects through suitable wetlands; detection by sighting and flushing.
- Targeted stationary observations at dawn and dusk of suitable foraging locations within wetlands; detection by sighting.
- Brief spotlight searching shortly after dusk may detect birds.
- To date, trials of broadcast (playback) have not been successful.
- Required survey effort for an area of 50ha:
 - A total of 10 hours of targeted stationary observations over five days, or

- 10 hours land-based area or transect searches over three days.
- Some modification to survey effort is required for larger sites with consideration to be given to the variety of landforms and vegetation types present.
- Surveys should be conducted when wetlands hold water but are not flooded.

Project survey effort

The survey included approximately 28 person hours of land based bird surveys. A further 300 hours were spent on-site recording birds opportunistically.

The majority of the sites were considered unsuitable habitat for the Australian painted snipe which has very specific habitat requirements. The field survey targeted areas that were considered to be suitable habitat for this species, such as wetland areas.

EHP considers the survey method and effort to be adequate to establish the population of this species in the project site.

Occurrence within the project site

One pair of the Australian painted snipe was confirmed to be present in the project site during field surveys. It was recorded at a large dam in the south of the project site. The other wetland areas within the project site (farm dams, watercourses and small areas of seasonal wetland REs) provide suitable habitat for this species. 83ha of high value habitat was mapped to occur within the project site. This habitat comprised REs 11.5.3, 11.5.17 and 11.3.27 along with a large farm dam where the species was recorded and a large dam to the east of the northern quarry. 246ha of low value habitat was also mapped, including other farm dams on the site and gilgai areas without fringing vegetation.

Potential impacts and mitigation measures

The EIS stated that only a relatively small area of high value habitat would be affected by the project and that this disturbance would not lead to long-term disruption, fragmentation or reduction of any populations that may be present. None of the high value habitat areas for this species were located within the proposed infrastructure footprint. Potential subsidence impacts, such as local ponding and changes in surface flow regimes, would have the potential to cause local disruption to breeding and foraging activities and loss of some small areas of habitat.

Residual impacts

The proponent concluded that the project would be unlikely to result in a significant impact to Australian painted snipe habitat, on the basis that the habitat within the project site does not represent significant or critical habitat for any of the species, and the potential impact on habitat was predicted to be minor and short term.

EHP accepts the conclusion drawn in the EIS that the residual impact to Australian painted snipe habitat would not constitute a significant impact.

Offsets

No offsets were proposed for potential impacts to the Australian painted snipe or its habitat.

***Geophaps scripta scripta* (squatter pigeon; southern)**

- **EPBC Act listing status:** Vulnerable
- **Recovery plan:** A recovery plan has not been prepared for this species
- **Conservation advice:** Approved by the Commonwealth Environment Minister on 3/7/2008

Description

The squatter pigeon (southern; *Geophaps scripta scripta*) is a medium-sized (approximately 30cm long) ground-dwelling pigeon. Adults of both sexes are mostly grey-brown with black and white stripes on the face and throat, iridescent green or violet patches on the wings, a blue-grey lower breast and white flanks and lower belly.

Distribution

The squatter pigeon (southern) occurs from the Burdekin-Lynd divide in central Queensland, west to Charleville and Longreach, east to the coast from Prosperine to Port Curtis, and south to scattered sites in south-eastern Queensland. The subspecies, which is suspected to occur as a single, contiguous breeding population, mostly inhabits grassy woodlands and open forest dominated by eucalypts. The squatter pigeon (southern) is considered to be resident in at least some parts of its range, but also appears to undertake some local movements.

Conservation advice, priority recovery and threat abatement actions

The priority recovery and threat abatement actions required for the squatter pigeon (based on the conservation advice approved by the Commonwealth Environment Minister) are summarised below:

Habitat loss, disturbance and modification

- Monitor known populations to identify key threats.
- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.
- Identify populations of high conservation priority.
- Manage threats to areas of vegetation that support important populations of the squatter pigeon (southern).
- Protect populations of the listed subspecies through the development of covenants, conservation agreements or inclusion in reserve tenure.

Trampling, browsing or grazing

- Develop and implement a stock management plan for key sites.
- Develop and implement a management plan, or nominate an existing plan to be implemented, for the control and eradication of feral herbivores in areas inhabited by the squatter pigeon (southern).

Animal predation or competition

- Implement the appropriate recommendations outlined in the threat abatement plan for predation by feral cats and the threat abatement plan for predation by the European red fox in areas inhabited by the squatter pigeon (southern).

