Appendix 2

Assessment of matters of national environmental significance under the *Environment Protection and Biodiversity Conservation Act 1999*

for the Taroborah Coal Project

proposed by Shenhuo International Group Pty Ltd

Table of Contents

1 Matters of national environmental significance

The submitted EIS included an assessment of the potential impacts of the Taroborah Coal Project on matters of national environmental significance (MNES) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

This appendix (Appendix 2) has been written as a stand-alone component of the EIS assessment report and has been prepared in accordance with section 59 of the *Environmental Protection Act 1994*. It 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 and section 9 of the Environmental Protection Regulation 2008.

1.1 Controlling provisions and assessment approach

On 18 January 2012, IMC Mining Group Pty Ltd, on behalf of the proponent, Shenhuo International Group Pty Ltd, referred the Taroborah Coal 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 20 February 2012, the delegate of the Commonwealth Environment Minister decided under sections 75 of the EPBC Act that the project is a controlled action for the relevant controlling provisions of listed threatened species and communities (sections 18 and 18A) and listed migratory species (sections 20 and 20A). On 17 October 2013, the delegate also decided that a water resource, in relation to coal seam gas development and large coal mining development (sections 24D and 24E) is also a controlling provision and that the project required assessment and approval under the EPBC Act before it could proceed.

The EIS process under Chapter 3, Part 1 of the EP Act for the Taroborah Coal Project was accredited for the assessment of the project's impacts on the controlling provisions under An Agreement Between the Australian Government and the State of Queensland under Section 45 of the Australian Government EPBC Act relating to environmental assessment (commonly called the Bilateral Agreement). The EIS process under the EP Act is administered by the Queensland Department of Environment and Heritage Protection (EHP).

The evaluation of potential impacts of the Taroborah Coal Project on MNES presented in this report is based on information contained in the submitted EIS, which consists of the following documentation:

- the EIS (Volumes 1 to 4) that was available for public comment from 15 May to 26 June 2014
- the response to submissions and the amended EIS received by EHP on 24 November 2014.

The Australian Government Department of the Environment (DOTE) 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 administrative arrangements for the Bilateral Agreement.

An assessment of the potential impacts of the Taroborah Coal Project on the controlling provisions is provided in section 3 of this appendix, specifically:

1. Section 3.1 contains an assessment of the impacts of the project on listed threatened species and communities (sections 18 and 18A of the controlling provisions) and listed migratory species (sections 20 and 20A of the controlling provisions)
2. Section 3.2 contains an assessment of impacts of the project on water resources by large coal mining development (sections 24D and 24E of the controlling provisions), including an evaluation of the proponent's response to the advice on water-related aspects of the project provided by the IESC (see section 1.2 below).

A copy of this report will be given to DOTE to assist the Commonwealth Minister with making a decision about the approval of the Taroborah Coal Project and any conditions that should apply under Part 9 of the EPBC Act.

1.2 Independent Expert Scientific Committee

In regard to the assessment of impacts of the project on water resources, 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. Federal, state and territory governments can request the IESC to provide advice on water-related aspects of EISs.

The EIS for the project was referred to the IESC on 7 May 2014 by DOTE and EHP. The IESC's advice to the departments dated 12 June 2014 has been considered in the preparation of this assessment report. A summary of the IESC's advice to the departments dated 12 June 2014 and the proponent's response to the issues raised by the

IESC, as well as an evaluation of the adequacy of the proponent's response is provided in section 3.2 of this appendix.

1.3 Feasible alternatives

The matters prescribed in section 9 of the Environmental Protection Regulation 2009 require, amongst other things, that this EIS assessment provide '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'.

Feasible alternatives do not include an alternative location for the mine due to geological and tenure constraints. Feasible alternatives assessed for the project, and the likely impact of the alternatives on MNES, are addressed in the following sections.

1.3.1 Coal extraction

The coal extraction methods considered for the project included a combination of open-cut and underground longwall mining techniques, and a combination of open-cut and underground bord and pillar mining techniques. Bord and pillar mining involves cutting a network of rooms or panels into the coal seam and leaving behind pillars of coal to support the roof of the mine, reducing coal recoveries to as little as 50%. In comparison, longwall mining involves self-advancing, hydraulic-powered supports which temporarily hold up the roof while the coal is being extracted, recovering up to 75% of the resource. To maximise resource recovery, the preferred coal extraction option for the Taroborah Coal Project was based on open-cut and underground longwall mining techniques. However, the bord and pillar technique does not usually result in subsidence of the land surface, whereas, the longwall technique does. Consequently, it was necessary to consider the potential impacts of subsidence on MNES.

For the Taroborah Coal Project, subsidence of up to 2m is predicted. No threatened ecological communities were identified in the area of predicted subsidence. Furthermore, the changes in surface drainage as a result of subsidence are anticipated to be temporary, and drainage pathways similar to the existing situation would be restored prior to project decommissioning. Subsidence is expected to impact on seven pastoral dams that provide potential habitat for migratory species. Some dams would be impacted negatively (i.e. subsidence would reduce capacity) and some positively (i.e. subsidence would increase capacity). However, any dams negatively impacted would be excavated to restore original capacity. Consequently, available habitat for migratory species would not be reduced as a result of subsidence. Therefore, the difference between impacts of bord and pillar, and longwall mining on MNES, are expected to be negligible.

1.3.2 Product coal transport

The product coal transport alternatives considered for the project were road and rail. The rail alternative would require a new on-site train load-out facility and rail loop to connect the mine to the Central West rail system. However, the new infrastructure would be positioned to minimise any impacts on MNES, and no threatened ecological communities would be cleared as a result of the new infrastructure. The rail alternative would also require upgrades to the Central West rail system. However, the upgrades would be undertaken within the existing rail corridor and no new track alignments would be required. Consequently, any impacts on MNES would be negligible.

The road alternative would be undertaken on the existing road network and no new road alignments would be required. Consequently, any potential impacts on MNES as a result of the road alternative would be negligible.

However, rail transport of the mined coal to port was identified as the most viable alternative due to concerns about road safety and dust and noise nuisance impacts associated with road transport.

1.3.3 Port facilities

The port facility alternatives considered for exporting coal from the project included Barney Point, Hay Point, Abbot Point, Dalrymple Bay and Wiggins Island coal terminals. Barney Point, Hay Point, Abbot Point and Dalrymple Bay would all require the construction of additional infrastructure to cater for the project, which may result in impacts on MNES, including the Great Barrier Reef marine park and migratory species. However, Wiggins Island has sufficient capacity to cater for the project without the construction of any additional infrastructure. Consequently, it was selected as the most viable alternative for the project.

1.3.4 Rejects disposal

The coarse and fine rejects alternatives considered for the project included the confinement of rejects in a purpose-built, above-ground rejects storage facility and co-disposal of rejects within the spoil dumps. Rejects disposal within a rejects storage facility would result in an additional disturbance footprint, which may result in impacts on MNES,

including threatened species and ecological communities. Contaminated run-off, or seepage, from a rejects disposal facility may also result in impacts on MNES, including water resources. Rejects disposal within overburden generated during mining would not require an additional disturbance footprint and any potential contamination would be contained within purpose-built, engineered cells within buried spoil. Co-disposal of rejects within spoil dumps was identified as the most viable alternative for the project.

1.3.5 Conclusion

The preferred project alternatives would result in less, or similar impacts on MNES, compared to alternatives that were not selected.

2 Description of the proposed action

The proposed Taroborah Coal Project would include the construction and operation of an open-cut and underground coal mine on a greenfield site. The project site lies in the Denison Trough of the Bowen Basin approximately 22 kilometres (km) west of Emerald in Central Queensland within the Central Highlands Regional Council local government area (Figure 2-1). The open-cut mining area lies to the south of the Central West rail system and the Capricorn Highway. The underground mining area lies to the north of the Central West rail system and the Capricorn Highway. An indicative project layout is shown in Figure 2-2.

The action area would be on mineral development licence (MDL) 467, covering approximately 7,966 hectares (ha). The disturbance footprint associated with the open-cut and underground operations is estimated to cover 2,568ha. A breakdown of disturbance is provided in Table 2-1.

Table 2-1 A breakdown of the disturbance footprint

Disturbance	Area (ha)
Open-cut mining, including dumps and haul roads	336
Underground (longwall) mining	2,071
CHPP, mine infrastructure and site offices	58
Rail balloon loop, sediment dams, CHPP water recycle dam and mine waste water dam	50
Visual amenity bunds	16
Total:	2,568

Source: Table 3.3 of the EIS

The life of the project would be approximately 22 years, including an initial twelve month construction phase, 20 year production period and a 15 month decommissioning and rehabilitation phase. An additional six month construction phase in preparation for underground mining would occur in parallel with open-cut mining, and would begin in the fifth year of the project.

Mining would target the A and B seams, which range from 0.1 metres (m) to 1.9m thick and 2.3m to 3.0m thick respectively, and lie at depths of 30m to 200m. The project would recover approximately 11.5 million tonnes (Mt) of run-of-mine (ROM) thermal coal from the open-cut pit and 64.3Mt of ROM thermal coal from the underground operation. Initially, 0.5Mt of ROM coal would be mined in the first year. The rate would progressively increase up to 5.75Mt a year (Mt/y) of ROM coal in year 8. Open-cut mining would overlap with underground mining between years 5 to 7. Open cut mining would cease after the seventh year. Between years 8 to 20, underground mining would continue to produce up to 5.75Mt/y of ROM coal.

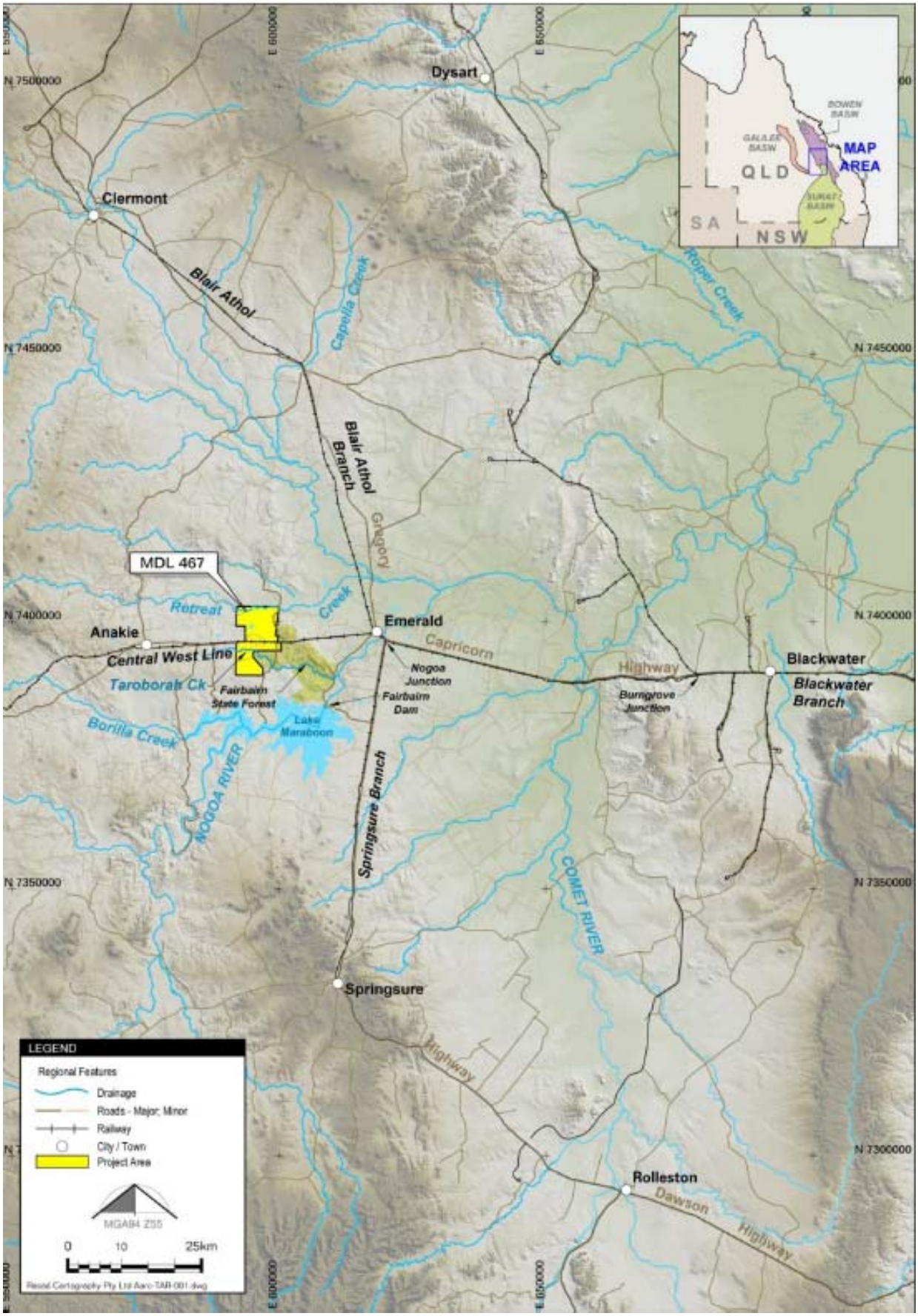
Open-cut mining would be carried out using conventional hydraulic excavators and a fleet of dump trucks to remove overburden and extract the coal resource. ROM coal from the open-cut pit would be loaded onto trucks and hauled to an on-site coal handling and processing plant (CHPP). Overburden would be hauled by truck, initially to out-of-pit spoil dumps adjacent to the open-cut pit. Once mining of the pit sufficiently progresses, spoil would be progressively backfilled in the advancing pit.

