Cameby Downs
Continued Operations Project

ENVIRONMENTAL VALUES ASSESSMENT
CAMEBY DOWNS CONTINUED OPERATIONS PROJECT

ENVIRONMENTAL VALUES ASSESSMENT

Cameby Downs Mine
MANAGED BY THE YANCOAL AUSTRALIA GROUP

SEPTEMBER 2018
Project No. SYN-16-02
Document No. 00813286-004
EXECUTIVE SUMMARY

The Cameby Downs Mine is located approximately 360 kilometres (km) west-north-west of Brisbane in the Western Downs Regional Council local government area (Figure ES.1).

The Cameby Downs Mine is owned and operated by Syntech Resources Pty Ltd (Syntech Resources) and is managed by Yancoal Australia Ltd. Syntech Resources is a wholly owned subsidiary of Yanzhou Coal Mining Company Limited.

Operating in accordance with Environmental Authority (EA) EPML00900113, the Cameby Downs Mine operation consists of an open cut coal mine and associated infrastructure, coal handling and preparation plant (CHPP) and rail load-out infrastructure within Mining Lease (ML) 50233.

The mine is currently approved to extract up to 2.8 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal with a mine life of approximately 45 years. After processing, approximately 2.2 Mtpa of product (thermal) coal is produced from the Cameby Downs Mine. Product coal is loaded onto trains within ML 50233, and transported to the Port of Brisbane for export.

Syntech Resources has lodged an amendment application to the Cameby Downs Mine EA, EPML00900113 in accordance with section 224 of the Queensland Environmental Protection Act 1994 to approve the Cameby Downs Continued Operations Project (the Project).

This Environmental Values Assessment assesses the potential environmental impacts associated with the development of the Project in accordance with the Department of Environment and Science’s (DES) Information Request dated 12 January 2017.

ES.1 PROJECT OVERVIEW

The Project involves extension of operations within ML 50233 and into Mining Lease Applications (MLAs) 50258, 50259, 50260 and 50269, at a mining rate of 3.5 Mtpa, for a period of approximately 75 years.

The main activities associated with the development at the Project would include:

- extension of open cut mining operations at an increased mining rate of 3.5 Mtpa ROM coal within ML 50233 and into MLAs 50258, 50259, 50260 and 50269;
- upgrade and use of CHPP and general coal handling and rail loading facilities and other existing and approved supporting mine infrastructure;
- the disposal of waste rock, comprising of overburden and interburden, in-pit or in out-of-pit waste rock emplacements;
- the disposal of (coarse and fine) coal rejects in dedicated in-pit and out-of-pit rejects emplacement structures and in a final void;
- transport of product coal via the existing rail system from the Cameby Downs Mine to the Port of Brisbane;
- construction and operation of new ancillary infrastructure in support of mining operations including: satellite mine service and infrastructure areas, haul and access roads, workshop, diesel storage tanks, electricity supply and communications infrastructure and water management infrastructure;
- closure of existing and construction of new local roads;
- realignment of existing 132 kilovolts electricity transmission line;
- 75 years of mining operations;
- increase in the peak operational workforce from approximately 140 to 160 people;
- ongoing exploration activities within ML 50233 and MLAs 50258, 50259, 50260 and 50269;
- progressive rehabilitation, as well as ultimate rehabilitation of the entire Project area once the site has been decommissioned; and
- other associated minor infrastructure, plant and activities, where required.

The approximate extents of the Project open cut mining components (including open cut pits, waste rock emplacements, out-of-pit rejects emplacement structures, water storages and final voids) are shown on Figure ES.2.

---

1 Yancoal Australia Ltd Manages the Cameby Downs Mine on behalf of its majority shareholder, Yanzhou Coal Mining Company Limited.
CAMEBY DOWNS CONTINUED OPERATIONS PROJECT

LEGEND
- Existing Mining Lease
- Mining Lease Application

SYNTECH RESOURCES PTY LTD

Regional Location

FIGURE

ES.1
ES.2 ENVIRONMENTAL ASSESSMENT

A number of environmental assessment studies were completed to assess the potential environmental impacts of the Project. A summary of the key findings of these studies and key commitments with respect to managing potential impacts is provided in Table ES.1.

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<td><strong>Land</strong></td>
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<td>• The Project would alter the landforms and topography within the Project area (e.g. rehabilitated out-of-pit waste rock emplacement landforms), however, these landforms would be similar in elevation to the existing/approved mine landform and existing topography across the Project area and would be rehabilitated.</td>
<td>• The Project would be rehabilitated to be safe, stable and non-polluting and able to support and sustain the proposed post-mining land use of light intensity grazing with areas of native vegetation.</td>
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<tr>
<td>• Potential impacts to soils would relate to direct disturbance of soil resources, alteration of soil structure beneath infrastructure, increased erosion and sediment movement due to construction activities and alteration of physical and chemical soil properties due to soil stripping and stockpiling.</td>
<td>• Management of impacts to land use and soils including minimisation of disturbance areas and identification of suitable topsoil for salvage prior to land disturbance and management of soil resources so they can be used for rehabilitation.</td>
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<tr>
<td>• The Project would result in the long-term disturbance or alteration of some existing low intensity grazing areas.</td>
<td>• Continued implementation of agricultural land resource management measures. In addition, the post-mining land use would be light intensity grazing with areas of native vegetation.</td>
</tr>
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<td>• A Site Investigation identified evidence of contamination or historical contaminating activities on five properties on the Project site. All of these locations were considered to be suitable for the land use proposed by the Project with the implementation of management measures and are not considered to be causing or are likely to cause or constitute serious or material environmental harm in their current state.</td>
<td>• Implementation of management measures at the five properties where evidence of contamination of historical contaminating activities has been identified.</td>
</tr>
<tr>
<td>• It is anticipated that potential impacts on visual amenity at privately owned dwellings associated with the Project would not be significant.</td>
<td>• All external lighting would be operated in accordance with Australian Standard 4282 (IN):1997 Control of Obtrusive Effects of Outdoor Lighting.</td>
</tr>
</tbody>
</table>
Summary of Environmental Assessment Conclusions | Key Management, Mitigation or Monitoring Measures for the Project
---|---
**Surface Water** | Site water management and monitoring would be conducted in accordance with the Site Water Management Plan.
- Based on the site water balance prepared for the Project, the potential for ‘worked’ water in the surface water management system overflowing to receiving waters is very low (i.e. <1% annual exceedance probability). Pumped releases to the receiving environment may however be undertaken as required subject to the water quality complying with the end-of-pipe and downstream receiving environment limits specified in the EA EPML00900113.
- The drainage features within the Project area and downstream watercourses are ephemeral in nature and therefore subject to compliance with the downstream receiving environment limits specified in the EA EPML00900113 (and considering indicative locally derived trigger levels), the potential impacts of releases (as required) would be negligible.
- Hydrologic and hydraulic modelling of local catchments have been completed to:
  - assess the existing and proposed flood behaviour at the Cameby Downs Mine and surrounds at the completion of the Project;
  - assist in the development of conceptual designs for clean water drains and drainage features diversions; and
  - assess the conceptual design of flood protection measures for the open cut pits and mine infrastructure, including final landforms.
- The flood modelling results indicate that:
  - with the proposed flood management measures (i.e. operational flood levees and drainage line diversion) the open cut pits, and the mine infrastructure area would be protected and would not be inundated for all mine stages for the 100-year average recurrence interval (ARI) and 1,000-year ARI flood events, respectively;
  - comparisons with the existing condition modelling show there would be no impact to the flood immunity at the drainage features crossings of the Warrego Highway and Western Railway;
  - the Western Railway would continue to have a 100-year ARI flood immunity at both Drainage Line 1 and Drainage Line 3 crossings;
  - flood velocities for the 100-year ARI event along the Western Railway embankment are generally less than 1 metre per second outside of drainage feature crossings (i.e. no impact);
  - the peak 100-year ARI flood velocities are generally similar along Drainage Line 1 and Drainage Line 3 (i.e. negligible change); and
  - with the proposed final landform design the two final voids would not be inundated up to and including the extent of a probable maximum flood event.
- Continuation of surface water level (flow) and quality monitoring within and surrounding the mine site in accordance with EA EPML00900113 (with additional proposed locations as required).
- The new water storages would be designed by a suitably qualified and experienced person in accordance with good engineering practice and the requirements of the relevant version of Department of Environment and Heritage Protection’s (DEHP) (now DES) Manual for assessing consequence categories and hydraulic performance of structures and Structures which are dams or levees constructed as part of environmentally relevant activities.
- A consequence category assessment of the new water storages would be conducted in accordance with the Manual for assessing consequence categories and hydraulic performance of structures following completion of the detailed design.
- The operational flood levees would be designed in accordance with DEHP’s (now DES) Manual for assessing consequence categories and hydraulic performance of structures and Structures which are dams or levees constructed as part of environmentally relevant activities.
- Operational flood levees and waste rock emplacements would be designed and constructed to provide 1:1,000 annual exceedance probability flood protection to open cut voids and 1:100 annual exceedance probability protection to operational mine infrastructure.
- A Reject Management Concept Study has been developed for the Project and concludes:
  - The proposed rejects management strategies are considered effective at managing the risk profile of reject material for the Project over the life of the mine. Out-of-pit placement of reject material has been minimised with in-pit disposal of coarse rejects and through the use of integrated waste landfill cells and the Central Pit (Pit 1) north-western void for disposal of fine rejects.
  - The monitoring programs including monitoring of the fine rejects surface (decant) water, downgradient seepage/groundwater and geochemistry of the reject material will provide the opportunity for early intervention and application of additional mitigation measures if required.
  - All rejects disposal areas will be rehabilitated in line with the rehabilitation objectives, Environmental Authority and Rehabilitation Management Plan requirements.