Conservation information

- Raise awareness of the squatter pigeon (southern) within the local community, particularly among land managers.

Survey requirements and survey effort

EPBC Act survey requirements/techniques

- Area searches or transect surveys in suitable habitat with flushing surveys.
- Survey effort for an area of 50ha:
 - A total of 15 hours of area searches or transect searches over three days, or
 - 10 hours of flushing surveys over three days.
- Some modification of survey effort is required for larger sites with consideration to be given to the variety of landforms and vegetation types present.

Project survey effort

The surveys of the project site included approximately 28 person hours of area search bird surveys. A further 300 hours were spent on-site recording birds opportunistically. The field survey targeted areas that were considered to be possible suitable habitat for this species, such as woodlands and natural grasslands.

EHP considers the survey method and effort used for the EIS to be adequate to establish the population of this species in the project site.

Occurrence within project area

The squatter pigeon (southern) was confirmed to be present in the project site during field surveys conducted for the EIS. The squatter pigeon was recorded from six locations across the central and southern portions of the project site during the field surveys. None of the recorded locations of the species was within the proposed infrastructure footprint. The EIS concluded that the squatter pigeon (southern) is common in the region and known to use disturbed habitats and may occur throughout the project site but the remnant woodlands are likely to represent higher quality habitat for this species.

5051ha of high value squatter pigeon (southern) habitat was mapped within the proposed project site in the woodland and natural grassland vegetation types corresponding to remnant and high value regrowth REs 11.3.2, 11.3.3, 11.3.4, 11.3.7, 11.3.25, 11.3.27, 11.4.4, 11.4.8, 11.5.3, 11.5.17, 11.8.5, 11.8.11 and 11.9.3.

10,535ha of low value habitat was mapped, representing previously cleared areas dominated by buffel grass where squatter pigeons may forage along tracks and in stockyards.

Potential impacts and mitigation measures

Approximately 483ha of high value habitat for this species would be cleared and an additional 19ha would be impacted by remediation surface cracking and ponding following subsidence over the proposed 27 year mine life.

The EIS concluded that the project would be unlikely to result in a significant impact to this species, based on the following considerations:

- the project site is not anticipated to contain an important population of the species
- the project site does not represent especially significant or critical habitat for the species given the extensive range and low density of occurrence throughout the range
- only a relatively small area of habitat would be impacted by the project
- disturbance of habitat by the project would not lead to long-term disruption, fragmentation or reduction of the population or the occurrence of this species in the project site.

Subsidence would result in localised ponding of water and changes in surface flow regimes with potential to cause local disruption to breeding and foraging activities and loss of small areas of habitat if not remediated. Proposed remedial drainage works would ensure that ponding would be temporary and disturb only a small area at any one time.

Residual impacts

Although the EIS identified that the vegetation clearing for surface infrastructure would fragment some reasonably intact habitat areas, particularly in the north and north-east of the project site, the EIS concluded that it would be unlikely to result in fragmentation of the population of this species as the species is known to occupy and utilise cleared areas for feeding habitat. Furthermore, the inherent mobility of the species would further reduce the potential for the project to fragment this local population.

Overall, in accordance with assessment of the project against the MNES Significant Impact Guidelines for the squatter pigeon (southern), the proponent considered the project as unlikely to have a significant impact on this species.

Offsets

No offsets were proposed for the removal of the 483ha of high value habitat for the squatter pigeon (southern).

EHP recommendations

- *For the purpose of clearing for infrastructure, the person taking the action must not clear more than 483ha of high value squatter pigeon habitat from the project.*
- *EHP considers that the clearing of 483ha of high value habitat for squatter pigeon would likely result in a significant impact to this species. While the species is known to be common in the region the species range has declined and habitat clearance is a known threat.*

***Phascolarctos cinereus* (koala - combined populations of Qld, NSW and the ACT)**

- **EPBC Act listing status:** Vulnerable
- **Recovery plan:** A recovery plan has not been prepared for this species
- **Conservation advice:** Approved by the Commonwealth Environment Minister on 30/04/2012
- **Threat Abatement Plan:** There is no relevant threat abatement plan for this species

Description

The koala is a tree dwelling, medium-sized marsupial with a stocky body, large rounded ears, sharp claws and variable but predominantly grey-coloured fur. Males generally are larger than females and there is a gradient in body weight from north to south across their range, with larger individuals occurring in the south and smaller individuals occurring in the north. The average weight of the males is 6.5kg in Queensland, compared to 12kg in Victoria. In the north of its range, the koala tends to have shorter, silver-grey fur, whereas in the south it has longer, thicker, brown-grey fur.