Underground mining would be carried out by longwall extraction techniques. ROM coal from the underground operations would be transported by conveyors via the open-cut highwall to the CHPP for processing.

Processing at the CHPP would involve crushing, screening and washing of ROM coal in order to separate product coal from coarse and fine reject materials. Fine rejects from the CHPP would be partially dewatered and mixed with

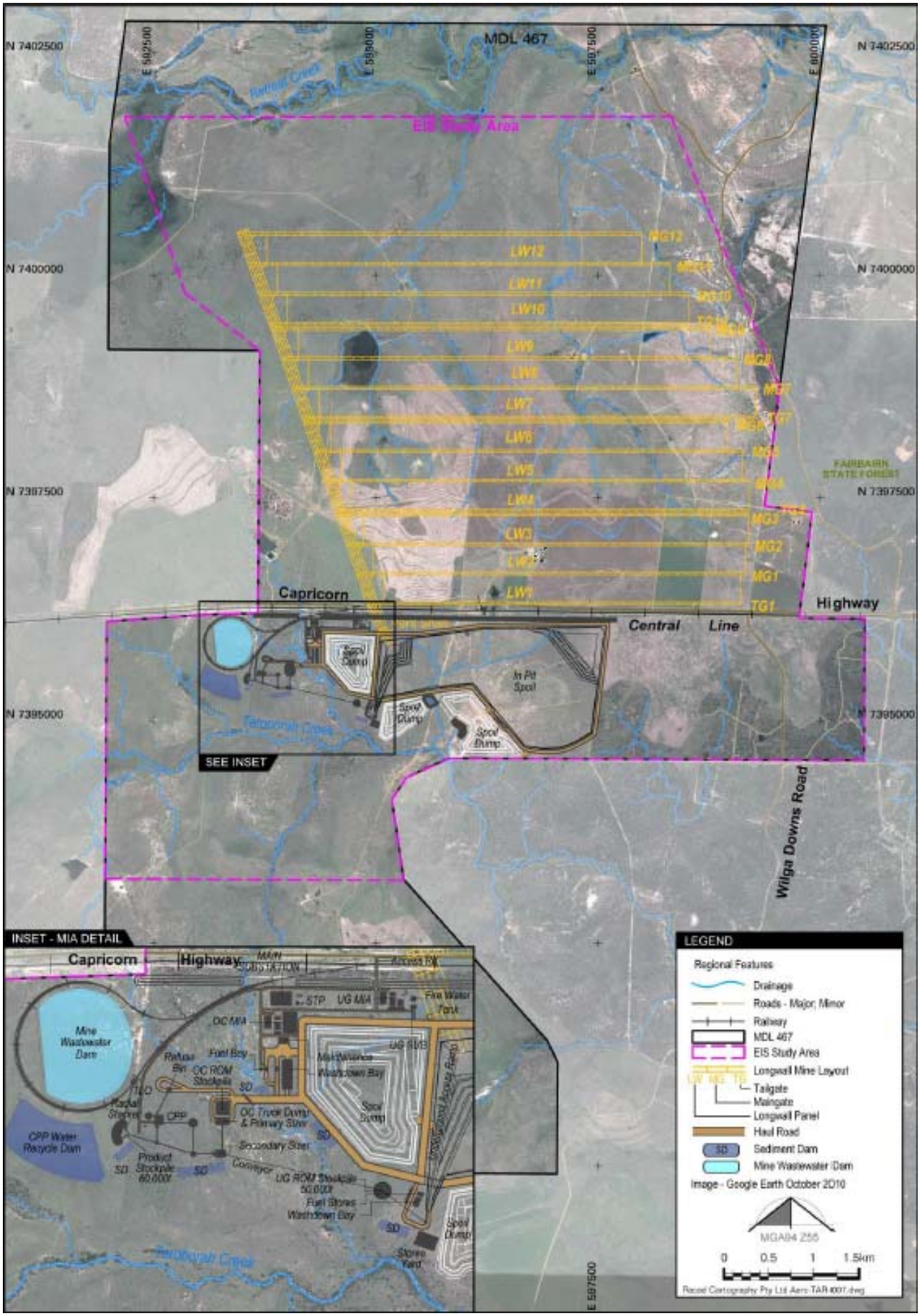
coarse rejects, prior to being hauled and buried in the spoil dumps.

Figure 2-1 Location of the action area for the project



Source: Figure 1.2 of the EIS

Figure 2-2 Proposed project layout



Source: Figure 3.5 of the EIS

Up to 5.73Mt/y of product coal would be transported from the project site via the Queensland Rail (QR) Central West rail system and the Aurizon Blackwater rail system to the Wiggins Island Coal Export Terminal (WICET) at the Port of Gladstone for export. The coal transport option would require the construction of a new on-site train load-out facility and rail loop to connect the mine to the Central West rail system, as well as an upgrade of the Central West rail line.

The real property descriptions of the action area are shown in Table 2-1.

Table 2-1 Real property descriptions underlying the action area

Real property description	Tenure type	Nature of the land
Lot 76 on plan PT372	Freehold	Private agriculture
Lot 12 on plan RP881318	Freehold	Private agriculture
Lot 13 on plan RP881318	Freehold	Private agriculture
Lot 14 on plan RP881318	Freehold	Private agriculture
Lot 15 on plan PLA4029	Freehold	Private agriculture
Lot 126 on plan PT372	Freehold	Private agriculture
Lot 21 on plan DSN29	Freehold	Private agriculture
Lot 201 on plan DN40176	Freehold	Private agriculture
Lot 23 on plan DN40176	Freehold	Private agriculture
Lot 24 on plan DN40201	Freehold	Private agriculture
Lot 20 on plan DSN377	Freehold	Private agriculture
Lot 124 on plan PT367	Leasehold	Private agriculture
Lot 203 on plan DSN377	Freehold	Private agriculture
Lot 4 on plan PT352	Leasehold	Private agriculture
Lot 12 on PT352	Leasehold	Private agriculture
Lot 81 on SP122079	State land	Queensland Rail, railway corridor
Lot 82 on SP122079	State land	Queensland Rail, railway corridor
Lot 101 on SP122080	State land	Queensland Rail, railway corridor
Lot 5 on PT132	State land	Queensland Rail, Capricorn Highway

Source: Table 4.6 of the EIS

Site access by road would be via the Capricorn Highway, which passes east-west through the middle of MDL467.

The construction and operation phases of the project would employ up to 150 and 375 full-time staff respectively. Construction and operational workforces would use a bus-in, bus-out (BIBO) transportation system from Emerald to the project site. While on roster, all staff would live in Emerald or the surrounding townships in either permanent or temporary accommodation.

The annual raw water demand during the 22 year life of the project is estimated to range from 330 megalitres (ML) per year during initial construction up to 2,680ML per year during peak open-cut and underground operations. Water would be sourced from coal seam dewatering and the collection of rainfall run-off in surface water storages. No specific surface water or groundwater allocations from external sources are proposed for the project. At present, a licence to take groundwater will need to be obtained under the provisions of the *Water Act 2000* (Water Act), although this would no longer be necessary once current reforms come into place. The Water Act (through the

Fitzroy Basin Water Resource Plan) also allows the take of all overland flow needed to meet the requirements of an environmental authority issued under the EP Act.

Flood protection bunds would be constructed to a nominal height of 0.5m, and would be designed to protect the open-cut pit and mine infrastructure area (MIA) from local flooding up to a 1-in-1000 year peak flow event.

A 66 kilovolt overhead feeder line running parallel to the Capricorn Highway is proposed to be connected to the Emerald substation located 22km to the east of the project site. It would supply 25 megawatts of electricity per year during peak project operations.

Key features of the conceptual rehabilitated final landform design for the project include:

- two final voids covering approximately 292ha on the southern side of the Capricorn Highway on MDL467
- elevated landforms associated with out-of-pit spoil dumps covering approximately 93ha on the southern side of the Capricorn Highway on MDL467
- landforms at-grade or only slightly below pre-mining topography associated with subsided areas from underground mining, covering approximately 2071ha
- landforms at-grade associated with rehabilitated infrastructure areas covering approximately 69ha.

3 Assessment of the potential impacts of the project on the controlling provisions

An assessment of the potential impacts of the project on listed threatened species and communities (sections 18 and 18A of the controlling provisions) and listed migratory species (sections 20 and 20A of the controlling provisions), and water resources by large coal mining development (sections 24D and 24E of the controlling provisions) is provided in the following subsections.

3.1 Listed threatened species and communities and listed migratory species

Section 5.7.1, 5.7.2 and 5.7.3 of the EIS contained a stand-alone assessment of the impacts of the project on listed threatened species, listed migratory species and threatened ecological communities (TECs) respectively. Additional supporting information about cumulative impacts on listed threatened species and communities was included in section 5.7.5 of the EIS. Measures to mitigate the potential impacts of the project on listed threatened species and communities, and listed migratory species were provided in sections 5.8.1 and 5.8.2 of the EIS. An environmental offsets strategy was provided in Appendix 21 of the EIS.

3.1.1 Existing environmental values

Desktop terrestrial, aquatic flora and fauna studies were undertaken prior to the field surveys to identify the potential ecological values present within and surrounding the project area, particularly values that are protected under state and Commonwealth legislation.

Flora surveys (including secondary and quaternary transects as defined by Neldner et al. 2012) and condition assessments were carried out to verify desktop results. The surveys included targeted searches for threatened flora species, weed infestations, as well as surveys to identify the location, extent and condition of vegetation across the project area using the regional ecosystem framework and threatened ecological community criteria. However, no flora survey sites were carried out within the areas mapped as regional ecosystem 11.8.11, which is analogous to the natural grassland TEC.

Terrestrial flora and fauna surveys were carried out in the dry season from the 8 to 16 September 2011 and in the wet season from 28 February to 5 March 2012. Aquatic flora and fauna surveys were carried out in October 2011 and February 2012. A stygofauna assessment was carried out in September 2011, and a targeted bat survey on the 7 and 8 August 2012. Fauna sampling was conducted primarily along transects established in each of the major fauna habitat types.

The EIS stated that the proposed project area and surrounding landscape was extensively cleared and mostly used for agricultural activities with vegetation often occurring along watercourses.

The EIS identified five threatened ecological communities, six EPBC listed threatened flora species and thirteen EPBC listed threatened fauna species as potentially occurring in the project area based on a desktop assessment.

3.1.1.1 Threatened ecological communities

The following listed TECs where found to occur in the project area during flora surveys conducted on-site:

- brigalow (*Acacia harpophylla* dominant and co-dominant) (brigalow TEC) – endangered
- natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin – endangered.

The estimated extent and proposed extent of clearing of each TEC is shown in Table 3-1.

Table 3-1 Estimated extent of TECs and proposed extent of clearing of each TEC

Threatened ecological community (TEC)	EPBC Act status	Total extent within project area	Extent of clearing
Brigalow TEC	Endangered	112.3ha	2.76ha
Natural grasslands TEC	Endangered	163.5ha	149.43ha

Source: Table 4.113 and Table 5.12 of the EIS

3.1.1.2 Threatened flora species

No threatened flora species were identified within the project area during flora surveys conducted on-site.

3.1.1.3 Threatened fauna species

No threatened fauna species were identified within the project area during fauna surveys conducted on-site.

3.1.1.4 Listed migratory species

Three EPBC listed migratory species were located within the project area:

- cattle egret (*Ardea ibis*)
- Latham's snipe (*Gallinago hardwickii*)
- glossy ibis (*Plegadis falcinellus*).

3.1.2 Potential impacts on TECs and listed migratory species

Potential impacts on TECs and migratory species would include:

- land clearance, resulting in the loss and fragmentation of extant vegetation
- habitat removal
- edge effects, such as the introduction and establishment of weeds (weed invasion); alteration to microclimatic conditions (such as greater light intensity, more wind penetration, lower humidity due to vegetation removal); and a reduction in plant health through loss of photosynthetic potential (such as due to dust cover from vehicle movement on unsealed tracks)
- a reduction in the natural regeneration of brigalow regrowth due to continuous livestock grazing and pasture management
- indirect impacts on listed flora, reptiles and mammals due to changes in frequencies and extent of ecological processes (e.g. the squatter pigeon could be indirectly impacted by changed fire regimes)
- increased numbers of pest fauna and flora species due to increased availability of food sources once the project is operational
- potential impacts on EPBC listed koalas include: habitat loss and fragmentation; mortality from dog bites and vehicle strikes; and declines in isolated populations caused by disease and myrtle rust.

Further information about the profile of each of the following threatened ecological communities and listed migratory species likely to be significantly impacted by the proposed action and the nature of the potential impacts of the action to each of those MNES is provided in the attachment to this appendix:

- brigalow TEC
- natural grasslands TEC
- cattle egret
- Latham's snipe
- glossy ibis.