Table ES.1 (Continued)

Key Outcomes of Environmental Assessment
### Table ES.1 (Continued)
**Key Outcomes of Environmental Assessment**

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<td><strong>Groundwater</strong></td>
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<tr>
<td>• There is no significant groundwater usage for agricultural purposes within (or neighbouring) the Project area.</td>
<td>• Continuation of groundwater level and quality monitoring within and surrounding the mine site in accordance with EA EPML00900113.</td>
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<tr>
<td>• This limited value for agricultural use was also reflected during a bore census conducted in October 2017. The census of 30 privately-owned properties surrounding the Cameby Downs Mine, across an area of more than 150 square kilometres, resulted in identification of only one stock bore in use (located approximately 6.5 km south of the Project and beyond the predicted drawdown extents).</td>
<td>• Expansion of existing groundwater level and quality monitoring program to include additional bores (MB1 to MB5) outside of the current mine area to target groundwater associated with the upper Macalister Horizon (MA1) down to the lower Wambo Horizon (WM3). These bores would be supplemented by additional groundwater monitoring locations adjacent the final voids (MB6, MB7 and MB9) as well as the out-of-pit and in-pit reject emplacement areas (MB8A/MB8B, MB10A/B, MB11A/B and MB12A/B).</td>
</tr>
<tr>
<td>• Notwithstanding, a 3D numerical groundwater flow model was developed for the Project. The peer review concluded the model has an appropriate level of complexity, is generally in accordance with the Australian Groundwater Modelling Guidelines and the groundwater impact assessment is 'fit-for-purpose'.</td>
<td>• The peer review concluded the groundwater monitoring strategy/program is appropriate, particularly as there are no landholder water supply bores located within the predicted drawdown extents by the Project alone and recognising the existing poorer groundwater quality (i.e. brackish to highly saline).</td>
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<td>• As a result of the Project, the depressurised zone in the Walloon Coal Measures is predicted to extend up to approximately 5 km towards the south-west of the Project area.</td>
<td>• Preparation of an annual monitoring report that would include records of groundwater levels and quality in the monitoring bores and details of any review undertaken of the groundwater model since the previous annual monitoring report (NB: A review of the groundwater model would be undertaken within three years of commencement of the Project by a suitably qualified hydrogeologist).</td>
</tr>
<tr>
<td>• No landholder water supply bores are located within the predicted drawdown extents attributable to the Project.</td>
<td>• An associated water licence for the Project would be obtained under the Water Act 2000 separately.</td>
</tr>
<tr>
<td>• Cumulative impacts in the region of the Project extend across much of the model domain, and are solely due to impacts from coal seam gas development, which partially overlaps with the Project area. Logically, the drawdown that is attributable to the Project is adjacent to the open cut pits, with the influence reducing with distance from the Project area.</td>
<td></td>
</tr>
<tr>
<td>• The Project would only add a small to moderate 'water take' that is predicted to be comparatively low compared to the already approved impacts from coal seam gas operations.</td>
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<tr>
<td>• The final pit voids would act as long-term groundwater sinks post mining. Therefore, no significant groundwater quality impacts are predicted as a result of the Project.</td>
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<tr>
<td>• There are no groundwater dependent ecosystems associated with drainage features, watercourses, wetlands or springs in the Project area or surrounds.</td>
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<tr>
<td>• No impact from mining is predicted on localised shallow alluvial or perched aquifers or any groundwater dependent ecosystems that may be associated with these groundwater systems.</td>
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### Table ES.1 (Continued)  
Key Outcomes of Environmental Assessment

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<th><strong>Biodiversity</strong></th>
<th><strong>Key Management, Mitigation or Monitoring Measures for the Project</strong></th>
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| • Over the 75 year life of the Project, a total of approximately 910 hectares of remnant vegetation would be progressively cleared. All of the native vegetation communities/regional ecosystems to be cleared occur more widely in the surrounding landscapes and subregions.  
• Matters of State Environmental Significance considered relevant to the Project include; Regulated Vegetation (RE 11.4.3, RE 11.4.10, RE 11.3.2 and RE 11.3.4), Regional Ecosystems within the Defined Distance of a Vegetation Management Watercourse, Connectivity, Protected Wildlife Habitat (Yakka Skink, Grey Snake, Glossy Black-Cockatoo, Short-beaked Echidna and Koala), and Waterways Providing for Fish Passage.  
• The Project would remove aquatic habitat in the Project area, comprising ephemeral drainage lines, sections of Drainage Line 1 and farm dams. None of these habitats are expected to support aquatic species of conservation significance. | • Implementation of a vegetation clearance protocol (including pre-clearance surveys).  
• Implementation of weed and feral animal control measures.  
• Implementation of a Biodiversity Offset Strategy in accordance with the Queensland Environmental Offsets Policy – Version 1.4 to offset potential impacts on relevant Matters of State Environmental Significance. |

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<th><strong>Air Quality</strong></th>
<th><strong>Key Management, Mitigation or Monitoring Measures for the Project</strong></th>
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</table>
| • Air quality modelling predicts that all privately-owned receivers that do not have an existing agreement in place with Syntech Resources are predicted to:  
  - experience cumulative 24 hour average particulate matter with an equivalent aerodynamic diameter of 2.5 micrometres or less (PM$_{2.5}$) concentrations below the objective of 25 micrograms per cubic metre ($\mu$g/m$^3$);  
  - experience cumulative annual average PM$_{10}$ concentrations below the objective of 8 $\mu$g/m$^3$;  
  - experience cumulative 6th highest 24 hour average particulate matter with an equivalent aerodynamic diameter of 10 micrometres or less (PM$_{10}$) concentrations below the objective of 50 $\mu$g/m$^3$;  
  - experience cumulative annual average total suspended particulate matter (TSP) concentrations below the objective of 90 $\mu$g/m$^3$; and  
  - comply with the dust deposition objective. | • Continued implementation of the near-neighbour engagement strategy (including seeking compensation or purchase agreements).  
• Continued implementation of general dust mitigation measures such as watering haul roads, water sprays on stockpiles and progressive rehabilitation.  
• Continued implementation of the existing air quality management system, including the use of a real-time Beta Attenuation Monitor (located near receivers to the south-west) and associated proactive/reactive mitigation measures. The monitoring network would be expanded with an additional real-time monitor near sensitive receivers to the north-west once operations expand to the north-west (e.g. Year 42). |