Distribution

The koala is endemic to Australia, and is widespread in coastal and inland areas from north-east Queensland to Eyre Peninsula South Australia. The range extends over 22° of latitude and 18° of longitude, or about 1 million square kilometres. The koala's distribution is not continuous across this range and it occurs in a number of populations that are separated by cleared land or unsuitable habitat.

In Queensland, the koala has scattered populations throughout Queensland, in moist forests along the coast, subhumid woodlands in southern and central Queensland, and in some eucalypt woodlands along watercourses in the semi-arid environments of the western part of the State. The koala has also been found to occur in non-riverine communities in semi-arid areas.

The greatest densities of koalas in Queensland occur in south-east Queensland; with lower densities found through central and eastern areas. For example, population densities range from moderately high in south-east Queensland (e.g. 1-3 koalas/ha) to low in other parts of central Queensland (e.g. 0.01 koalas/ha).

Conservation advice, priority recovery and threat abatement actions

The priority recovery and threat abatement actions required for the squatter pigeon (based on the conservation advice approved by the Commonwealth Environment Minister) are summarised below:

Habitat Loss, disturbance and modification

- Develop and implement a development planning protocol to be used in areas of koala populations to prevent loss of important habitat, koala populations or connectivity options.
- Development plans should explicitly address ways to mitigate risk of vehicle strike when development occurs adjacent to, or within, koala habitat.
- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.
- Identify populations of high conservation priority.
- Investigate formal conservation arrangements, management agreements and covenants on private land, and for Crown and private land investigate and/or secure inclusion in reserve tenure if possible.
- Manage any other known, potential or emerging threats such as a Bell Miner Associated Dieback or Eucalyptus rust.
- Develop and implement options of vegetation recovery and re-connection in regions containing

fragmented koala populations, including inland regions in which koala populations were diminished by drought and coastal regions where development pressures have isolated koala populations.

Animal predation

- Develop and implement a management plan to control the adverse impacts of predation on koalas by dogs in urban, peri-urban and rural environments.

Conservation information

- Engage with private landholders and land managers responsible for the land on which populations occur and encourage these key stakeholders to contribute to the implementation of conservation management actions.

Survey requirements and survey effort

EPBC Act survey requirements/techniques (from draft koala referral guidelines)

- A habitat assessment including an assessment of the vegetation, particularly in relation to vegetation condition and structure, and the types and intensity of existing threats to the koala in your impact area.
- Direct methods including:
 - strip transects
 - nocturnal spotlighting
 - call playback
 - remote sensor activated cameras.
- Indirect survey methods including faecal pellet searches, for example the Spot Assessment Technique (SAT)

Project survey effort

- A habitat assessment was undertaken identifying suitable vegetation.
- Active searching for a total of 30 person hours at 30 sites over two replicate surveys.
- Spotlighting surveys on foot for 32 hours at 32 sites and approximately 30 person hours from a slow moving vehicle over 2 surveys during suitable climatic conditions

EHP considers the survey method and effort used for the EIS to be adequate to establish the population of this species in the project site.

Occurrence within project area

The koala was confirmed to be present in the project site during field surveys conducted for the EIS. The koala was recorded from two locations in south of the project site. None of the recorded locations of the species was within the proposed infrastructure footprint. The EIS concluded that the koalas that were recorded in the project site are considered unlikely to be a key source population for breeding and dispersal or for maintaining genetic diversity and therefore the project is unlikely to result in a significant impact to the koala.

3845ha of high value koala habitat was mapped within the proposed project site.

Potential impacts and mitigation measures

Approximately 111ha of high value habitat for this species would be cleared for the construction of surface infrastructure and an additional 13ha would be impacted by remediation surface cracking and ponding following subsidence over the proposed 27 year mine life.

The EIS concluded that the project would be unlikely to result in a significant impact to this species, based on the following considerations:

- the project site is not anticipated to contain an important population of the species
- the amount of cleared habitat on site is a small proportion 3% of the overall habitat available to the koala on site.
- the koala is known to readily cross cleared areas and the removal of 3% of habitat on site is unlikely to fragment an important population of koala.
- the additional disturbance caused during seismic surveying and tension crack remediation is described in the EIS as small scale, temporary and of short duration. Furthermore, the techniques proposed for seismic surveying and tension crack remediation avoid disturbance to large trees where possible.