3.1.3 Cumulative impacts on TECs

The proponent considered that there was a potential for cumulative impacts on the brigalow TEC, including:

- clearing from multiple projects would reduce the existing remnant vegetation within the Brigalow Belt bioregion
- clearing has the potential to increase fragmentation and edge effects by creating smaller patches which would be less sustainable for flora and fauna that use these habitats. Species that rely on these habitats could be impacted such as the ornamental snake (*Denisonia maculata*) and Dunmall's snake (*Furina dunmalli*)
- drawdown of groundwater level could modify factors necessary for the Brigalow TEC to persist in the

surrounding landscape.

3.1.4 Proposed mitigation measures

To reduce adverse impacts, the proponent proposed the following measures:

- minimising the disturbance footprint and retaining tracts of vegetation, where possible
- managing non-impacted brigalow TEC (e.g. south of the rail line) to be free from anthropogenic disturbance, so it can contribute to the production of viable seed
- periodic monitoring of isolated remnant vegetation to ensure that species richness does not decline during the life of the project
- non-impacted brigalow regrowth areas within the project area would be allowed to regenerate naturally to increase the overall area of the brigalow community
- clearing of brigalow TEC would only be conducted after the area has been clearly delineated and identified to equipment operators and supervisors and appropriate erosion and sediment control structures are in place
- rehabilitation and revegetation works within the project area would use the most appropriate species for the regeneration of the brigalow community
- developing a weed monitoring program to minimise the establishment and spread of declared pest species
- staff induction would include information about the conservation values within the project area
- a rehabilitation strategy would be developed and include provisions for monitoring rehabilitation progress over the life of the project.

Mitigation measures to minimise project impacts to migratory species include:

- minimising the project footprint to retain intrinsic values of local vegetation and associated fauna habitat
- minimal interference with the movement of any fauna species located during pre-clearing surveys
- staff or contractors carrying out clearing would be made aware of the possible presence of migratory species
- staff induction would include information about migratory species and their management requirements
- final rehabilitation would include restoration of wetland habitat, to support the cattle egret, Latham's snipe and glossy ibis, that may have been impacted by project actions.

3.1.5 Offsets proposed for residual impacts on MNES

The proponent has committed to providing offsets after project approval, but before commencement of project activities. The proponent's preferred option to meet regulatory requirements is to provide a land-based offset via an agreement with an offset broker or provider for the provision of an offset area. The proponent has not quantified the impacts of subsidence to either MNES or MSES values and should any impacts occur to any values within the subsidence area, these would need to be offset accordingly. The proponent is committed to providing the following offsets for significant impacts on MNES:

- 2.76ha of brigalow TEC for which the proponent is prepared to provide an offset of 11.04ha
- 149.43ha of natural grassland TEC for which the proponent is prepared to provide an offset of 587.72ha.

3.1.6 Major issues raised in submissions

In its submission on the EIS, EHP commented that the Queensland Herbarium regional ecosystem mapping indicated there were areas of the natural grasslands TEC mapped within the project area, but the proponent had not undertaken a flora survey at any sites within these mapped areas. Furthermore, during a site visit undertaken during the EIS submission period, an EHP officer sighted key natural grassland species. EHP recommended that the proponent should conduct flora surveys within the natural grassland mapped areas to confirm the extent of the TEC. In response to this issue, the proponent acknowledged that natural grassland areas existed within the project area and agreed that further field surveys would be prudent to identify the extent of the natural grasslands TEC. The proponent committed to conducting the assessment prior to the project development, and to offsetting the full extent of the mapped natural grassland TEC. EHP was satisfied that this would be an acceptable mitigation measure.

3.1.7 Conclusions and recommendations

With the exception of natural grassland TEC, the EIS used adequate studies, survey methods and effort to assess and quantify the potential impacts on threatened species and communities and listed migratory species. The flora surveys within the mapped natural grassland TEC were not adequate. However, the proponent's commitment to offset the impacts to this community satisfactorily addressed any potential impacts of the project on this community.

The following recommendations address the key outstanding issues in relation to threatened species and communities:

Recommendation 1

The proponent should finalise the biodiversity offset strategy consistent with the EPBC Act offsets policy and offset assessment guide. This would include field surveys to confirm the presence of the natural grasslands TEC within the project area and field surveys to confirm that brigalow TEC and natural grassland TEC are present at proposed offset locations and to confirm that the condition and extent of the proposed offset area(s) is sufficient to offset the residual impact to 2.76ha of brigalow and 149.43ha of natural grassland respectively.

Recommendation 2

In line with commitments made by the proponent, EHP recommends that it be a condition of approval that the person(s) undertaking the action for the project must not clear more than:

- 2.76ha of brigalow TEC
- 149.43ha of natural grassland TEC.

Recommendation 3

In order to achieve the best possible conservation outcomes for MNES within the project area, the proponent should communicate the presence of MNES values to background landholders with the purpose of involving them and encouraging management of these values in a manner not inconsistent with the conservation advice, recovery plan and threat abatement plans relevant to each MNES value.

Recommendation 4

It should be a condition of approval that the proponent completes flora surveys before any disturbance for construction of the mine at the site to ensure that impacts on MNES are as described in the EIS and/or as summarised in this report. The surveys should cover areas that would be affected by underground mining as well as open-cut mining, including the associated infrastructure. It should also be a condition of approval that the proponent provides offsets for any residual impacts on species or ecological communities that are covered by the controlling provisions. Before any disturbance for construction, the proponent should report the results of pre-clearing surveys to the Department of the Environment, and state the extent of, and mechanism for delivering, the necessary offsets for residual impacts.

3.2 Water resources

Section 5.7.4 of the EIS contained a stand-alone assessment of the impacts of the project on water resources in relation to sections 24D and 24E of the controlling provisions under the EPBC Act. An assessment of the significance of the potential project impacts on water resources in accordance with the Draft Significant Impact Guidelines: Coal seam gas and large coal mining developments—impacts on water resources (Department of Environment 2013a) was provided in Appendix 26 of the EIS. Additional supporting information about cumulative impacts on water resources was included in section 5.7.5 of the EIS. Measures to mitigate the potential impacts of the project on water resources are outlined in section 5.8.3 of the EIS. Additional supporting information was provided in Appendix 13, Surface water management plan, and Appendix 14, Groundwater impact assessment.

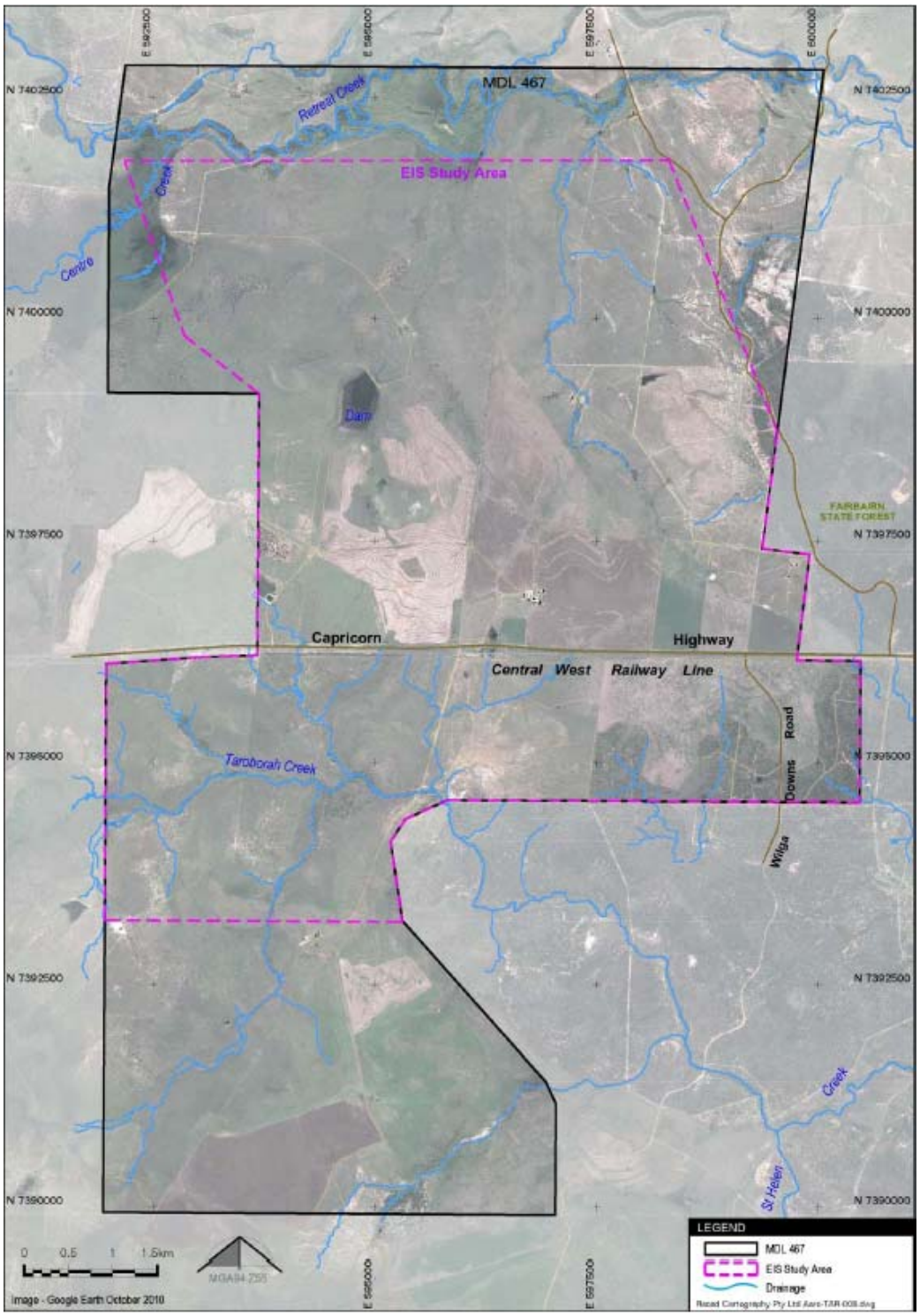
3.2.1 Existing surface water hydrology

The Taroborah Coal Project is located within the Fitzroy River Basin, which has a total catchment area of approximately 142,600km^2. The Taroborah Coal Project is located in the lower Nogoa and Theresa Creek sub-basin. The major drainage features within the project site that are defined as watercourses under the *Water Act 2000* are identified in Figure 3-1 and include the following:

- Retreat Creek, which flows west to east across the north of the project site into Theresa Creek, before joining the Nogoa River
- Centre Creek, which originates to the west of MDL467 and discharges into Retreat Creek in the north-west corner of the project site
- Taroborah Creek, which is located in the south of the project site and flows in an east to south-easterly direction into St. Helens Creek, which then flows into the Nogoa River.

Lake Maraboon and Fairbairn Dam are located 5km to the south of the project site. Lake Maraboon is on the Nogoa River and provides water to approximately 300 irrigators who farm in the Emerald area. However, the Taroborah Coal Project is located downstream of the catchment area for Lake Maraboon, and will not impact on it.