<table>
<thead>
<tr>
<th><strong>Noise and Vibration</strong></th>
<th><strong>Key Management, Mitigation or Monitoring Measures for the Project</strong></th>
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</table>
| • Noise modelling predicts that with the continued implementation of general and proactive/reactive noise mitigation measures, all privately-owned receivers that do not have an existing agreement in place with Syntech Resources are predicted to:  
  - meet the daytime, evening and night-time noise objectives under neutral/calm and conservative adverse meteorological conditions; and  
  - meet the adopted low frequency noise objectives.  
• The Project blasting overpressure and vibration levels are predicted to exceed the relevant objectives at one privately-owned receiver that does not have an agreement in place with Syntech Resources. | • Continued implementation of near-neighbour engagement strategy (including seeking compensation or purchase agreements).  
• Continued implementation of the existing noise management system, including the use of general mitigation measures (implemented regardless of recorded noise levels or weather conditions) and real-time directional noise loggers and associated proactive/reactive mitigation measures.  
• The blast maximum instantaneous charge would be reduced when blasting at the nearest point to this receiver. Blast monitoring would be conducted at a representative location in order to maintain compliance with the EA EPML00900113 blast limits. |
### Table ES.1 (Continued)
Key Outcomes of Environmental Assessment

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<th>Summary of Environmental Assessment Conclusions</th>
<th>Key Management, Mitigation or Monitoring Measures for the Project</th>
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<td><strong>Aboriginal Cultural Heritage</strong></td>
<td>• Conduct Aboriginal cultural heritage surveys of the Project area with the Barunggam Endorsed Parties and the Western Wakka Wakka Aboriginal Parties.</td>
</tr>
<tr>
<td>• Ground disturbance associated with the Project would result in disturbance of cultural heritage sites where avoidance is not practicable or reasonable.</td>
<td>• Any Aboriginal cultural heritage sites identified during the surveys would be managed in accordance with the Cultural Heritage Management Plans and in consultation with the Barunggam and the Western Wakka Wakka Aboriginal parties.</td>
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INTRODUCTION

Syntech Resources Pty Ltd (Syntech Resources) has lodged an amendment application to the Cameby Downs Mine Environmental Authority (EA) EPML00900113 in accordance with section 224 of the Queensland Environmental Protection Act 1994 (EP Act) to approve the Cameby Downs Continued Operations Project (the Project).

The Project involves the extension of operations within Mining Lease (ML) 50233 and into Mining Lease Applications (MLAs) 50258, 50259, 50260 and 50269 and an increase in the run-of-mine (ROM) coal mining rate from the currently approved 2.8 million tonnes per annum (Mtpa) to 3.5 Mtpa.

This Environmental Values Assessment (EVA) assesses the potential environmental impacts associated with the development of the Project in accordance with the Department of Environment and Science’s (DES) Information Request dated 12 January 2017 (Section 1.5).

1.1 PROJECT PROPOSENENT

The Project proponent is Syntech Resources Pty Ltd (ACN 095 102 971), a wholly owned subsidiary of Yanzhou Coal Mining Company Limited.

The Cameby Downs Mine is owned and operated by Syntech Resources and is managed by Yancoal Australia Ltd².

The registered address for the proponent is:
Darling Park – Tower 2, Level 18
201 Sussex Street
SYDNEY NSW 2000

1.2 EXISTING CAMEBY DOWNS MINE

The Cameby Downs Mine is located approximately 360 kilometres (km) west-north-west of Brisbane in the Western Downs Regional Council (WDRC) local government area. The regional location of the Project is shown on Figure 1.1.

The Cameby Downs Mine has been operating for approximately eight years, with excavation of overburden commencing in July 2010 and first coal excavated in August of that year. The coal handling and preparation plant (CHPP) was commissioned in November 2010 with first railing of coal occurring in December 2010.

Operating in accordance with EA EPML00900113 (mining black coal and mineral processing activities), the Cameby Downs Mine operation consists of an open cut coal mine and associated infrastructure, CHPP and rail load-out infrastructure within ML 50233 (Figure 1.2). The mine is currently approved to extract up to 2.8 Mtpa of ROM coal with a mine life of approximately 45 years. After processing, approximately 2.2 Mtpa of product (thermal) coal is produced from the Cameby Downs Mine. Product coal is loaded onto trains within ML 50233, and transported to the Port of Brisbane for export.

The Cameby Downs Mine transitioned from contractor operation to owner-operator operation in December 2013. Through improved operating efficiencies and strategies in mining and processing operations increased production rates have been achieved.

The Cameby Downs Mine employs a total workforce of approximately 140 persons and is approved to operate 24 hours per day, 7 days per week.

1.3 PROJECT OVERVIEW

The Project involves extension of operations within ML 50233 and into MLAs 50258, 50259, 50260 and 50269, at a mining rate of 3.5 Mtpa, for a period of approximately 75 years.

The approximate extents of the Project open cut mining components (including open cut pits, waste rock emplacements, coal rejects emplacement structures and final voids) are shown on Figure 1.3.

The ownership of land in the Project area and immediate surrounds as of June 2018 is shown on Figure 1.4.

A detailed description of the Project is provided in Section 2.

1.4 CONSULTATION

Consultation has been conducted with the neighbouring landholders, local community, Aboriginal stakeholders, key State and Commonwealth government agencies, WDRC, QGC (Shell Australia) and relevant infrastructure owners during the preparation of this EVA. A summary of this consultation is provided below.

It is anticipated that consultation with these stakeholders will continue during the assessment of the Project by the Queensland State Government.

² Yancoal Australia Ltd manages the Cameby Downs Mine on behalf of its majority shareholder, Yanzhou Coal Mining Company Limited.
CAMEBY DOWNS CONTINUED OPERATIONS PROJECT

Miles

Chinchilla

Condamine

Tara

Dalby

PROJECT AREA

Mackay

Rockhampton

Gladstone

Brisbane

Cairns

Townsville

BRISBANE

Regional Location

LEGEND

Existing Mining Lease

Mining Lease Application

0
10
20km

SYNTECH RESOURCES PTY LTD

Regional Location

FIGURE

1.1

SYNTECH RESOURCES PTY LTD

Cameby Downs Continued Operations Project
1.4.1 Local Community

Community Reference Group

A Cameby Downs Mine Community Reference Group (CRG) was established in 2010 comprising representatives from the Chinchilla and Miles communities, neighbouring landholders, WDRC and Syntech Resources. The CRG provides a mechanism for ongoing communication between Syntech Resources and the local community.

Syntech Resources provided an initial overview of the Project at the CRG meeting in December 2016. Details presented included information regarding the existing Cameby Downs Mine operations, an overview of the Project and a summary of the environmental assessments and stakeholder consultation being undertaken for the Project.

Further updates on the Project were provided to the CRG in June and November 2017.

A briefing on the Project will be provided at the next CRG meeting scheduled for September 2018.

Project Area Landholders

Syntech Resources distributed consultation letters to neighbouring landholders located in the Project area and immediate surrounds in December 2016. The consultation letter provided information regarding the existing Cameby Downs Mine operations, an overview of the proposed Project and a summary of the environmental assessments being undertaken to support an amendment application under the EP Act for the Project.

A Project briefing newsletter was also distributed to neighbouring (and other local) landholders in June 2017. A further Project briefing newsletter will be distributed to neighbouring (and other local) landholders in September 2018.

A dedicated Project community information line (1300 770 150) has been established for community members (including neighbouring landholders) to contact Syntech Resources with any questions they may have regarding the Project.