The EIS has not undertaken an assessment of the koala based on information available within the Draft EPBC Act referral guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory). While these were not available at the time the EIS was written they provide the Department of the Environment with a detailed framework for assessing the impacts to koala as a result of this project.

Residual impacts

The EIS identified that there would be an impact to the koala through the clearing of 111 ha of high value habitat for the construction of surface infrastructure and clearing of 13 ha through the remediation of tension cracking and ponding.

In accordance with assessment of the project against the MNES Significant Impact Guidelines for the koala the proponent considered the project was unlikely to have a significant impact on this species.

Offsets

No offsets were proposed for the removal of high value koala habitat.

EHP recommendations

- *For the purpose of clearing for infrastructure, the person taking the action must not clear more than 111 ha of high value koala habitat from the project.*
- *In order to achieve the best possible conservation outcomes for the survival of koalas on the project area, EHP recommends that the proponent negotiate with the background landholders and land managers responsible for the land to encourage these key stakeholders to contribute to the implementation of conservation management actions not inconsistent with EPBC's conservation advice for the koala (see above).*

***Denisonia maculata* (ornamental snake)**

- **EPBC Act listing status:** Vulnerable
- **Recovery plan:** A recovery plan is not required for this species
- **Conservation advice:** Approved by the Commonwealth Environment Minister on 29th April 2014

Description

The ornamental snake is a brown, grey-brown or black snake growing up to 50cm in length with lighter coloured body scales, often with darker streaks/flecks. The crown of the head is darker brown/black with lighter flecks, it has distinctly barred lips, a white/cream belly with dark spots/flecks on the outer edges, and smooth scales.

Distribution

The species is known only from the Brigalow Belt North and parts of the Brigalow Belt South biogeographical regions. The core of the species' distribution occurs within the drainage system of the Fitzroy and Dawson rivers. Important populations occur in remnant vegetation on, or surrounding, gilgai mounds and depressions. The ornamental snake's preferred habitat is within, or close to, habitat that is favoured by its prey – frogs. The species is known to prefer woodlands and open forests associated with moist areas, particularly gilgai (melon-hole) mounds and depressions in regional ecosystem land zone 4, but also occurs in lake margins and wetlands. Gilgai formations are found where deep-cracking alluvial soils with high clay contents occur. The ornamental snake is likely to be found in brigalow (*A. harpophylla*), gidgee (*A. cambagei*), blackwood (*A. argyrodendron*) or coolabah (*E. coolibah*) dominated vegetation communities, or pure grassland associated with gulgais.

The most common RE in which the species has been recorded is RE 11.4.3. Other REs where the species has been recorded include: 11.4.3, 11.4.6, 11.4.8, 11.4.9, 11.3.3 and 11.5.16. Ornamental snakes shelter in logs and under coarse woody debris and ground litter. Sites where ornamental snake have been recorded in abundance share the following habitat characteristics:

- Located within the lowest part of the catchment.
- The ornamental snake is found in greatest numbers in shallow water where some aquatic vegetation is present, or where fringing groundcover vegetation has been inundated, especially in flooded gulgais where the dominant aquatic macrophyte is *Monochoria cyanea*.
- A diversity of gilgai size and depth.
- The soils contain high clay content and deep-cracking characteristics. Water retention capacity increases with an increase in the fine clay particle fraction of soils.
- Ground timber is usually relatively common.
- Where burrowing frogs are abundant.
- Habitat patches are typically greater than 10ha in area and are within, or connected, to larger areas of remnant vegetation.

Conservation advice, priority recovery and threat abatement actions

The priority recovery and threat abatement actions required for the ornamental snake (based on the conservation advice approved by the Commonwealth Environment Minister) are summarised below:

Habitat loss, disturbance and modification

- Identify populations of high conservation priority.
- Investigate formal conservation arrangements, management agreements and covenants on private land, and for crown and private land investigate inclusion in reserve tenure if possible.
- Minimise adverse impacts from land use at known sites.

Animal impacts

- Control introduced pests such as pigs to manage threats at known sites.
- Develop and implement a management plan for the control of cane toads in the region.

Conservation information

- Raise awareness of the ornamental snake and other reptiles found in the Brigalow Belt Bioregion within the local community.

Survey requirements and survey effort

EPBC survey requirements/techniques

- Actively search suitable gilgai habitats, especially during warm evenings following rain when frogs are most active.
- Surveys should be conducted over a minimum of three days and nights with at least one replicate survey.