Figure 3-1 Surface water drainage features on the project site



Source: Figure 4.61 of the EIS

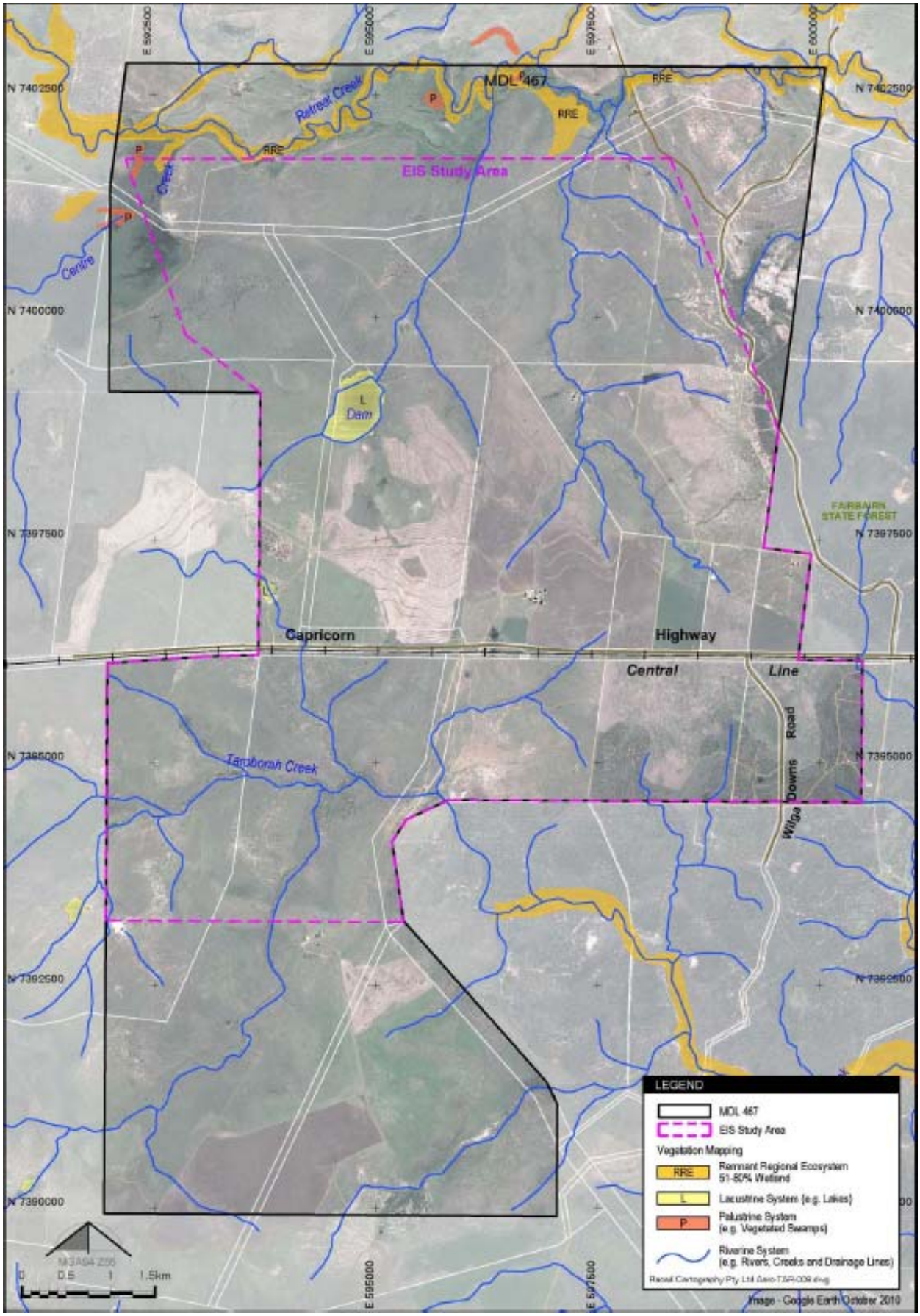
3.2.2 Wetlands

The major wetland features within the project site are highlighted in Figure 3-2 and include the following:

- remnant regional ecosystem (RE) consisting of 51% to 80% wetland along Retreat Creek
- lacustrine dam located in the west central portion of the project site
- limited areas of palustrine wetlands to the north and north-west of the project site.

Wetland systems on the site were assessed to have moderate to good aquatic habitat quality, and were considered to be important as permanent and semi-permanent water sources in a region characterised by ephemeral watercourses.

Figure 3-2 Wetland features of the Taroborah Coal Project site



Source: Figure 4.62 of the EIS

3.2.2.1 Lacustrine wetlands

Two lacustrine wetlands artificially created by dams were identified on the project site. The larger dam in the central west of the project site is the only source of permanent water on-site and is used for agricultural purposes. The dam was found to support substantial and complex habitat for fauna, with little evidence of erosion due to an abundance of vegetation both in and surrounding the dam. This dam was scored as medium under the Aquatic Conservation Assessment (ACA). The smaller dam is located on a drainage line of Taroborah Creek near the Capricorn Highway. This dam was mapped during the field survey, but does not have permanent water and was not scored under the ACA.

3.2.2.2 Palustrine wetlands

One large, ephemeral palustrine wetland was identified in the north-west of the project site, incorporating two smaller palustrine wetlands. The two small palustrine wetlands were scored as medium under the ACA. During the dry season survey, only a small quantity of water was evident. However, the wetland was found to support good aquatic habitat, evidenced by the variation in substrate and cover elements. The banks of the wetland were dominated by grass species.

3.2.2.3 Regional ecosystems associated with wetlands

Some vegetation communities on the project site were noted for their potential to use groundwater. A close association was noted between palustrine wetlands and REs along Retreat Creek in the north of the project site. These REs are considered to be 51%–80% wetland, and typically consists of 190.1ha of river red gum riparian woodland (RE11.3.25 *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines) and 26.2ha of river teatree riparian woodland (RE 11.3.3a riverine wetland or fringing riverine wetland and *Melaleuca bracteata* woodland on alluvial plains). About 117ha of RE11.3.3a in the riparian area of Taroborah Creek was also mapped during the field survey.

While Retreat and Taroborah Creeks are not considered likely to receive surface expressions of groundwater, measured groundwater levels along Retreat and Taroborah Creeks range between 6m–10m below ground level. That depth is shallow enough for deep-rooted vegetation species, such as eucalypt species of RE11.3.25 and RE11.3.3a, to have the potential to access and use the sub-surface groundwater.

3.2.3 Groundwater regime

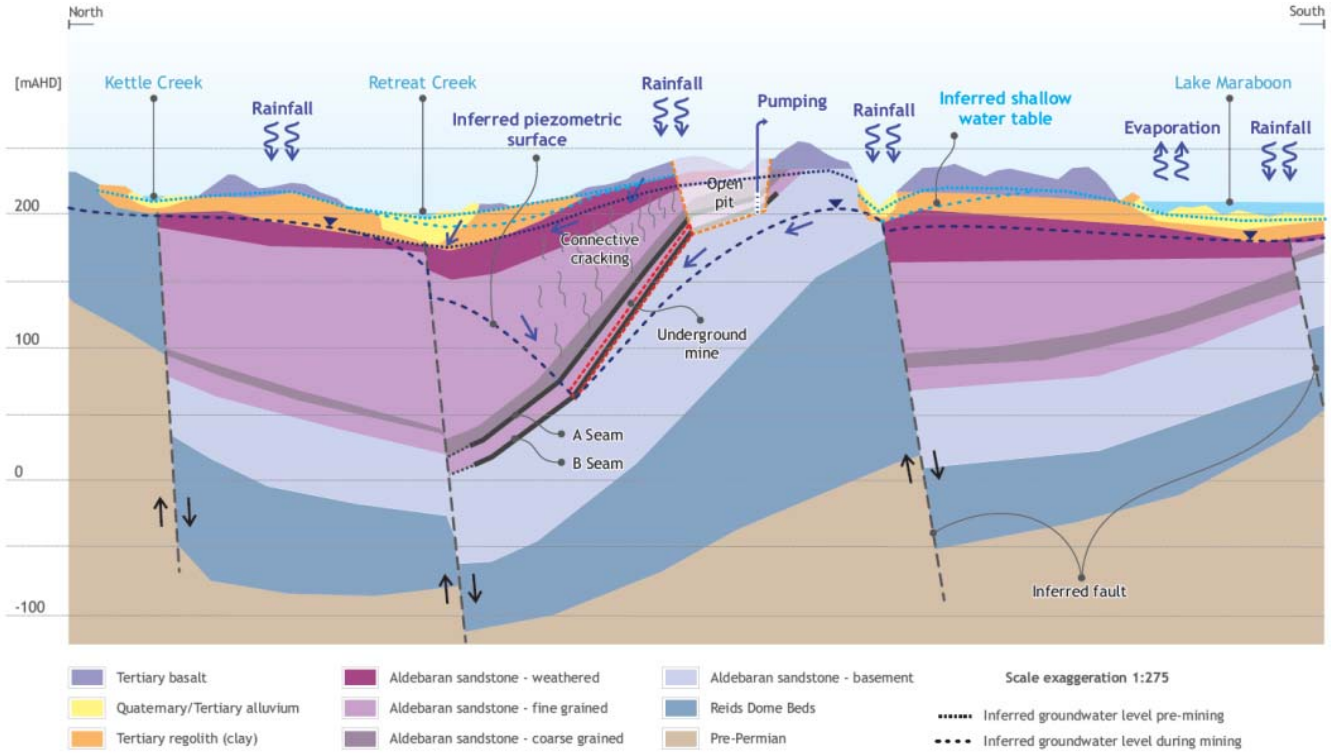
The three major geological units and their characteristics within the project area are described below:

1. Quaternary alluvium consists of a cover, less than 30m thick, of alluvial and colluvial sediments deposited across much of the western and northern portions of the project area. The alluvial cover, where encountered, generally comprises less than 25m of poorly consolidated clays, silts, sands and gravels. The alluvial deposits unconformably overlie Tertiary basalt and sediments. Where the Tertiary geology is absent, the Quaternary alluvium and colluvium directly overlie the Permian Aldebaran sandstone. The typical depth of groundwater in the alluvium is generally less than 10m below ground level. However, no users of alluviual groundwater were identified in the project area. The alluvium is generally a losing system and stored water is likely to discharge as leakage to nearby sub-cropping tertiary and permian units
2. Tertiary basalt and sediments outcrop throughout much of the middle and southern portions of the project area. The occurrence of fresh basalt is sporadic, and where encountered, is generally less than 30m thick. Fresh basalt is generally underlain by highly weathered tertiary clays and sands, and occasional by silts and gravels that range in thickness from 30m to 90m. Furthermore, the weathered clays and sands progressively grade into weathered Permian deposits beneath. Fractured rock aquifers in Tertiary basalts are predominantly used by landholders located to the west of the project area and by one landholder within the project area. Tertiary units are likely to be confined and hydraulically disconnected from the underlying Aldebaran Sandstone. Groundwater flow within the Tertiary is towards the east and north-east within the project area and surrounds, which suggests that the main source of recharge to the Tertiary is from rainfall percolation in the sub-crop areas to the west and south-west of the project area. Discharge from Tertiary sediments is likely to occur as lateral flow down-gradient of the project area. Leakage to underlying units may also occur where impermeable Tertiary clays are absent in the geological profile.
3. Permian Aldebaran sandstone sub-crops throughout the central and northern areas of the project area and is predominantly composed of quartzose sandstone deposited during cyclic marine to fluvial-deltaic environments, and is interbedded with conglomerate, shale, siltstone and coal. Below the base of weathering, strata are dominated by fine to very fine grained sandstones with occasional medium grained horizons deposited during a marine transgression. This fine grained sandstone is up to 150m thick in the northern portion of the project area, but has been removed by erosion in the south, where outcropping granite is present. Groundwater appears to be present under confined conditions throughout the Aldebaran Sandstone. A total of six of the 22 landholder bores identified within 10km of the project area target groundwater within the Aldebaran Sandstone. The main water bearing unit within the project area is the pebbly, coarse grained sandstone that lies directly on top of the

'A' coal seam. Recharge predominantly occurs through more permeable zones within the regolith and tertiary basalt, as well as downward percolation from quaternary alluvium associated with Retreat Creek.

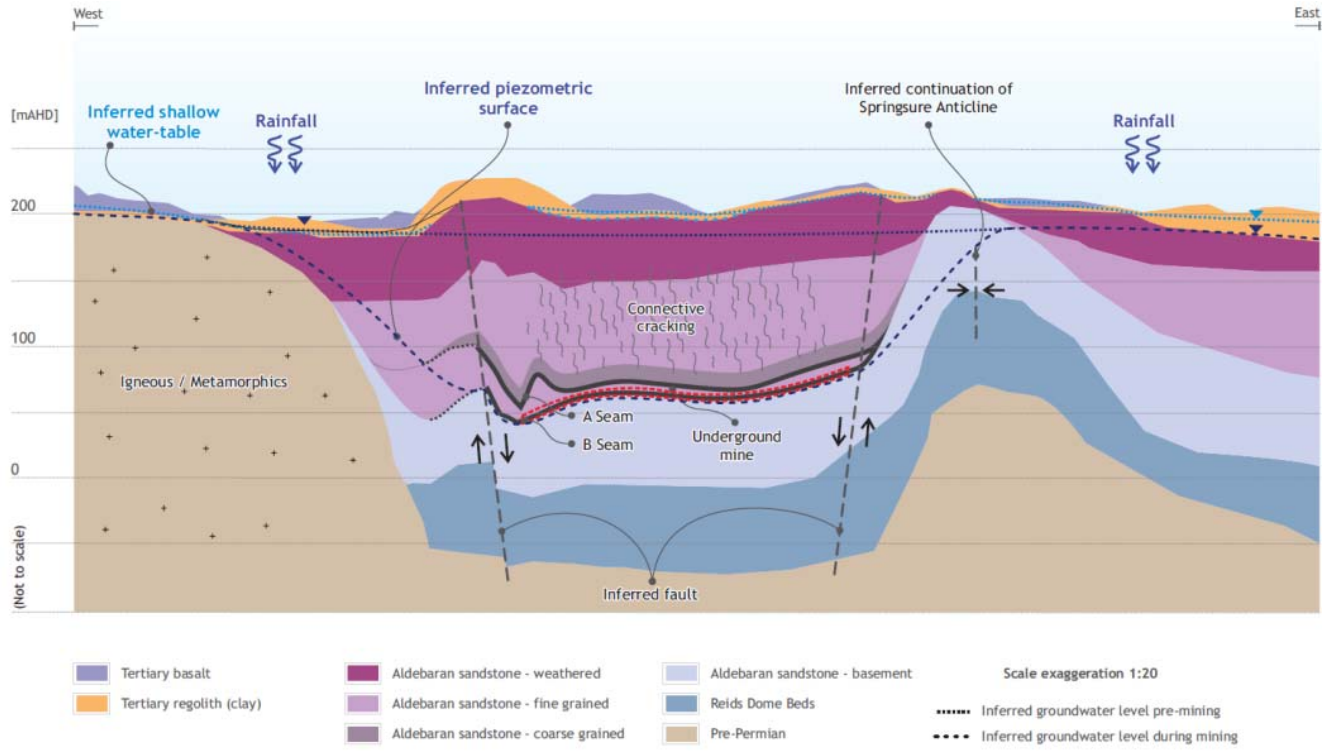
A geological conceptualisation of the groundwater regime in the vicinity of the project is shown in Figures 3-3 and 3-4 below.