Syntech Resources also consulted with neighbouring and other local landholders as part of a bore census (to inform the Groundwater Assessment) undertaken in October 2017 (Section 3.3).

Regular consultation has been undertaken with the neighbouring landholders regarding mitigation of potential Project impacts through a negotiated agreement or property acquisition.

Other Community Consultation

The following additional consultation initiatives in relation to the Project have been undertaken:

- Project information (i.e. the Major EA Amendment application) has been made publicly available on the Cameby Downs Mine website.
- Project information was available at the Syntech Resources stand at Chinchilla Melon Festival in February 2017.
- Project information was available at the Syntech Resources stand at the Chinchilla Trail Ride in August 2018.
- Project information was available at the Syntech Resources stand at Miles Back to the Bush Festival in September 2018.
- A Project community information line has been established (see above).

1.4.2 Aboriginal Community

Cultural Heritage Management Plans (CHMPs) have been formed with the Barunggam Endorsed Parties and the Western Wakka Wakka Aboriginal Parties. The CHMPs apply to the full extent of the Project ML and MLA areas and clearly define management measures to avoid or minimise harm to Aboriginal cultural heritage.

Syntech Resources provided an overview of the Project to the Western Wakka Wakka Aboriginal Parties and Barunggam Endorsed Parties in August 2017 and November 2017, respectively.

1.4.3 Queensland State Government Agencies

Syntech Resources consults with relevant Queensland State Government agencies on a regular basis in relation to the current operations at the Cameby Downs Mine.

Consultation with Queensland State Government agencies regarding the Project is ongoing. Consultation initiatives to date are discussed below.

Department of Environment and Science

Syntech Resources provided a briefing on the Project to the DES in April 2016. An overview of the Project and the proposed approval process were discussed.
The DES conducted a Cameby Downs Mine site visit in November 2016. The site visit included an inspection of the existing Cameby Downs Mine operations and Project update briefing. The scope of environmental assessments and the Project rehabilitation strategy were discussed.

An EA amendment application for the Project was lodged with DES on 21 November 2016. An Assessment Level Decision was subsequently issued on 30 November 2016 that the proposed amendment is a Major EA Amendment application.

DES issued an Information Request (Attachment 1) on 12 January 2017 to request additional information from Syntech Resources to enable the DES to make a decision on the application.

Syntech Resources provided a Project update presentation to the DES in May 2017. The status of the environmental assessments was discussed during the meeting.

Syntech Resources provided a detailed summary of the environmental assessment outcomes to the DES in November 2017. The DES subsequently provided feedback on the environmental assessment outcomes in January 2018. The feedback focussed on the Project water resource assessments and the rehabilitation strategy.

A follow-up meeting with the DES to provide an overview of how Syntech Resources had considered the DES’ feedback was held in May 2018. This meeting was followed by a DES site visit to the Cameby Downs Mine.

**Department of Natural Resources, Mines and Energy**

Syntech Resources provided a briefing on the Project to the Department of Natural Resources and Mines and Energy (DNRME) in August 2016. An overview of the Project and the status of MLAs 50258, 50259, 50260 and 50269 were discussed.

Syntech Resources continued to consult with the DNRME regarding the status of MLAs 50258, 50259, 50260 and 50269 during the preparation of the EVA.

A pre-lodgement meeting was held with the DNRME in September 2018 to discuss the public notification of the EVA and MLAs 50258, 50259, 50260 and 50269.

**Office of Groundwater Impact Assessment**

Syntech Resources provided a briefing on the Project to the Office of Groundwater Impact Assessment (OGIA) in January 2017. The briefing focussed on the approach to the assessment of potential Project groundwater impacts.

The OGIA inspected the Cameby Downs Mine in July and October 2017 and conducted independent groundwater monitoring on existing exploration holes. This groundwater data was provided by the OGIA to Syntech Resources, along with other existing hydrogeological information available to the OGIA, to use in the development and calibration of the Project groundwater model (Section 3.3).

Syntech Resources has continued to consult with the OGIA in regard to the OGIA’s update of the Underground Water Impact Report for the Surat Cumulative Management Area.

**Department of Transport and Main Roads**

Syntech Resources provided a Project briefing letter to the Department of Transport and Main Roads (DTMR) in December 2017. The briefing letter provided an overview of the Project, EA Amendment approval pathway, potential environmental impacts and a description of the relevant environmental assessments.

**1.4.4 Commonwealth Department of the Environment and Energy**

Syntech Resources will conduct a briefing meeting with the Department of Environment and Energy (DEE) in September 2018 to provide an overview of the Project, the Commonwealth Environment Protection and Biodiversity Act 1999 (EPBC Act) approval process, and a description of the relevant environmental assessments.

**1.4.5 Western Downs Regional Council**

Syntech Resources consults with the WDRC on a regular basis in relation to the current operations at the Cameby Downs Mine (including representation as part of the CRG – Section 1.4.1).

A briefing on the Project was provided to the WDRC Mayor and Deputy Mayor (Planning and Environment Councillor) in August 2016. An overview of the Project, the proposed approval process and environmental assessments were discussed.
Key issues discussed during the August 2016 meeting included: maximum employee numbers and accommodation requirements; proposed road closures; site rehabilitation and final land uses and community consultation.

Regular updates on the Project have been provided to the WDRC in March, April, August, October and November 2017 and in February and May 2018.

1.4.6 Service Providers

Power Link

Syntech Resources provided a briefing letter on the Project to Power Link in May 2017. The briefing letter outlined the proposed 132 kilovolt (kV) electricity transmission line (ETL) re-alignment (Section 2.10).

A follow-up meeting with Power Link was held in November 2017 to discuss the ETL re-alignment in more detail.

Aurizon

Syntech Resources provided a briefing letter to Aurizon describing the Project in November 2017. The letter outlined the potential rail transport requirements of the Project.

Queensland Bulk Handling

Syntech Resources provided a briefing letter to Queensland Bulk Handling to describe the Project in November 2017. The letter outlined the potential port capacity requirements of the Project to demonstrate that port capacity was available.

1.4.7 QGC (Shell Australia)

QGC is a Shell Australia operated venture that conducts coal seam gas (CSG) extraction activities within and surrounding the Project area.

Consultation with QGC regarding the Project is ongoing as the CSG extraction activities are conducted con-currently (under a co-development agreement) with the Cameby Downs Mine. During this consultation, the interactions between the Project and existing and future infrastructure and assessment of cumulative impacts were discussed.

QGC has also provided groundwater monitoring data from its exploration and gas extraction activities which has been used in the development and calibration of the Project groundwater model (Section 3.3).

1.5 ENVIRONMENTAL APPROVAL PROCESS

Syntech Resources is seeking approval of the Project through a major amendment of EA EPML00900113 in accordance with Chapter 5, Part 7 of the EP Act.

As described in Section 1.4.3, an EA amendment application was lodged with DES on 21 November 2016. DES subsequently made its Assessment Level Decision on 30 November 2016 that the proposed amendment is a Major EA Amendment application. DES did not require the preparation of an Environmental Impact Statement.

DES issued an Information Request on 12 January 2017 for additional information from Syntech Resources to enable the DES to make a decision on the application. DES issued a Notice of Decision on Request to Extend the Information Response Period on 11 January 2018 and again on 9 August 2018.

This EVA presents Syntech Resources’ response to the Information Request. A reference summary to relevant sections of the EVA where the Information Request is addressed are provided as Attachment 1.

1.6 RELEVANT LEGISLATION REQUIREMENTS

Table 1.1 describes the principal statutory approvals relevant to mining projects and establishes their relevance to the Project. The list of approval requirements in Table 1.1 is confined to principal approval requirements and is not an exhaustive list of all approval requirements for the Project.