Project survey effort

- Active searching for a total of 30 person hours at 30 sites over two replicate surveys.
- Spotlighting surveys on foot for 32 hours at 32 sites and approximately 30 person hours from a slow moving vehicle over two surveys during suitable climatic conditions.
- The majority of the site was considered unsuitable habitat for this species given that the site has been cleared for grazing and contains exotic grass species. The survey targeted areas that were considered to be possible suitable habitat for this species, such as gilgai areas.

EHP considers the survey method and effort to be adequate to establish the population of this species in the project site.

Occurrence within project site

Ornamental snake was recorded from the project site during the field surveys in two locations with gilgai in the central and southern portion of the project sites. Both of the locations supported regrowth brigalow vegetation with well-developed gilgai formations. However, the species could also be present at other locations where gilgai occurs. A total 232ha of high value habitat for ornamental snakes was mapped in the project site which included all areas of gilgai.

Potential impacts and mitigation measures

The EIS estimated that 2ha of high value ornamental snake habitat would be cleared for construction of surface infrastructure. No mitigation measures were proposed for this species.

Residual impacts

The proposed project was considered unlikely to have a significant impact on the ornamental snake in accordance with the. The proponent concluded, having regard to the MNES Significant Impact Guidelines, that the project would be unlikely to result in a significant impact to this species, based on:

- the project site not representing especially significant or critical habitat for the species
- only a relatively small area of habitat likely to be affected by the project
- disturbance would not lead to long-term disruption, fragmentation or reduction of any populations of the species or the occurrence of the species in the project site.

Offsets

No offsets were proposed for the ornamental snake.

EHP recommendation

- *Although no direct mitigation measures were proposed by the proponent for the ornamental snake, EHP considers the general mitigation measures of weed and pest animal control would be of benefit to improve ecological conditions for the species to continue to exist in the project site.*

***Erythrotriorchis radiatus* (red goshawk)**

- **EPBC Act listing status:** Vulnerable
- **Recovery plan:** A recovery plan has been prepared for this species (approved by the Commonwealth Environment Minister 2012)
- **Conservation advice:** Not available for this species

Description

The red goshawk (*Erythrotriorchis radiates*) is a large, swift and powerful rufous-brown hawk, growing to a length of 45–60 cm, with a wingspan of 100–135 cm. The two sexes of this species are quite different in size and appearance. The females weigh approximately 1.1kg, the males approximately 0.63kg. The red goshawk is boldly mottled and streaked, with rufous scalloping on the back and upper wings, rufous underparts that are brightest and lack streaking on the thighs, and with massive yellowish legs and feet, and boldly barred underwings.

The red goshawk is solitary and very thinly dispersed. It is usually observed singly, and occasionally in pairs or family groups. Red goshawk pairs are believed to remain within the nesting territory all year, but some may expand their home range when not breeding. In the southeast of their range it has been suggested that adults may migrate from the ranges to lowland winter territories. Occasional records of individuals hundreds of kilometres from the known breeding range suggest juvenile dispersal from their natal territories may be extensive.

Distribution

The red goshawk is endemic to Australia. It is very sparsely dispersed across approximately 15% of coastal and sub-coastal Australia, from western Kimberley Division to north-east NSW, and occasionally on continental islands. It has probably always occurred in central Australia, where three widely-spaced, recent confirmed sightings corroborate earlier, previously doubted records. However, no breeding has been recorded in central Australia and these records are thought to be of dispersive individuals.

The estimated extent of occurrence is likely to be stable at 1,000,000km². There is no clear data to indicate past declines in extent of occurrence, and there is no information available on predicted future changes in extent of occurrence. The red goshawk is suspected to have always had a very large distributional range and extent of occurrence within which it was very sparsely distributed.

The estimated area of occupancy is suspected to be 200,000km², though the reliability of this estimate is low. Area of occupancy was estimated from the number of one km² grid squares in which the species is thought to occur at the time when its population is most constrained, which is during the breeding season for the red goshawk. Multiplying the estimated 1000 breeding red goshawks, which would be 500 breeding pairs, by the estimated home range of 200km² yields an area of occupancy of 100,000km².