Figure 3-3 Conceptual north to south geological cross-section of the project site



Source: Figure 16 of Appendix 14 of the EIS

Figure 3-4 Conceptual west to east geological cross-section of the project site



Source: Figure 17 of Appendix 14 of the EIS

3.2.4 Water quality

3.2.4.1 Surface water quality

Background surface water quality at some locations around the project site was not always below applicable water quality objectives or trigger values.

With regard to salinity levels in Retreat Creek and its tributaries, the average water quality results ranged from 768µS/cm to 2,302µS/cm. With regard to salinity levels in Taroborah Creek and its tributaries, the average water quality results ranged from 988µS/cm to 2,285µS/cm. All salinity results at all sites in Retreat and Taroborah Creeks exceeded the base flow salinity aquatic ecosystem protection water quality objective (WQO) of 340µS/cm for the Lower Nogoa and Theresa Creek sub-basin specified in the Queensland Water Quality Guidelines.

With regard to other physio-chemical parameters in Retreat Creek, the mean pH at one site (9.04) and dissolved oxygen at three sites (74.73%, 57.15% and 72.2%) fell outside the ranges of both the Lower Nogoa and Theresa Creek trigger values and the ANZECC (2000) Aquatic Ecosystem 95% species protection WQOs of pH 6.5 to 8.5 and 85% to 110% dissolved oxygen. Mean measurements of turbidity (476NTU, 907NTU, 419NTU and 1430NTU) at four sites exceeded the Lower Nogoa and Theresa Creek trigger values of 50NTU. The mean of 1430NTU at one site in Retreat Creek also exceeded the ANZECC (2000) Livestock Drinking Water Guidelines of 1000 NTU. Mean concentrations of total phosphorus (0.17mg/L, 0.31mg/L, 0.19mg/L and 0.11mg/L) at four sites, sulfate at one site (54mg/L), and nitrate at a different site (0.12mg/L) exceeded the Lower Nogoa and Theresa Creek trigger values of 0.05mg/L, 25mg/L and 0.06mg/L respectively.

With regard to heavy metals in Retreat Creek, mean dissolved concentrations of copper (0.002mg/L and 0.003mg/L) and silver (0.00010mg/L and 0.0004mg/L) at two sites, and zinc (0.009mg/L) at one site, exceeded the ANZECC (2000) Aquatic Ecosystem 95% species protection WQOs of 0.0014mg/L, 0.00005mg/L and 0.008mg/L respectively.

With regard to other physio-chemical parameters in Taroborah Creek, the mean pH (8.66 and 8.89) and dissolved oxygen (67.40% and 140.16%) at two sites, fell outside the ranges of both the Lower Nogoa and Theresa Creek trigger values and the ANZECC (2000) Aquatic Ecosystem 95% species protection WQOs of pH 6.5 to 8.5 and 85% to 110% dissolved oxygen. Mean measurements of turbidity (432NTU and 918.5NTU), nitrite (0.18mg/L and 0.07mg/L), nitrate (1.71mg/L and 0.35mg/L), total nitrogen (0.7mg/L and 4.07mg/L) and total phosphorus (0.10mg/L and 0.75mg/L) at two sites, exceeded the Lower Nogoa and Theresa Creek trigger values of 50NTU, 0.06mg/L, 0.06mg/L, 0.5mg/L and 0.05mg/L respectively. The mean concentration of total phosphorus (0.75mg/L) at one site also exceeded the ANZECC (2000) Aquatic Ecosystem 95% species protection WQO of 0.5mg/L. The mean concentration of sulfate (30.1mg/L) at one site also exceeded the Lower Nogoa and Theresa Creek trigger value of 25mg/L.

With regard to heavy metals in Taroborah Creek, mean dissolved concentrations of copper (0.002mg/L and 0.005mg/L) at two sites, and silver (0.0004mg/L) at one site exceeded the ANZECC (2000) Aquatic Ecosystem 95% species protection WQOs of 0.0014mg/L and 0.00005mg/L respectively.

3.2.4.2 Groundwater quality

Groundwater at the site is slightly brackish. The average recorded values for salinity (measured as conductance) in the Aldebaran sandstone geology are 1,435µS/cm in the course-grained sandstone, 1,765µS/cm in the fine-grained sandstone, and 2,301µS/cm in the coal measures. The average recorded values for salinity in the Tertiary geology are 2,059µS/cm and 1,354µS/cm in the Tertiary regolith and Tertiary basalt respectively. The average recorded values for salinity in the alluvium is 1,430µS/cm. Salinity of the coal seams is comparatively low for the Bowen Basin, which typically ranges from 5,000µS/cm to 50,000µS/cm. The lower salinity in the coal seams is likely related to leakage of fresher groundwater from the immediately overlying pebbly coarse sandstone unit, and from rainfall infiltration where it sub-crops to the south.

A significant number of salinity samples exceeded the 80th percentile limit specified for deep (>30m) groundwater quality objectives for the Nogoa River and all waters of the Nogoa River sub-basin listed under the Environmental Protection (Water) Policy 2009. Major ion exceedences included sodium, calcium, magnesium, bicarbonate, chloride and sulfate. A number of minor ions and metals also exceed the groundwater quality objectives.

Comparison of the data against the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ, 2000) for irrigation indicates that groundwater collected from most of the monitoring bores is suitable for short term irrigation.

Comparison of the data against the Australian Drinking Water Guidelines 2011 (NRMMC, 2011) (ADWG) show that in general all of the groundwater tested is not suitable for human consumption because it exceeds either the aesthetic or health guidelines. All bores exceeded the ADWG health guidelines for at least two criteria, including total dissolved solids, pH, total hardness, chloride, sodium, sulfate, aluminium, iron, and manganese. All bores exceeded the ADWG aesthetic guidelines for smell, taste, and appearance.

3.2.5 Potential impacts

3.2.5.1 Surface water impacts

The potential impacts of the project on surface water would include the following:

- aquifer dewatering associated with open-cut and underground coal mining activities, thereby creating groundwater drawdown and affecting groundwater and surface water interactions
- permanent alteration (e.g. due to final void and out-of-pit spoil dumps) of the direction and quantity of surface drainage south of the Capricorn Highway
- temporary alteration of the direction and quantity of surface drainage north of the Capricorn Highway due to subsidence of the land surface associated with underground mining.

3.2.5.2 Cumulative surface water impacts

A study conducted by EHP in 2009 investigated the cumulative impacts of mining activities on water quality in the Fitzroy River Basin. The study determined that salinity presents the most significant risk to water quality in the Fitzroy Basin due to discharges from coal mines. The proponent referred to the EHP study in the EIS for the Taroborah Coal Project and concluded that the project would not pose a significant cumulative impact from controlled or uncontrolled releases due to the following reasons:

- the EHP investigation of cumulative surface water impacts found that a number of mines in the northern Isaac-Connors sub-catchment posed the greatest risk of cumulative impacts in the Fitzroy Basin
- the investigation found that all of the mines (with the exception of Ensham mine) in the southern sub-catchments (i.e. Dawson, Nogoa and Mackenzie river systems) posed a low risk to cumulative water quality impacts
- the Taroborah Coal Project would be located in the Nogoa River sub-catchment, which was found by the EHP study to be in a low risk catchment for cumulative surface water impacts
- no operating mines exist upstream of the project and the nearest downstream operating mine is Ensham, which is located 60km to the east
- the EHP's Fitzroy Basin model water conditions would be applied to the environmental authority for the project, and those conditions were specifically developed to prevent the cumulative impacts of multiple mine discharges on the downstream surface water environment
- the Taroborah Coal Project is expected to require controlled discharges of less than 100ML/y with a salinity concentration below 2,500µS/cm.
- discharges would be undertaken in accordance with the model water conditions, which would include minimum flow requirements, discharge limits, and trigger investigation levels developed with regard to the spatial location of the project within the sub-catchment.

3.2.5.3 Groundwater impacts

A three-dimensional numerical simulation of groundwater flow for the project was run for the 21 year life of the mine to, amongst other things, predict the zone of depressurisation in alluvial and other aquifers, and predict changes in the groundwater regime. The model predicts that the Taroborah Coal Project would result in the following impacts:

- an average groundwater inflow rate to mine workings of 2.6 megalitres per day (ML/day), peaking at 5.7ML/day around year 19
- groundwater level drawdown of up to 5m within the alluvium around Retreat Creek
- groundwater level drawdown of up to 30m within the alluvium around Taroborah Creek, with a cone of depression extending up to 3.5km east of the MDL467 boundary
- potential die back of 190.1ha of river red gum riparian woodland (RE11.3.25 *Eucalyptus tereticornis* or *E. cambaldulensis* woodland on fringing drainage lines) in riparian areas of Retreat Creek and 143ha of river teatree riparian woodland (RE11.3.3a riverine wetland or fringing riverine wetland and *Melaleuca bacteata* woodland on alluvial plains) in the riparian areas of Retreat and Taroborah Creeks
- groundwater level drawdown of up to 8.5m in the Tertiary basalt extending up to 3km south of the boundary of MDL467, resulting in a reduction in available drawdown on two known bores of up to 30%
- groundwater level drawdown of up to 30m in the Aldebaran sandstone extending up to 3.5km east of the MDL467 boundary, resulting in a reduction in available drawdown between 3% and 48% on five known bores
- groundwater level recovery of about 70% within 100 years of stopping mine dewatering.

3.2.5.4 Cumulative groundwater impacts

With regard to potential cumulative groundwater impacts, the nearest proposed coal mine is the Teresa Coal Project, which if developed would be located approximately 19km to the north of the Taroborah Coal Project MDL467 boundary. Based on the findings of the EIS for the Teresa Coal Project, the worst-case modelled drawdown is predicted to extend 2.5km to the north and west of the project boundary and 10km to the south and

south-east of the project boundary. Groundwater drawdown for the Taroborah Coal Project is predicted to extend up to 3.5km outside of the project boundary. Given the two project boundaries are approximately 19km apart, there should be no overlap of impacts, and the Teresa and Taroborah Coal Projects may each be considered in isolation rather than having a cumulative impact on the groundwater aquifers.

The Taroborah Coal Project is unlikely to have significant cumulative impact in conjunction with other projects on the ecological integrity of Taroborah or Retreat Creeks. Both of these waterways are ephemeral, flow in an easterly direction and ultimately flow into the Nogoa River, downstream of Fairbairn Dam or Lake Maraboon. The project does not propose water to be dammed, extracted or diverted from these watercourses, and only minimal overland flow that drains to these waterways during the wet season will be temporarily captured in ponds created by subsidence.

3.2.6 Mitigation measures

Measures proposed to mitigate the impacts of the project on surface and groundwater resources include:

- construction activities that affect stormwater flow paths would commence only after suitable stormwater management infrastructure has been established
- clearing of vegetation would be undertaken in a staged manner to minimise the disturbance footprint at any one time
- stabilisation of disturbed areas would be undertaken as soon as practicable after disturbance
- the majority of the current surface water drainage patterns disturbed in open-cut areas would be rehabilitated
- deepening or replacing affected landholder bores, or supplementing landholders with an alternative water supply
- ongoing surface and groundwater monitoring in accordance with the requirements specified in the water management plan for the project.

3.2.7 Independent Expert Scientific Committee (IESC)

When considering the IESC advice, EHP sought assistance from other government departments, including the Department of Natural Resources and Mines (DNRM) and the Department of Science, Information Technology, Innovation and the Arts. The IESC advice on the EIS for the Taroborah Coal Project is available on the IESC website (www.iesc.environment.gov.au/advice/proposals.html). The proponent responded to this advice in the response to submissions, and made amendments to the EIS, including: section 4.5, Water; Appendix 13, Surface water management plan; and Appendix 14, Groundwater impact assessment. The major issues raised in the IESC's advice and the proponent's response to the advice are summarised below.

IESC Issue 1

The extent of groundwater drawdown as a result of the project is uncertain based on the groundwater model conceptualisation presented in the EIS.

Proponent's response to Issue 1

In response to Issue 1, the proponent explained that a conservative approach for developing the groundwater model was used by assuming local continuity of groundwater flow, rather than representing impermeable faults in the model domain. The proponent provided further information about the groundwater conceptualisation that was used to develop the groundwater model and make groundwater drawdown predictions, including the following key points:

- the numerical groundwater model used regional scale faults and structural domains based on referenced and publicly available reports and mapping to provide the basis for the model extent
- a graben (fault bounded) structure in which the coal measures are to be mined was identified during project specific seismic data, detailed exploration drilling, and state government drilling and mapping
- the graben structure was simulated in the groundwater model as a drape feature with hydraulic conductivity on either side of the faults, rather than defining linear fault features as impermeable barriers
- the coal seams were simulated in the model to end where the strata gets shallower to the east and west, based on regional drilling data (see Figure 3-4 above)
- existing transient groundwater level data shows minimal seasonal variation
- once mining commences and mine inflow data from the open-cut pit is available, it will be coupled with transient water level data to conduct a transient calibration of the groundwater model.