1.7 DOCUMENT STRUCTURE

The EVA comprises a main text component and supporting studies, which include Appendices A to K. An overview of the main text is presented below:

Section 1 Introduction

Provides an introduction to the proponent, the Project and the function of the EVA as part of the assessment and approvals process.
## Table 1.1
### Principal Statutory Approvals

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Purpose</th>
<th>Applicable Act</th>
<th>Administering Authority/Parties</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mining Approvals</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mining Lease (ML)</td>
<td>A ML is required to permit the undertaking of specified mining activities within the defined lease location.</td>
<td>Mineral Resources Act 1989</td>
<td>DNRME</td>
</tr>
<tr>
<td>Environmental Authority (EA) (Mining Activities) and related documents, including:</td>
<td>The Project requires a major EA amendment. The Plan of Operations and Financial Assurance for the Cameby Downs Mine will be revised to incorporate the Project.</td>
<td>EP Act</td>
<td>DES</td>
</tr>
<tr>
<td>- Plan of Operations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Financial Assurance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Regional Interests Development Approval (RIDA)</strong></td>
<td>A RIDA is required when a resource activity is proposed to be located in an area of regional interest. The Project is not required to obtain a RIDA (Section 3.1.1).</td>
<td>Regional Planning Interests Act 2014 (RPI Act)</td>
<td>Department of Infrastructure, Local Government and Planning (DILGP) DNRME</td>
</tr>
<tr>
<td><strong>Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) Approval</strong></td>
<td>The EPBC Act is triggered where an action will have, or is likely to have, a significant impact on a Matter of National Environmental Significance. The Project will be referred to the Commonwealth Minister for the Environment.</td>
<td>EPBC Act</td>
<td>DEE</td>
</tr>
<tr>
<td><strong>Water Approvals</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Associated Water Licence to take or interfere with groundwater</td>
<td>The Water Act 2000 regulates the taking of and/or interference with water within Queensland.</td>
<td>Water Act 2000 Water Resource (Condamine and Balonne) Plan 2004</td>
<td>DNRME</td>
</tr>
<tr>
<td><strong>Biodiversity Approvals</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offset approval</td>
<td>The Environmental Offsets Act 2014 provides methods to determine the environmental offsets required for significant residual impacts on Matters of State Environmental Significance (MSEs). The Project would result in significant residual impacts on some MSEs. An offset proposal has been prepared to offset the predicted significant residual impacts on MSEs.</td>
<td>Environmental Offsets Act 2014</td>
<td>DES</td>
</tr>
</tbody>
</table>
### Table 1.1 (Continued)
**Principal Statutory Approvals**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Purpose</th>
<th>Applicable Act</th>
<th>Administering Authority/Parties</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Native Title Approvals/Cultural Heritage Approvals</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The majority of the Project land is freehold and therefore Native Title rights are not applicable. However, the <em>Native Title Act 1993</em> is relevant to the Project for areas of land where Native Title may apply, such as road reserves, drainage features and easements. Native Title rights relevant to those small areas of land have not been extinguished.</td>
<td>The <em>Native Title Act 1993</em> provides for the recognition and protection of Native Title rights in Australia. The Act provides a mechanism for determining Native Title rights and to establish a way in which dealings affecting Native Title rights may proceed.</td>
<td><em>Native Title Act 1993</em></td>
<td>Commonwealth Attorney-General’s Department</td>
</tr>
<tr>
<td>Prepared of:</td>
<td>When constructing the Project, all reasonable and practicable measures must be taken to ensure it does not harm Aboriginal cultural heritage. Activities at the Project would be undertaken in accordance with the CHMPs to support the above Duty of Care. This is to be augmented by a Duty of Care Statement.</td>
<td><em>Aboriginal Cultural Heritage Act 2003</em></td>
<td>DES</td>
</tr>
<tr>
<td>- Duty of Care Statement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- CHMP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Infrastructure Approvals</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For off-mining lease infrastructure, Development Permits may be required for:</td>
<td>Development permits may be required for Project infrastructure not located within a ML under the Planning Act 2017 or associated planning scheme.</td>
<td><em>Sustainable Planning Act 2009 Murilla (Miles) Shire Planning Scheme</em> <em>Chinchilla Shire Planning Scheme</em> <em>Building Act 1975</em> <em>Building Regulation 2006</em> <em>Building Code of Australia 2008</em></td>
<td>WDRC DILGP</td>
</tr>
<tr>
<td>- Material Change of Use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Operational Works</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Building Works</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Plumbing and Drainage Works</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approval to permanently or temporarily close a local government controlled road.</td>
<td>A local government may close a road where it is necessary or desirable in the interests of public safety.</td>
<td><em>Local Government Act 2009</em></td>
<td>WDRC</td>
</tr>
<tr>
<td>Alteration or Improvement of Roads (Licence)</td>
<td>A person (other than the local government) must not make an alteration or improvement to a local government road unless authorised by a licence.</td>
<td><em>Local Law 21 (Roads)</em></td>
<td>WDRC</td>
</tr>
<tr>
<td>Permit to Occupy (Permit)</td>
<td>A Permit to Occupy is required from the Chief Executive Officer where works or infrastructure are proposed to be located on unallocated state land; not located within a ML.</td>
<td><em>Land Act 1994, Chapter 4, Part 4</em></td>
<td>DNRME</td>
</tr>
</tbody>
</table>
### Table 1.1 (Continued)
#### Principal Statutory Approvals

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Purpose</th>
<th>Applicable Act</th>
<th>Administering Authority/Parties</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Infrastructure Approvals (cont.)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notification of works affecting electricity entity works</td>
<td>Where works would interfere with Power Link’s works (or other electricity entity’s works).</td>
<td>Electricity Act 1994, section 99</td>
<td>Power Link</td>
</tr>
<tr>
<td>Temporary and Permanent Road Closures to facilitate Local Road Relocations (Permit)</td>
<td>Temporary/permanent road reserve closure; where an area of closed road is to be included into the adjoining land, a survey plan will be required.</td>
<td>Land Act 1994 Road Closure Manual</td>
<td>DNRME</td>
</tr>
</tbody>
</table>
Section 2  Project Description
Describes the various components and stages of development of the Project, as well as a description of the Project workforce and the community.

Section 3  Environmental Assessment
Details the environmental assessment.

Section 4  Rehabilitation and Biodiversity Offset Strategy
Describes the rehabilitation and offset strategy for the Project.

Section 5  Summary of Environmental Management Commitments
Provides a consolidated description of the commitments to implement management measures for the Project.

Section 6  References
Lists documents referenced in Sections 1 to 5 of the EVA, including guidelines and policies.

Attachments to the main text are provided as follows:
Attachment 1  DES Information Request – Reference Summary
Attachment 2  Site Water Management Plan
Attachment 3  Receiving Environment Monitoring Program
Attachment 4  Peer Review Letters

Appendices A to K contain supporting documentation, including a number of specialist/technical reports:
Appendix A  Surface Water Assessment
Appendix B  Flood Study
Appendix C  Groundwater Assessment
Appendix D  Terrestrial Flora Assessment
Appendix E  Terrestrial Fauna Assessment
Appendix F  Aquatic Ecology Assessment
Appendix G  Air Quality and Greenhouse Gas Assessment
Appendix H  Noise and Vibration Assessment
Appendix I  Soil Resources Review
Appendix J  Contaminated Land Assessment
Appendix K  Reject Management Concept Study
2 PROJECT DESCRIPTION

2.1 GEOLOGY AND COAL RESOURCE

The Project is located within the northern Surat Basin coalfields in south-east Queensland. The Project coal resource is hosted within the middle Jurassic aged sediments of the Injune Creek Group. The upper Juandah Coal Measures, of the Walloon Subgroup, is the target coal resource for the Project.

Within the Juandah Coal Measures the Macalister Coal seams comprise the main economic resource for the Project, supplemented by the overlying Kogan Coal seams and underlying Wambo Coal seams. A representative stratigraphic column of the Juandah Coal Measures is presented in Figure 2.1.