The area of occupancy has declined since European settlement. While this decline cannot be quantified, the lack of any breeding records in NSW over the last 50 years, and the decline in sightings of red goshawk further from the coast especially in Queensland suggest that fewer areas are not being used for breeding. Indirect evidence of reduction in the area of occupancy exists from egg collecting hotspots during the 1800s in the Cooktown, Cairns and Moreton Bay areas of Queensland and the Northern Rivers area of NSW. Breeding in these areas no longer occurs. Further, it is suggested that since European settlement, development and habitat alteration have rendered about 20% of the predicted red goshawk's range unsuitable for breeding, especially in coastal Queensland. There are no quantified predictions of future changes to area of occupancy. However, it is suspected that continuing clearing of coastal and sub-coastal forests in eastern Australia, and on Melville Island, will likely to lead to a reduction in breeding pairs, and therefore a reduction in area of occupancy.

The distribution of the red goshawk is not severely fragmented. It is suspected that there is some fragmentation, but there is no evidence that fragmentation in the red goshawk distribution is severe. However, some fragmentation may have occurred in the more heavily settled and cleared regions of the species' range, such as in the coastal lowlands of eastern Queensland. The degree of this

fragmentation in the lowlands may be masked by the persistence of birds in the adjacent foothill and hinterland country which has not suffered the same degree of clearing.

Although thought not to breed in north-eastern NSW or across sub-coastal areas of the Gulf of Carpentaria and western Cape York Peninsula, historical records suggest that the breeding distribution is continuous.

Conservation advice, priority recovery and threat abatement actions

The National Recovery Plan for the red goshawk stated that the main cause of the decline of the red goshawk in north-east New South Wales and eastern Queensland is widespread clearance of native forests and woodlands for agriculture. Other threats to the species include fragmentation and degradation of habitat, direct disturbance and/or loss of nesting sites and changes in prey availability.

The recovery plan's overall objective was stated as the maintenance of red goshawk populations across their range and implementation of measures to promote recovery of the species, such as:

- Monitoring of red goshawk habitat and determining territory occupancy and productivity, and the use DNA analyses of feathers to determine adult survival rates.
- Collating information on known nest sites from the past 25 years and producing descriptive maps of important habitat and ensure information is secure.
- Conducting searches to identify previously unknown pairs of red goshawks, nest sites, and habitats critical for red goshawk survival.
- Identifying important populations and nest sites, and using this information to inform monitoring programs and state and federal government planning frameworks.
- Providing specific information and advice to assist with the identification, acquisition and management of important habitat for the red goshawk.
- Conducting research to understand the relationship between habitat fragmentation, prey density and population persistence to better inform management.
- Protecting habitat through acquisition or voluntary conservation agreements.
- Reducing the effects of red goshawk habitat fragmentation and degradation by encouraging landholders to protect and manage threatened red goshawk territories.
- Training personnel from state and local government to identify and understand the threats to red goshawk habitat.
- Producing and distribute information on the conservation status and habitat requirements of the red goshawk.
- Providing feedback to the public and agency personnel on progress of red goshawk recovery.
- Reviewing the effectiveness of the community awareness program.

Occurrence within project site

The red goshawk was not recorded from the project site during field surveys; however, it was determined that suitable habitat is present and the project occurs within the likely range of the species. The EIS concluded that the red goshawk is considered to have a moderate potential to occur within the riparian forest along the Isaac River. However, it was also stated that the proposed project would only remove 2.9% of suitable red goshawk woodland vegetation, and hence an assessment of significance was not warranted by the proponent.

Survey requirements and survey effort

EPBC survey requirements/techniques

- Area searches for 80 hours across 10 days.

Project survey effort

- Active searching for a total of 28 person hours.
- A further 300 hours were spent on site recording birds opportunistically.
- 28 hours survey were undertaken on-site, in addition to this surveying a total of 156 hours of bird surveying was undertaken in surveying for adjacent projects.

EHP considers the survey method and effort to be adequate to establish the population of this species in the project site.

Potential impacts and mitigation measures

The EIS identified that 7ha of high value habitat would be cleared for the surface infrastructure. The proponent has concluded that the project would be unlikely to result in a significant impact to this species due to the species not being recorded on-site, the project site primarily supporting low value habitat and impacts to high value potential habitat are relatively small in comparison to the remaining habitat within the region.

Residual impacts

The EIS identified the removal of approximately 7ha of suitable red goshawk woodland vegetation as part of the proposed project. However, the EIS concluded that the proposed project would be unlikely to have a significant impact on the red goshawk in accordance with the MNES Significant Impact Guidelines.

Offsets

No offsets were proposed for the red goshawk.

-----END of listed threatened ecological communities and species information for MNES