EHP sought advice from DNRM in relation to the groundwater model. DNRM advised that the major issues about the groundwater model conceptualisation raised by the IESC have been adequately addressed. However, DNRM recommended that a peer review of the groundwater model should be undertaken. Furthermore, the hydraulic conductivity values used for the coal seams are lower than field measurements and were estimated using only

three permeability tests. Consequently, DNRM recommends that the groundwater model should be reviewed and recalibrated after three years once additional permeability information is available. Refer to the recommendations in section 3.2.9 below.

IESC Issue 2

The representation of subsidence induced fracturing and deformations in the groundwater model are likely to underestimate groundwater flow, groundwater recharge and mine water inflows.

Proponent's response to Issue 2

In response to Issue 2, the proponent provided further information regarding the assumptions made about the vertical extent of fracturing above subsided mine workings, including the likelihood of fracturing within the Tertiary clay/mud units, which were assumed in the groundwater model to act as an aquitard between the Tertiary basalt and Aldebaran sandstone geological units at the Taroborah site. The proponent referred to a number of Australian and overseas studies that support the proponent's height of fracturing assumptions used in the model, including that:

- apart from the typically recognised fractured zone of deformation above subsided mine workings, there also exists an overlying dilated zone, where the strata bend and are subject to bed separation, with limited vertical cracking that does not provide an effective vertical connection to the lower strata (Figure 3-5)
- the dilated zone results in an increase in horizontal permeability and storage capacity of the strata in that zone, but with no resultant increase in vertical permeability
- the filling of the increased storage created in the dilated zone results in only a temporary drawdown of overlying groundwater and pre-mining levels return once the increased storage is filled
- the typical heights of the fractured and dilated zones referred to in relevant studies supports the fracturing height assumptions used in the Taroborah groundwater model
- subsurface fracturing in weak sediments (i.e. mudstones, claystones and weathered siltstones) and clays do not generally form continuous open fractures due to their plasticity and ability to strain without fracturing, and because fractures that do form tend to be self-healing due to swelling from moisture over a relatively short period of time
- the weak Tertiary strata and weathered Permian strata, which include layers of clay and weathered claystone north near Retreat Creek, are not expected to be highly fractured from subsidence where they occur more than 60m to 70m above the mine workings, and will continue to act as an aquiclude to the overlying groundwater and surface waters.

The proponent also conducted a sensitivity analysis, which indicated that the modelling was robust and the areal extent of the 1m drawdown contour does not substantially increase in response to the likely range of input parameters. DNRM was satisfied that the issue raised by the IESC has been adequately addressed.

IESC Issue 3

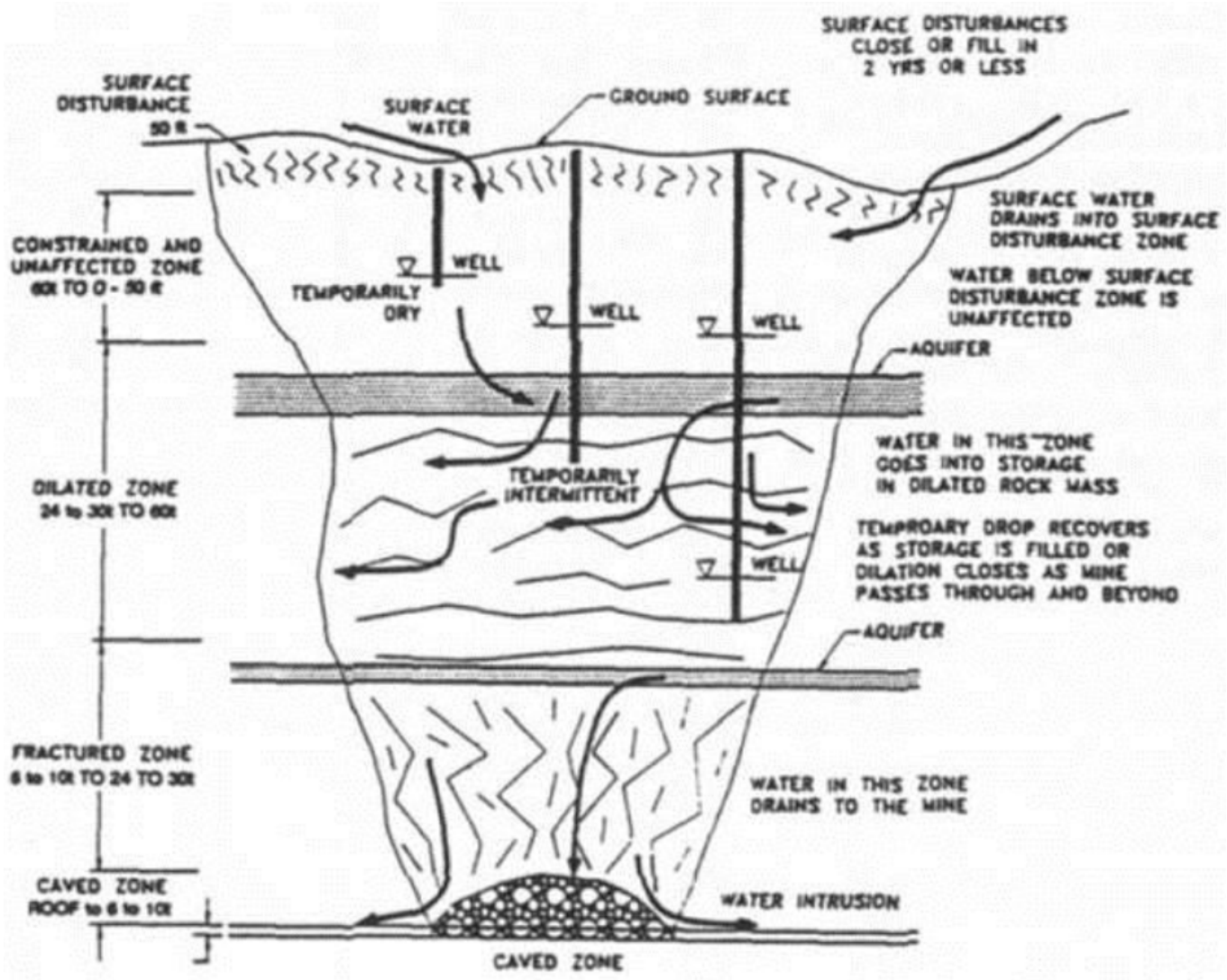
The degree of interaction between surface water and groundwater having regard to seasonal variations is uncertain.

Proponent's response to Issue 3

In response to Issue 3, the proponent referred to recent transient water level data for the site, which indicates that there is no seasonal variation in surface water and groundwater interaction. Therefore, converting the groundwater model to a transient calibration was determined to be unnecessary. The proponent also clarified that the net change on baseflow in streams as a result of mining is predicted to be negligible, and this is supported by the ephemeral nature of the streams on-site which only flow in response to sustained rainfall.

Nevertheless, DNRM advised EHP that a minimum of 12 consecutive months of groundwater level and quality data would be required to support the proponent’s conclusions. Consequently, it would be useful for the proponent to conduct an ongoing transient calibration of the groundwater model, using seasonal groundwater data gathered from recently installed monitoring bores. The calibration would enable the model to predict impacts on, and variations in, seasonal groundwater levels and baseflows to surface water systems. Following commencement of mining, groundwater mine inflow monitoring data should be coupled with transient water level data to conduct a transient calibration of the groundwater model. DNRM recommends that the groundwater model be reviewed and recalibrated no later than 3 years after commencement of dewatering. Refer to the recommendation in section 3.2.9 below.

Figure 3-5 Model of strata behaviour above full-extraction mining panels (Kendorski 1993)



Source: Page 172 of the response to submissions document

IESC Issue 4

The proposed surface water and groundwater monitoring programs are insufficient to provide suitable baseline data.

Proponent's response to Issue 4

In response to Issue 4, the proponent revised the surface water and groundwater monitoring programs as follows:

- a new downstream surface water monitoring location on Taroborah Creek
- new surface water monitoring points for the major lacustrine wetland system and associated palustrine wetland system in the central west of the project site
- a new surface water monitoring point for the palustrine wetland in the north-west of the project site, adjacent to Centre Creek
- a new surface water monitoring point for a potential intermittent spring system that may feed a drainage line into Retreat Creek on which 33.2ha of silver-leafed iron bark (RE11.3.6 *Eucalyptus melanophloia* woodland on alluvial plains) occurs in the central area of the project site
- a commitment to install flow metres on Retreat and Taroborah Creeks to measure flows following rainfall events
- the near-pit groundwater monitoring bores will be included in the ongoing groundwater monitoring program to monitor impacts from open-cut mining
- a commitment to maintain surface water and groundwater monitoring for a further twelve months to provide at least 24 months of baseline monitoring data, prior to the commencement of mining activities
- a commitment to establish site specific surface water and groundwater quality trigger investigation levels, prior to the commencement of mining activities.

EHP considers that the revised surface water monitoring program will address the issues raised by the IESC. The

monitoring program would be suitable to determine existing seasonal flow dynamics and baseflow estimates on Retreat and Taroborah Creeks and would improve the overall suitability of baseline surface water quality data for developing site specific surface water quality trigger investigation levels. The groundwater monitoring network would be suitable to identify any potential quality and quantity impacts on private groundwater bores resulting from mining activities. The surface water and groundwater monitoring programs would be required by conditions in the project EA.

IESC Issue 5

Groundwater dependant ecosystems (GDEs), springs and semi-permanent pools within and surrounding the project area have not been clearly identified, and therefore, the full suite of potential ecological impacts cannot be determined.

Proponent's response to Issue 5

In response to Issue 5, the proponent clarified information about the GDEs, springs and semi-permanent pools found in the vicinity of the project, including:

- a local spring supported by shallow groundwater between 6m to 10m below ground level, feeding the deep-rooted vegetation associated with the silver leaved ironbark open woodland community (RE 11.3.6) within the riparian zone of a drainage line of Retreat Creek
- springs associated with the Great Artesian Basin (GAB) in the catchment areas surrounding the site, none of which are in the immediate vicinity of the project site
- semi-permanent pools on a drainage line feeding Taroborah Creek from the south
- inflow dependent lacustrine wetlands in the central west and west of MDL467
- inflow dependent ecosystem RE 11.3.3a (river teatree riparian woodland) fringing Taroborah Creek.

The proponent included additional monitoring sites for these locations in the surface water monitoring program and committed to using the Australian Groundwater Dependent Ecosystem Toolbox to determine the ecological water requirements of the GDE's in the vicinity of the project.

IESC Issue 6

Drawdown associated with the project poses a risk to private groundwater users.

Proponent's response to Issue 6

In response to Issue 6, the proponent proposed to enter into make good agreements with potentially affected landholders, and either, deepen any affected bores, or provide an alternative supply from the mine dewatering scheme. DNRM would manage the take of groundwater through mine dewatering by including conditions in the water licence that would require the tenure holder to enter into agreements with potentially affected landholders to make good any groundwater supply that is predicted to be unduly affected in the future.

IESC Issue 7

Uncertainties about the site water balance may result in uncontrolled discharges from the site and requirements for supplementary water supplies.

Proponent's response to Issue 7

In response to Issue 7, the proponent provided further information about the data inputs to the site water balance and reiterated that there is expected to be a surplus of water during the life of mining, even in the driest conditions. Uncontrolled discharges from the mine site would be prevented by providing excess site water to local landholders impacted by groundwater drawdown, discharging excess water into the Selma irrigation channel system for use by downstream irrigators, and selling excess water to a third party (subject to agreement) proposing to construct a water supply pipeline from Fairbairn Dam to the Galilee Basin. Matters such as that would be regulated under a water licence.

IESC Issue 8

Predicted groundwater drawdown in the water table of Retreat Creek from the Teresa Coal Project extends into the Taroborah groundwater model domain and should be represented in the groundwater model for the Taroborah Coal Project to predict any cumulative impacts.

Proponent's response to Issue 8

In response to Issue 8, the proponent stated that the drawdown in the water table of Retreat Creek from each mine (3.5km to the north-east from the Taroborah mine, and 10km to the south-west from the Teresa mine) will not interact with each other, due to the 19km distance of separation between the two mines. DNRM noted that the Teresa groundwater model predicts 0.1-0.2m drawdown in the water table of Retreat Creek to the north of the proposed Taroborah mining lease boundary. Drawdowns of this low magnitude at the outer extents of a

groundwater model generally have a lower degree of accuracy and are considered negligible in a modelling sense. Therefore, while the groundwater model for the Teresa Project predicts a contribution of an additional 0.1-0.2m drawdown through the alluvium of Retreat Creek, DNRM is satisfied that this would not contribute to significant cumulative groundwater impacts.

IESC Issue 9

The risk of contaminant enrichment within the final void lakes and potential impacts on water resources has not been assessed.