The target resource for the Project has been estimated at approximately 250 million tonnes (Mt) of proven and probable in-situ thermal coal reserves.

The coal measures subcrop in the north-east of the Project area, forming the north-east boundary of the open cut pit, before dipping to the south-west. The coal measures consist of laminated and thinly bedded carbonaceous shale, mudstone, siltstone, claystone and banded coal measures.

Within the Project area, the coal measures are conformably overlain by middle to late Jurassic aged Springbok Sandstone, which thickens to the south-west with the general dip of the stratigraphy. Exploration drilling at the Project site has not identified any significant alluvium within the Project area. Rather, the surface profile consists of very thin soil above clay or claystone.

Early Jurassic sandstone formations are located at depth below the coal measures in the area and include the CSG targets for QGC’s operations.

2.2 PROJECT GENERAL ARRANGEMENT

The general arrangement of the Project would utilise the existing infrastructure and service facilities of the Cameby Downs Mine.

The main activities associated with the development at the Project would include:

- extension of open cut mining operations at an increased mining rate of 3.5 Mtpa ROM coal within ML 50233 and into MLAs 50258, 50259, 50260 and 50269;
- upgrade and use of CHPP and general coal handling and rail loading facilities and other existing and approved supporting mine infrastructure;
- the disposal of waste rock, comprising of overburden and interburden, in-pit or in out-of-pit waste rock emplacements;
- the disposal of (coarse and fine) coal rejects in dedicated in-pit and out-of-pit rejects emplacement structures and in a void;
- transport of product coal via the existing rail system from the Cameby Downs Mine to the Port of Brisbane;
- construction and operation of new ancillary infrastructure in support of mining operations including: satellite mine service and infrastructure areas, haul and access roads, workshop, diesel storage tanks, electricity supply and communications infrastructure and water management infrastructure;
- closure of existing and construction of new local roads;
- realignment of existing 132 kV ETL;
- 75 years of mining operations;
- increase in the peak operational workforce from approximately 140 to 160 people;
- ongoing exploration activities within ML 50233 and MLAs 50258, 50259, 50260 and 50269;
- progressive rehabilitation, as well as ultimate rehabilitation of the entire Project area once the site has been decommissioned; and
- other associated minor infrastructure, plant and activities, where required.

The approximate extents of the Project open cut mining components (including open cut pits, waste rock emplacements, out-of-pit rejects emplacement structures, water storages and final voids) are shown on Figure 1.3.

Indicative Project general arrangements for approximately Year 1, Year 24, Year 29, Year 42, Year 48 and Year 75 are shown on Figures 2.2 to 2.7. These general arrangements are based on planned maximum production and mine progression. The mining layout, sequence and rate of mining (up to 3.5 Mtpa) may vary to take into account localised geological features, coal market quality and volume requirements, mining economics and Project detailed engineering design.
EPC732 REPRESENTATIVE STRATIGRAPHIC COLUMN

Source: JB Mining Services
SYNTech Resources Pty Ltd
Cameby Downs Continued Operations Project

Project General Arrangement - Year 1

FIGURE

2.2

REFERENCE

Mining Lease
Mining Lease Application
Topography (RL m) AHD - 5m Contours
Existing Powerline
Indicative Extent of Additional Surface Development
Mining Activity

- Water Dam
- Haul Road
- Rehabilitation Commenced
- Active Mining Area

Design
P. Toole
13/03/2018

Scale
1:60,000

Cad File
Rev2.8

SYNTech Resources Pty Ltd

Scale 1 : 60 000

0 400 800 1200 1600 2000m

MGA94 Z56

ML 50233

MLA 50258

MLA 50259

ML 50260

Cameby Downs Mine

FIGURE

SYNTech Resources Pty Ltd
Cameby Downs Continued Operations Project

Project General Arrangement - Year 1

FIGURE

2.2

REFERENCE

Mining Lease
Mining Lease Application
Topography (RL m) AHD - 5m Contours
Existing Powerline
Indicative Extent of Additional Surface Development
Mining Activity

- Water Dam
- Haul Road
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- Active Mining Area

Design
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SYNTech Resources Pty Ltd

Scale 1 : 60 000

0 400 800 1200 1600 2000m

MGA94 Z56

ML 50233

MLA 50258

MLA 50259

ML 50260

Cameby Downs Mine

FIGURE

SYNTech Resources Pty Ltd
Cameby Downs Continued Operations Project

Project General Arrangement - Year 1

FIGURE

2.2

REFERENCE

Mining Lease
Mining Lease Application
Topography (RL m) AHD - 5m Contours
Existing Powerline
Indicative Extent of Additional Surface Development
Mining Activity

- Water Dam
- Haul Road
- Rehabilitation Commenced
- Active Mining Area

Design
P. Toole
13/03/2018

Scale
1:60,000

Cad File
Rev2.8

SYNTech Resources Pty Ltd

Scale 1 : 60 000

0 400 800 1200 1600 2000m

MGA94 Z56

ML 50233

MLA 50258

MLA 50259

ML 50260

Cameby Downs Mine

FIGURE

SYNTech Resources Pty Ltd
Cameby Downs Continued Operations Project

Project General Arrangement - Year 1

FIGURE

2.2

REFERENCE

Mining Lease
Mining Lease Application
Topography (RL m) AHD - 5m Contours
Existing Powerline
Indicative Extent of Additional Surface Development
Mining Activity

- Water Dam
- Haul Road
- Rehabilitation Commenced
- Active Mining Area

Design
P. Toole
13/03/2018

Scale
1:60,000

Cad File
Rev2.8

SYNTech Resources Pty Ltd

Scale 1 : 60 000

0 400 800 1200 1600 2000m

MGA94 Z56

ML 50233

MLA 50258

MLA 50259

ML 50260

Cameby Downs Mine
SYNTECH RESOURCES PTY LTD
Cameby Downs Continued Operations Project

Project General Arrangement - Year 48

REFERENCE

Mining Lease
Mining Lease Application
Topography (RL m) AHD - 5m Contours
Indicative Extent of Additional Surface Development
Existing Powerline
Realigned Powerline

Mining Activity
Water Management
Water Dam
Haul Road
Rehabilitation Commenced
Rehabilitation Completed
Active Mining Area
Active In-pit Fine Rejects Emplacement Area
In-pit Fine Rejects Emplacement Area (Rehabilitated)

SCALE 1:60 000

MGA94 Z56

FIGURE 2.6

SYNTECH RESOURCES PTY LTD
Cameby Downs Continued Operations Project

 Mine Lease Application
Topography (RL m) AHD - 5m Contours
Indicative Extent of Additional Surface Development
Existing Powerline
Realigned Powerline

Mining Activity
Water Management
Water Dam
Haul Road
Rehabilitation Commenced
Rehabilitation Completed
Active Mining Area
Active In-pit Fine Rejects Emplacement Area
In-pit Fine Rejects Emplacement Area (Rehabilitated)

SCALE 1:60 000

MGA94 Z56
The detailed mining sequence over any given period would be documented in the relevant Plan of Operations as required by the DES.

2.3 CONSTRUCTION ACTIVITIES

Development of the Project to facilitate the increase to 3.5 Mtpa would require limited construction activities given the utilisation of existing infrastructure and services (with some minor upgrades) at the Cameby Downs Mine (e.g. the CHPP, train load-out infrastructure, water management infrastructure and out-of-pit coal rejects emplacement structures).

Notwithstanding, construction activities would be required to enable the progressive development of the Cameby Downs Mine over the life of the Project. This would include:

- access roads, haul roads and drainage feature crossings;
- satellite mine service and infrastructure areas;
- coal rejects emplacement structures (in-pit and out-of-pit);
- minor modifications to the CHPP;
- electrical supply infrastructure;
- water management infrastructure including pipelines, water storages, sediment dams and operational flood levees;
- closure of existing and construction of new local roads;
- realignment of existing 132 kV ETL; and
- other associated minor infrastructure, plant and activities necessary to support the Project.