Proponent's response to issue 9

In response to issue 9, the proponent provided the results of pit water quality modelling over a 100 year period. The model predicted that salinity would gradually increase due to saline inflows of groundwater and the concentration effect of evaporative water loss. However, the concentrations of sulfates, cations and trace elements were not predicted to be toxic to livestock. Importantly, the final void was predicted to be a groundwater sink with flows into rather than out of its pond. Consequently, the level of risk to water resources was assessed to be low. The proponent also committed to preparing a final void management plan, which will be required as a condition of the project EA. Furthermore, a requirement for the proponent to prepare a water management plan would also be included as a condition of the EA. The water management plan must include:

1. a study of the source of contaminants
2. a water balance model for the site
3. a water management system for the site
4. measures to manage and prevent saline drainage
5. measures to manage and prevent acid rock drainage
6. contingency procedures for emergencies
7. a program for monitoring and review of the effectiveness of the water management plan.

3.2.8 Major issues raised in submissions

DNRM and SunWater requested the proponent to provide further information about the proposed beneficial use of excess mine water, including the piping and pumping infrastructure required to transfer water from the mine to the proposed release location in the Selma irrigation channel. In response, the proponent stated that a 100kW pumping station would be installed at the mine site and a 250mm diameter water pipeline capable of transferring up to 5ML/day would be constructed parallel to the Central West railway line. DNRM and SunWater were satisfied with the additional information provided by the proponent, subject to pre-approval consultation with the relevant parties (refer to the recommendation in section 3.2.9 below).

DNRM requested the proponent to provide any additional groundwater monitoring data that was collected after April 2013 (i.e. any new data since the EIS was released for public notification) to identify any trends or seasonal variation in groundwater level and quality, and determine whether the groundwater model requires recalibration. In response, the proponent provided additional data collected in May and September 2014. The proponent's analysis of the data indicated that there were no significant changes in groundwater levels recorded between April 2013 and September 2014, and water quality was generally within 10% of the April 2013 dataset. The proponent concluded that the additional monitoring results indicate that there is little seasonal variation in the groundwater regime, which validates the assumptions used in the groundwater model. However, groundwater quality and levels would continue to be monitored in accordance with the proposed groundwater monitoring program. DNRM did not raise any additional questions in regard to this issue. However, the groundwater model should be reviewed and recalibrated, as discussed in the recommendation in section 3.2.9 of this report.

DNRM requested the proponent to outline any mitigation measures to address the potential impacts of the project on neighbouring groundwater bores. In response, the proponent proposed to enter into make good agreements with potentially affected landholders, and either deepen any affected bores, or provide an alternative supply from the mine dewatering scheme. EHP is of the opinion that the proposed mitigation measures are adequate and are consistent with typical measures to mitigate impacts on neighbouring groundwater users.

3.2.9 Conclusions and recommended conditions

The EIS used adequate studies, survey methodology, and survey effort to assess potential impacts on water resources (sections 24D and 24E of the controlling provisions). The mitigation and management measures proposed by the proponent are considered adequate to manage potential impacts during the life of the project. The proponent’s commitments in the EIS to undertake ongoing monitoring programs during the life of the Taroborah Coal Project are reflected in the recommended draft EA conditions included in Appendix 1 of this report.

The state generally agrees that the water resources issues raised by the IESC are relevant, but is of the opinion that the proponent’s response to the advice adequately addresses the key issues raised by the IESC. The surface

and groundwater monitoring programs proposed to be carried out by the proponent during the life of the project are considered adequate to identify the potential impacts of the project on the surface and groundwater resources. The state's draft EA conditions for the project provided in Appendix 1 of this report include conditions about the ongoing requirements of these monitoring programs. The IESC raised some concerns about the groundwater model conceptualisation and the level of certainty associated with the extent of groundwater drawdown predicted by the model. Consequently, the proponent should be required to commission a peer review of the groundwater model. Furthermore, an ongoing review and recalibration of the groundwater model would increase the level of certainty of the drawdown predictions and help identify groundwater impacts and any indirect impacts on groundwater dependent vegetation communities as mine dewatering progresses. The state's draft EA conditions for the project provided in Appendix 1 of this report include conditions about the peer review and ongoing review and recalibration of the groundwater model. Consequently, there are no additional recommendations for the Commonwealth approval under the EPBC Act with regard to water resources for the project. The potential impacts of the project on GDEs located on and off the project site were not adequately identified in the EIS. Consequently, the state's draft EA conditions for the project provided in Appendix 1 of this report include conditions about identifying the extent of potentially affected GDEs and establishing a monitoring program to identify any impacts. Residual impacts must be offset. Consequently, there are no recommended conditions for water resources.

Attachment

Profile of each threatened ecological community and listed migratory species likely to be significantly impacted by the proposed action

Listed threatened ecological communities (ss. 18 & 18A)

Brigalow (*Acacia harpophylla* dominant and co-dominant)

EPBC Status: Endangered

Recovery Plan: A recovery plan has not been prepared for the Brigalow (*Acacia harpophylla*) dominant and co-dominant ecological community.

Conservation Advice: Approved by the Commonwealth Environment Minister on the 17th December 2013.

Description

The Brigalow ecological community is characterized by the presence of Brigalow (*Acacia harpohylla*) 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.

Animal species associated with the Brigalow ecological community 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 and fruit (food for birds, including Belah seed for the Vulnerable Glossy Black-cockatoo).

Distribution

The Brigalow community 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 national ecological community 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:

1. the presence of *Acacia 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

2. in the Brigalow Belt, meets the description of one of 16 regional ecosystems – 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

3. the vegetation in the patch is brigalow regrowth with species composition and structural elements broadly typical of one of the identified regional ecosystems and at least 15 years since last comprehensively cleared.

With the condition threshold:

1. the patch is 0.5ha or more in size

And

2. 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 as stated in the conservation advice approved by the Commonwealth Environment Minister on 17/12/13.

Threat reduction/control

- protect and conserve remnant and regrowth areas of the ecological community. Prevent clearance of this endangered ecological community and of nearby native vegetation including buffer zones and connecting corridors
- where further clearance is unavoidable:
  - mitigate the severity of impacts (e.g. avoid higher quality areas, avoid dissection of patches, act to minimise hydrological disruption and the spread of weeds)
  - offsetting should consider the location and emulate qualities of affected patches.
- manage areas of brigalow to reduce threats, including through:
  - fire management that considers brigalow conservation, protection and ecological heterogeneity; and,
  - targeted weed and feral animal control with a particular focus on high biomass exotic grasses (buffel grass, Rhodes grass, green panic grass) and feral pigs
- manage all weeds appropriately within and close to the Brigalow ecological community; e.g. spot application of herbicides, rather than aerial spraying; avoid fertiliser application; minimise tree thinning and soil disturbance
- manage foxes and cats (as well as feral pigs) using a coordinated approach, preferably among groups of neighbours and across regions
- help woodland birds to avoid aggression from noisy miners by: encouraging and protection shrubby understorey; managing grazing pressure so that it does not degrade native vegetation; and retaining dense stands of trees and regrowth.

Land management

- encourage landholders to balance primary production and the conservation of native flora and fauna within and close to the ecological community. Examples of this are:
  - managing stocking rates Managing stocking rates, paddock numbers/sizes, grazing practices and livestock camp sites to avoid damage to woodland understorey and ground cover – this may include adopting rotational or cell grazing regimes; or, excluding grazing entirely from intact stands of brigalow where appropriate (e.g. unless managing fuel loads through grazing)
  - 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 where it falls on the ground
- undertake regeneration of high value regrowth sites and revegetation of degraded sites
- increase the area of brigalow ecological community managed for conservation, such as through the reservation of high quality/large areas of remnant or regrowth and by facilitating conservation agreements with landholders
- establish adequate buffer zones to protect remnants
- devise 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; this requires thinking about habitat use at multiples scales. General management actions that benefit many fauna species include:
  - 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 sites disturbed during proposed works
  - 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
- encourage woodland regeneration close to areas of existing woodland.

Survey requirements and survey effort

EPBC survey requirements/techniques

- there are no specific guidelines for survey requirements, however this species is identifiable at all times of the

year.

Project Survey effort

- several secondary and quaternary sites vegetation sites were undertaken in both dry and wet season within mapped regional ecosystems that are analogous with the Brigalow TEC. The field data was collected using methodology compatible with the Queensland Herbarium CorVeg database as defined in Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland (Neldner et al. 2005).

EHP is satisfied with the survey method and effort undertaken for the Brigalow TEC.

Occurrence within project area

Within the project area, Brigalow TEC occurs in the form of three vegetation communities:

- brigalow woodland (RE 11.9.1) of which there is 72.6ha within the project area
- Dawson's gum open woodland (RE11.4.8) of which there is 31.2ha within the project area in the north-west portion of the project area
- brigalow/Belah open woodland (RE 11.4.9) of which there is 8.5ha associated with a drainage line of Taroborah creek and was in a highly disturbed state.

Impacts of the proposed action

Potential impacts associated with the proposed project activities include:

- 2.76ha of brigalow TEC out of a total area of 112.3ha within the project would be cleared
- weed invasion associated with edge effects along the interface of the retained brigalow communities and the project disturbance area would be an indirect impact that would need to be managed
- edge effects could also alter the microclimatic conditions (such as greater light intensity, more wind penetration, lower humidity) and a reduction in plant health through loss of photosynthetic potential (as a result of plants being covered by dust generated from vehicle movement on unsealed tracks)
- loss of habitat could result in a loss of biological diversity (with associated removal of leaf litter, hollow bearing trees, fallen timber and resultant changes to soil biota)
- introduction of additional weed species and spread of weeds on the project area via transport of seeds on vehicles and machinery
- Underground mining north of the Capricorn highway. Underground longwall mining would result in surface subsidence (ponding) and tension cracking. Impacts of surface subsidence are detailed below:
  - the drainage profile could experience subtle changes and result in additional ponded areas
  - some areas of remnant vegetation could be impacted by subsidence-induced ponding, if ponded areas have significant depth (i.e. 1m or greater), this could significantly impact remnant vegetation causing vegetation dieback
  - surface cracking could occur in the subsidence impact area, with the worst case scenario predicting cracks less than 5m deep with a maximum width of 0.2 to 0.3m. While tension cracking itself would not necessarily impact on vegetation, the rehabilitation of cracks would involve remedial earthworks which could impact on vegetation.

Avoidance and mitigation measures

Key mitigation measures proposed by the proponent to address potential impacts to the brigalow TEC include:

- through project planning and design phases, the boundaries of the project area have been redefined since the dry season survey to include a 50m buffer to minimise the area of impact and avoid disturbance to Fairbairn State Forest and the brigalow TEC areas
- ongoing opportunities to further avoid impacts at a local scale through the detailed design process
- vegetation clearing within the project area would be minimised to only those areas required for the project operation
- areas to be cleared would be clearly delineated and identified to equipment operators and supervisors
- weed control measures such as vehicle wash downs would be implemented to prevent the spread of weed species along riparian corridors
- appropriate erosion and sediment-control structures would be put in place
- approval for clearing from environmental staff would be obtained
- suitable sediment and erosion control measures would be implemented to prevent sediment deposition in adjacent retained habitats. Retained vegetation would be protected and maintained throughout the project life to ensure seed availability for mine rehabilitation works
- groundwater reductions could impact the deep-rooted eucalypt trees that grow along both Retreat creek and Taroborah creek in terms of availability of local groundwater for these trees

- subsidence impacts would be mitigated in accordance with a Subsidence Management Plan with mitigation measures to include:
  - subsidence-induced ponding would be mitigated by completion of minor remedial drainage earthworks to re-establish free drainage
  - exact locations of tension cracks confirmed by monitoring with surface cracks rehabilitated using remedial earthworks and use of sealants if required. Rehabilitation of cracks would be managed appropriately to avoid impacts on vegetation. A crack rehabilitation plan would be prepared to guide remediation works on tension cracks whilst minimising impacts on surrounding vegetation. The crack rehabilitation program would be designed to ensure vegetation communities disturbed during repairs to tension cracks would be returned to pre-disturbance condition
- rehabilitation flora species (from species lists of dominant flora of each community) should be appropriate to the landscape elements of the project area. The rehabilitation strategy would include provision for monitoring the progress of rehabilitation progress over the life of the project. Areas to be rehabilitated/stabilised in stages as soon as possible after disturbance to minimise soil erosion. Rehabilitation would aim to restore the impacted vegetation communities and revegetate with local native species to achieve a similar pre-disturbance condition in order to maintain the current regional ecosystem conservation status
- rehabilitated landforms created as a result of the project would be contoured to resemble the original topography – flat to undulating plain.

Residual impact

A residual impact of 2.76ha of brigalow TEC would occur within the project area.

Offset

The proponent has proposed to provide an 11.04ha offset to acquit their impacts on brigalow TEC. The proponent's preferred option for offset delivery is to undertake a proponent-driven offset via an agreement with an offset broker/provider for the provision of the offset area. A desktop assessment by the proponent has indicated that there is 1,625,900ha of suitable offset areas within the brigalow belt bioregion.

Conclusion

The proponent has proposed a number of mitigation and management measures to reduce the level of impact to brigalow TEC and has committed to the disturbance limits for the project, which are reflected in the recommendations for conditions. The proponent must offset the residual impact to the TEC in accordance with the EPBC Act Offsets Policy and this is reflected in the recommendations at the end of the MNES chapter. EHP considers the proposed offset area to be of an adequate size to acquit their offset obligations, however the proponent must demonstrate that a conservation outcome would be achieved.

Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin

EPBC 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 grasslands 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 grasslands 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 (*Astrebla* species). Native perennial grass indicator species for this community are *Aristida leptopoda*, *Astrebla elymoides*, *Astrebla squarrosa*, *Eriochloa crebra*, *Panicum queenslandicum*, *Thellungia advena*, *Aristida latifolia*, *Astrebla 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 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 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 15/12/08) 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 spp*.).

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.

Project survey effort

- several secondary and quaternary sites vegetation sites were undertaken in both dry and wet season within mapped regional ecosystems that are analogous with the Natural Grasslands TEC. The field data was collected using methodology compatible with the Queensland Herbarium CorVeg database as defined in Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland (Neldner et al. 2005).

EHP is satisfied with the survey methodology, however noted that no survey was undertaken in an area of RE11.8.11 within the proposed mine pit area.

Occurrence within the project area

678.1ha of RE 11.8.11 which is analogous to the Natural Grassland TEC is mapped within the project area (as per the Queensland Herbarium certified regional ecosystem mapping). Some of this area is within the subsidence are and some within the area that coincides with the proposed open-cut pit and infrastructure area. Insufficient ground-truthing of the natural grassland TEC areas was undertaken during vegetation surveys to determine whether it meet the threshold conditions to be deemed Natural Grassland TEC.

Impacts of the proposed action

Potential impacts associated with the proposed project activities include:

- the majority of the natural grassland (RE11.8.11), located in the western portion of the open-cut pit and spoil pile area, will be impacted as a result of construction of these facilities. An area of 149.43ha of natural grassland TEC will be impacted
- edge effect resulting from proposed works could include the introduction and establishment of weeds, alteration of microclimatic conditions (such as greater light intensity, more wind penetration, lower humidity) and a reduction in plant health through loss of photosynthetic potential (as a result of plants being covered by dust generated from vehicle movement on unsealed tracks
- loss of habitat could result in a loss of biological diversity (associated with removal of leaf litter, hollow bearing trees, fallen timber and resultant changes to soil biota)
- land clearing could increase soil erosion, inadvertently causing silting or sedimentation of riverine habitats and waterholes downstream. Soil erosion could also trigger a loss of nutrients to one area, with disruption of natural nutrient cycling
- introduction of additional weed species and spread of weeds within the project area via transport of weeds on vehicles and machinery
- underground mining north of the Capricorn highway. Underground longwall mining would result in surface subsidence (ponding) and tension cracking within natural grassland areas in the subsidence area. Impacts of surface subsidence are detailed below:
  - the drainage profile could experience subtle changes and result in additional ponded areas
  - some areas of remnant vegetation could be impacted by subsidence-induced ponding, if ponded areas have significant depth (i.e. 1m or greater), this could significantly impact remnant vegetation causing vegetation dieback
  - surface cracking could occur in the subsidence impact area, with the worst case scenario predicting cracks less than 5m deep with a maximum width of 0.2 to 0.3m. While tension cracking itself would not necessarily impact on vegetation, the rehabilitation of cracks would involve remedial earthworks which could impact on vegetation.

Avoidance and mitigation measures

Key mitigation measures proposed by the proponent to address potential impacts to the Natural Grassland TEC include:

- vegetation clearing within the project area would be minimised so that only the areas required for the operation of the project are disturbed
- native vegetation removal would only occur after:
  - clearing areas would be clearly delineated and identified to equipment operators and supervisors

  - weed control measures such as vehicle wash-down would be implemented to prevent weed species spreading along riparian corridors
  - appropriate erosion and sediment-control structures would be in place
  - clearing permission attained from environmental staff
- suitable sediment and erosion control measures would be implemented to prevent sediment deposition in adjacent retained habitats. All retained areas of remnant vegetation would be protected and maintained for the life of the project to ensure seed availability for mine rehabilitation works
- flora species used for rehabilitation would be appropriate to the landscape of the project area and consistent with community descriptions
- landforms would be created and contoured to resemble the original local topography
- staff induction program would incorporate information on the conservation values of the project area and its surrounding areas to increase staff awareness. This information would include photographs, descriptions and the management requirements for known conservation values
- progressive rehabilitation of disturbed areas would occur as soon as possible to minimise soil erosion and the length of time land is altered from its pre-mining condition. Rehabilitation aims to restore native vegetation so that it is capable of supporting low intensity cattle grazing
- subsidence impacts would be mitigated in accordance with a Subsidence Management Plan with mitigation measures to include:
- subsidence-induced ponding would be mitigated by completion of minor remedial drainage earthworks to re-establish free drainage
- exact locations of tension cracks confirmed by monitoring with surface cracks rehabilitated using remedial earthworks and use of sealants if required. Rehabilitation of cracks would be managed appropriately to avoid impacts on vegetation. A crack rehabilitation plan would be prepared to guide remediation works on tension cracks whilst minimising impacts on surrounding vegetation. The crack rehabilitation program would be designed to ensure vegetation communities disturbed during repairs to tension cracks would be returned to pre-disturbance condition.

Residual impact

A residual impact of 149.43 ha of natural grassland TEC would impacted by the proposed action.

Offset

While the proponent has not ground-truthed the area of natural grassland TEC to be impacted, they are prepared to offset this area should its threshold condition not be verified in the field. In the Environmental Offset Strategy presented as part of the SEIS the proponent presents 597.72ha of natural grassland offset area (the impact area x relevant multiplier (4) as per the Queensland EOA) and from a desktop assessment has detailed that 219,688ha of suitable offset areas are available within the Brigalow Belt bioregion. The proponent's preferred offset delivery option is to undertake a proponent-driven offset via an agreement with an offset broker/provider, for the provision of an offset area.

Conclusion

The proponent has proposed a number of mitigation and management measures to reduce the level of impact to the ecological community Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin and committed to disturbance limits for the project, reflected in the recommendations below. The proponent must offset residual significant impacts to the natural grassland TEC in accordance with the EPBC Act Offsets Policy; this is reflected in the recommendations for conditions.

EHP is of the view that the proposed action will not have an unacceptable impact on the listed threatened ecological community Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin.

Ultimately the threshold condition of the natural grassland TEC area to be impacted needs to be assessed as to its ecological condition, firstly to establish whether it is necessary to offset and then to input this condition value into the EPBC offsets calculator. EHP supports the provision of an offset four times the area of impact as suitable to acquit the offset requirements should an offset be required.

Listed migratory species (sections 20 & 20A)

Australia provides critical non-breeding habitat for millions of migratory waterbirds each year. To ensure their conservation, the Australian Government has fostered international cooperation through a range of important agreements, including the Ramsar Convention and the Convention on Migratory Species, bilateral agreements with Japan, China and the Republic of Korea, and through the recently launched East Asian — Australasian Flyway Partnership. A range of important activities have also been undertaken within Australia to conserve migratory waterbird populations and their habitats.

Migratory waterbirds include species such as plovers, sandpipers, stints, curlews and snipe. These birds make round trip migrations of up to 26,000 km each year between their breeding grounds in the northern hemisphere and their non-breeding areas in the south. These trips are made in several weeks, with brief stops at staging sites along the way to rest and refuel for the next leg of their journey.

The corridor through which these waterbirds migrate is known as the East Asian - Australasian Flyway (the Flyway). It extends from within the Arctic Circle, through East and South-east Asia, to Australia and New Zealand. Stretching across 22 countries, it is one of eight major waterbird flyways recognised around the globe.

Wetland habitat loss and degradation is a significant threat to migratory waterbirds, and the conservation of important sites across the Flyway is essential to their survival. Many pressures are contributing to this degradation, of which population growth and economic development in East and South East Asia are of particular concern.

The proponent identified the following migratory species as potentially present within the project area:

- magpie goose (*Aneseranas semipalmata*)
- fork-tailed swift (*Apus pacificus*)
- great egret (*Ardea alba*)
- cattle egret (*Adrea ibis*)
- Latham's snipe (*Gallinago hardwickii*)
- white-bellied sea eagle (*Haliaeetus leucogaster*)
- white-throated needletail (*Hiraundapus caudacutus*)
- rainbow bee-eater (*Merops ornatus*)
- black-faced monarch (*Monarcha melanopsis*)
- satin flycatcher (*Myiagra cyanoleuca*)
- Australian cotton pygmy-goose (*Nettapus coromandelianus albipennis*)
- Australian painted snipe (*Rostratula australis*).

The following migratory bird species, were observed or had been recorded previously within the project area:

- cattle egret (*Adrea ibis*)
- Latham's snipe (*Gallinago hardwickii*)
- glossy ibis (*Plegadis falcinellus*)
- Australian painted snipe (*Rostratula australis*).

Migratory wetland birds

The cattle egret, Latham's snipe, Australian painted snipe and glossy ibis inhabit permanent and ephemeral wetlands throughout the majority of Australia. These species utilises habitat which includes freshwater wetlands with dense vegetation such as swamps, flooded grasslands or heathlands. These species are known to inhabit broader habitat range which include disturbed habitat such as farm dams, agricultural lands and sewage treatment ponds.

Distribution

The cattle egret, Latham's Snipe, Australian painted snipe and glossy ibis inhabit permanent and ephemeral wetlands throughout the majority of Australia. Cattle egret is widespread and common. Latham's snipe is mainly confined to eastern Australia. The Australian painted snipe is most common in eastern Australia, where it has been recorded at scattered locations throughout much of Queensland. The glossy ibis is known to breed in the Channel Country.

Survey requirements and survey effort

EPBC Act survey requirements/techniques

Wetland birds vary in their conspicuousness depending on lifestyle and time of the year. Generally, species that frequent open water will be conspicuous and easily detected throughout the day. Others that inhabit dense vegetation in wetlands and on the margins of water-bodies will often be difficult to sight, and detection will usually rely on call recognition or flushing. In general, calls will be most frequent in the early morning but are also strongly dependent on time of year. Currently, three wetland species are listed as threatened under the EPBC Act.

Broadcast surveys in suitable habitat for solicited call responses and sightings. Broadcast stations may be established at wetland edges to avoid damage to wetland vegetation. Stations should usually be at least 250m apart.

Observations of targeted foraging habitat within wetlands in the early morning or early evening are recommended. Wetland birds are detected by sightings and unsolicited calls.

Area searches in suitable habitat for sightings, nests, indicative footprints and feathers.

Project survey effort

A dedicated search for diurnal birds was conducted visually and aurally on mornings and afternoons of the survey in the immediate vicinity of each fauna transect. Additionally, opportunistic diurnal searches were conducted in areas considered likely to have high avian diversity such as vegetated creek lines and dams.

Occurrence within the project area

Both Latham's snipe and the glossy ibis were located during aquatic field survey at a large lacustrine dam within the project area, but the dam is not considered important habitat for either species due to the widespread distribution of the species and alternative suitable habitat throughout Australia. The cattle egret was located at fauna survey site four located in the north-western corner of the project area.

Impacts of the proposed action

Potential impacts associated with the proposed project activities include:

- habitat loss and habitat degradation. Where habitat is retained, degradation from adjacent works could result in a loss of habitat quality through secondary effects such as sedimentation
- edge effects such as the introduction of pest and weed species could result in the degradation of habitat. Additionally, noise and light may result in the displacement of individuals
- land clearing activities could increase soil erosion, inadvertently causing silting or sedimentation of riverine habitats and waterholes downstream. Soil erosion could trigger a loss of nutrients to one area, causing a disruption of natural nutrient cycling
- processing and mining activities in the project area could contaminate riverine habitats and waterholes downstream.

Avoidance and mitigation measures

Key mitigation measures proposed by the proponent to address potential impacts to the listed migratory birds include:

- minimisation of the proposed disturbance footprint in order to retain the intrinsic values of local native vegetation and associated fauna habitat
- prior to disturbance, vegetation would be surveyed to identify any fauna that may be present in order to minimise impacts on fauna communities. If any fauna is present, the fauna would be given the opportunity to move away naturally prior to clearing. Staff or contractors responsible for land clearing would be made aware of the possible presence of migratory species
- staff induction programme would contain information on the project area's conservation values in order to increase staff awareness of the potential presence of the migratory species;
- photographs, descriptions and the management requirements for any migratory species encountered within the project area would be developed as part of the conservation induction package
- final rehabilitation would include the restoration of wetland habitat to support cattle egret, Latham's snipe and glossy ibis, which may have been impacted by project actions.

Conclusion

The proponent has concluded that given the protection of potential habitat for listed migratory species through the project's minimisation of impact to wetland habitat and proposed pre-clearance surveys, the project is unlikely to have a significant impact on any important populations of listed migratory species.

The migratory species that have been detected on site are all highly mobile species which may visit periodically. The project footprint does not include significant or locally uncommon habitat values and these species are therefore unlikely to utilise the site for breeding purposes. While individuals may occasionally visit the project site, it is considered unlikely that the habitat on-site would represent important habitat; or that a population would be dependent on the project area.

EHP is of the view that the proposed action is unlikely to have a significant impact on any population of listed migratory species.