Construction activities would generally be restricted to daytime hours, however some construction works would be conducted up to 24 hours per day, seven days per week.

2.4 MINING OPERATIONS

2.4.1 Hours of Operation

Project open cut mining operations would be conducted up to 24 hours per day, seven days per week.

2.4.2 Open Cut Mining Area

Open cut mining would continue to target the Juandah Coal Measures coal seams (Section 2.1).
Vegetation Clearing and Topsoil Salvage

Vegetation clearing and topsoil salvage would continue to be conducted in accordance with procedures outlined in the Plan of Operations (Syntech Resources, 2017).

Vegetation would be progressively cleared ahead of the active open cut and waste rock emplacement areas. Topsoil would be stripped prior to excavation of underlying overburden. Where the topsoil cannot be directly used for progressive rehabilitation (i.e. placed directly onto waste rock emplacement areas) it would be stockpiled for use at a later date.

Waste Rock Removal and Handling

Waste rock material at the Project would generally consist of weathered clays and sandstone and a competent upper silcrete horizon.

The weathered waste rock would continue to be removed using excavators and dozer push where applicable. The competent waste rock would be drilled and blasted prior to removal by the same methods.

The waste rock would be dozer pushed into in-pit waste rock emplacements and/or loaded into haul trucks for hauling to out-of-pit waste rock emplacements consistent with current mining methods at the Cameby Downs Mine. Approximately 1,550 million bank cubic metres of waste rock would be mined over the life of the Project.

As mining in the Central Pit (Pit 1) (within ML 50233) progresses towards the south, waste rock would predominately be dozer pushed into in-pit waste rock emplacements. The Central Waste Rock Emplacement is anticipated to be approximately 45 m above natural ground level (Figure 2.3).

Emplacement of waste rock in out-of-pit emplacements would be required once the box cut for the Eastern Pit (Pit 2) (within MLA 50259) has commenced (approximately Year 42 [Figure 2.5]). The approximate maximum height of the Eastern Waste Rock Emplacements is anticipated to be approximately 35 m above natural ground level (Figure 2.7).

Waste rock removed during the mining of the western side of the Eastern Pit (Pit 2) would be used to backfill the void on the eastern side of the Eastern Pit (Pit 2) reducing the number of final voids required for the Project (Figures 2.6 and 2.7).

Similar to the Eastern Pit (Pit 2), emplacement of waste rock in out-of-pit emplacements would be required once the box cut for the Western Pit (Pit 3) (within MLA 50259) has commenced (approximately Year 42 [Figure 2.5]). The approximate maximum height of the Western Waste Rock Emplacements is anticipated to be approximately 35 m above natural ground level (Figure 2.7).

Waste rock would also be placed in out-of-pit waste emplacements in selected areas around the final voids so that the rehabilitated final landform provides flood immunity for the final voids (Section 2.8.2).

Waste rock material generated by the Project is anticipated to be generally non-acid forming with a low risk of dispersivity (SRK Consulting, 2012). In the unlikely event that any waste rock material is identified as having a high risk of being potentially acid forming (PAF), it would be emplaced within in-pit waste rock emplacement areas. Waste rock would be subject to progressive geochemical investigations to inform emplacement management strategies.

The nature of open cut mining results in the formation of a final void when the open cut resource is fully extracted. Disposal of waste rock and coal rejects in-pit would be undertaken during the Project to minimise the number and size of the final voids. Notwithstanding this, the Project mining schedule would result in the creation of two final voids upon completion of the Project (Figure 2.7). The final voids would be left in a safe and stable condition upon completion of mining activities. Additional discussion on the proposed final landform (including the final voids) is provided in Section 4.

ROM Coal Mining and Handling

Each of the open cut pits for the Project would continue to be mined using conventional open cut methods utilising dozer push and truck and shovel. Wheel loaders would be used to mine thin coal horizons and excavators would be used to mine thick coal seams.
The Project would mine ROM coal from the four Kogan Seams (KG1, KG2, KG3 and KG4), the Macalister Coal Interval (MA1, MA2T, MA2B, MA3 and MA4), lying below the Kogan Coal Interval, and the Wambo Coal Interval (WM1 and WM2) (Figure 2.1). The MA2 seam would always be mined and the relatively thin MA3 and MA4 seams would be extracted wherever possible.

The mined ROM coal would be trucked from the open cuts to the CHPP consistent with current operations. Extensions to existing ROM coal haul roads and access roads would be constructed as required.

2.4.5 Mobile Equipment

The mobile equipment used for the Project would vary according to the equipment requirements of the advancing open cut mining operations.

The existing mobile equipment used at the Cameby Downs Mine would continue to be used, with some replacement and additional fleet items as required throughout the Project life.

An indicative list of major mobile equipment proposed for the Project is provided in the Noise and Vibration Assessment (Appendix H).

2.5 COAL PROCESSING AND HANDLING

The existing CHPP (Figure 1.2) would be used to process ROM coal at the Project. Minor modifications to the existing CHPP would be undertaken within the existing surface development footprint where required.

Coal processing and handling operations would continue to be conducted up to 24 hours per day, seven days per week.

ROM coal from the open cut pits would continue to be transported by haul truck or road train to the CHPP. The ROM coal would be directed to either stockpiles, the CHPP, or the bypass circuit for processing (Figure 2.9) consistent with existing operations at the Cameby Downs Mine.

The majority of ROM coal would be processed in the CHPP. The CHPP processing includes initial coal sizing followed by washing in the desliming screens, with fine coal/slimes (less than 1 millimetre [mm]) fed to the fine coal circuit and coarse coal (greater than 1 mm) fed to the coarse coal circuit.

The fine coal circuit separates coal fines from fine reject and comprises classifying cyclones, spirals, fine coal cyclones, centrifuges and tailings thickener.

The coarse coal circuit comprises dense medium cyclones, screens and centrifuges to separate the coarse coal from the coarse rejects.

The management of coal rejects (coarse and fine) at the Project is described in Section 2.7.

A portion of Project ROM coal would be of such quality that it could be sold directly without any significant processing other than sizing. This ROM coal would be processed in the bypass circuit using either a mobile or fixed crusher to size the ROM coal to sale specifications.

Product coal from the CHPP and bypass circuit would be conveyed to the existing product stockpile or direct to the train load-out facility.

2.6 PRODUCT COAL TRANSPORT

The existing rail loop and spur would have sufficient capacity to service the peak product coal rate for the Project. Accordingly, no major infrastructure upgrades or additions to the rail infrastructure would be required for the Project.

Product coal would be transported by rail to the Port of Brisbane via the Queensland Rail West Moreton System, consistent with the currently approved operations.

Product coal loading and transport activities would be conducted up to 24 hours per day, seven days per week.

The Project would not require any change to the current maximum number of trains per day (i.e. up to 4 trains per day).

2.7 COAL REJECTS MANAGEMENT

A Reject Management Concept Study (Engeny, 2018) has been prepared for the Project and is provided in Appendix K. A summary of the coal rejects management strategy is provided below.

Coal rejects consist of coarse and fine rejects.
**PROCESS COAL**

- DUMP TRUCK & FRONT END LOADER
- DUMP HOPPER
- PRIMARY CRUSHER 250mm
- METAL DETECTOR
- SURGE BIN 35t Capacity
- SECONDARY CRUSHER -100mm
- TERTIARY CRUSHER -38mm
- SUMP
- WEIGHER
- 225t/h
- Pumped to CPP
- ROM STOCKPILE 25,000 - 50,000t Capacity
- Capacity - 100t
- 250mm
- -100mm
- -38mm
- WEIGHER
- THERMAL
- STOCKPILE 16,000t
- SAMPLER
- & FRONT END LOADER
- DUMP HOPPER
- Capacity - 100t
- PRIMARY CRUSHER 250mm
- METAL DETECTOR
- SECONDARY CRUSHER 250t/h
- SAMPLER
- WEIGHER
- BYPASS STOCKPILE 25,000 - 50,000t Capacity
- PRIMARY CRUSHER 250mm
- METAL DETECTOR
- SECONDARY CRUSHER 250t/h
- SAMPLER
- BYPASS STOCKPILE 15,000t
- WEIGHER
- THERMAL STOCKPILE 15,000t
- 225t/h
- Pumped to CPP
- SAMPLER
- COAL LOADER Loading rate - 48,000t/day SSHINC
- SHIP Panamax 89,000t
- Maximum Draft 13.5m
- RAIL BIN Capacity - 100t
- 2000t Train consist
- RAIL To PORT OF BRISBANE ~380km
- PORT STOCKPILE 125,000t
- PORT TO PORT OF BRISBANE
- RAIL
- Materials Handling Schematic Flowsheet
- SYNTECH RESOURCES PTY LTD Cameby Downs Continued Operations Project
- Cameby Downs
- FIGURE 2.9
- WEIGHER
- TRAIN LOADOUT
- SUMP
- RAIL BIN Capacity - 100t
- 2000t Train consist
- RAIL To PORT OF BRISBANE ~380km
- PORT STOCKPILE 125,000t
- RAIL
- SAMPLER
- Avg. train loading rate - 1200t/h
- FEL
- COAL LOADER Loading rate - 48,000t/day SSHINC
- SHIP Panamax 89,000t
- Maximum Draft 13.5m
- RAIL BIN Capacity - 100t
- 2000t Train consist
- RAIL To PORT OF BRISBANE ~380km
- PORT STOCKPILE 125,000t
- RAIL
Coarse rejects generated at the Cameby Downs Mine were initially co-disposed with fine rejects in the out-of-pit coal rejects emplacement located within the rail loop (Figure 1.2). In early 2017, dry coarse rejects began to be disposed of in-pit and encapsulated with waste rock.

Coarse rejects would continue to be disposed in-pit and encapsulated with waste rock over the Project life. Approximately 57.7 Mt of coarse reject would be produced over the Project life.

Fine rejects are currently pumped to the out-of-pit coal rejects emplacement located within the rail loop (Figure 1.2). Water from the fine rejects stream is decanted and returned to the site water management system for re-use.

Fine rejects would either continue to be pumped to the out-of-pit coal rejects emplacement within the rail loop (Rejects Dam 1), or placed in a new out-of-pit coal reject emplacement (Rejects Dam 2), placed in in-pit coal rejects emplacements (integrated waste landform [IWL] cells) or placed in the Central Void.

Approximately 24.7 Mt of fine rejects would be produced over the Project life.

The moisture content of the fine rejects in the out-of-pit emplacement structures would be allowed to reduce, then be capped with an inert waste material, topsoiled and rehabilitated.

The Central Void (once available) would contain the majority of the fine rejects produced. Until then, one new out-of-pit coal rejects emplacement and four in-pit IWL cells would be constructed over the Project life.

The following general rejects strategy is proposed for the Project (Figures 2.2 to 2.7 and Figure 2.10):

- Years 1 to 3 – existing Rejects Dam 1;
- Years 3 to 20 – in-pit coal reject emplacements (IWL cells);
- Years 20 to 33 – new Rejects Dam 2; and
- Years 29 to 75 – Central Void.

Schedule I of EA EPML00900113 outlines design, construction, ongoing management, maintenance and monitoring requirements for regulated structures (e.g. coal reject emplacements) at the Cameby Downs Mine.

The coal reject dams at the Project would continue to be designed, constructed, managed, maintained and monitored in accordance with the requirements of Schedule I of EA EPML00900113.

The detailed design of the coal rejects emplacements would be undertaken in accordance with Structures which are dams or levees constructed as part of environmentally relevant activities (Department of Environment and Heritage Protection [DEHP], 2017a) based on the Consequence Category assessed under the Manual for assessing consequence categories and hydraulic performance of structures (DEHP, 2016a).

A number of geochemical characterisation studies have been conducted on the coal reject material at the Cameby Downs Mine, including SRK Consulting (2012). Coal reject material was found to include some PAF material and was found to have a low risk of dispersivity (SRK Consulting, 2012). PAF reject material would continue to be managed in such a way as to minimise potential oxidation during disposal.

Further details of the specific management strategies to minimise the risk for acid mine drainage are provided in Appendix K.

Overall, the Reject Management Concept Study (Engeny, 2018) concludes (Appendix K):

- The proposed rejects management strategies are considered effective at managing the risk profile of reject material for the Project over the life of the mine. Out-of-pit placement of reject material has been minimised with in-pit disposal of coarse rejects and through the use of IWL cells and the Central Pit (Pit 1) north-western void for disposal of fine rejects.
- The monitoring programs including monitoring of the fine rejects surface (decant) water, downgradient seepage/groundwater and geochemistry of the reject material, will provide the opportunity for early intervention and application of additional mitigation measures if required.
- All rejects disposal areas will be rehabilitated in line with the rehabilitation objectives, EA and Rehabilitation Management Plan requirements.

### 2.8 WATER MANAGEMENT

The existing water management system would be progressively augmented as water management requirements change over the life of the Project.

Figure 2.11 provides a schematic of the indicative Cameby Downs Mine water management system incorporating the Project.
Fine Rejects Management - Conceptual Cross and Long Sections of Disposal Locations

Out of Pit Rejects Dams

Central Pit Final Void Rejects Placement

IWL Cell
A detailed description of the Project water management system is provided in the Surface Water Assessment (Appendix A) and Flood Study (Appendix B) prepared by WRM Water & Environment (2018a; 2018b). The assessments have been based on the concept designs for the operational flood levees and final landforms which provide flood immunity for the open cut operations and post-mining final voids respectively, as detailed in a memorandum provided by WRM Water & Environment dated 11 September 2018 (WRM, 2018c).

2.8.1 Existing Water Management System

Site water management at the Cameby Downs Mine is conducted in accordance with the Site Water Management Plan prepared in accordance with Condition F14 of EA EPML00900113.

The existing water management strategy at the Cameby Downs Mine is based on the containment and re-use of water as well as the control of sediment that may be potentially carried with runoff from disturbed areas such as the waste rock emplacements or areas cleared in advance of mining. Runoff from undisturbed areas is separated from disturbed areas by up-catchment diversions and channels.

The existing/approved Cameby Downs Mine water management system includes:

- water storages, including Return Water Dam and CHPP Dam;
- out-of-pit rejects emplacement;
- sediment dams;
- five EA EPML00900113 discharge points including automated upstream and downstream monitoring sites;
- internal water reticulation system including multiple pipes, pumps and associated infrastructure;
- up-catchment diversions and channels;
- operational flood levees;
- Drainage Line 1 diversion (not constructed);
- external water supply from CSG operators; and
- sewage treatment plant (STP) and associated irrigation system.

Water is used for ROM coal processing, dust suppression, washdown of mobile equipment and other minor uses. During wet periods, controlled releases occur from five discharge points in accordance with EA EPML00900113 as required.

The development of the approved Cameby Downs Mine includes the diversion of Drainage Line 1 around the open cut extent within ML 50233 (Figure 1.2). In May 2015, a watercourse determination from DNRME confirmed Drainage Line 1 within the limits of the Project site is not a watercourse as defined under the Water Act, 2000.

2.8.2 Project Water Management System

The objectives of the Project water management system would be generally consistent with the existing water management system at the Cameby Downs Mine, specifically to:

- protect the integrity of local and regional water sources;
- maintain separation between runoff from areas undisturbed by mining and water generated within active mining areas;
- design and manage the system to operate reliably throughout the life of the Project in all seasonal conditions, including both extended wet and dry weather periods;
- provide sufficient storage capacity to store, treat and discharge runoff as required, including in extended wet weather periods;
- operate in accordance with EA EPML00900113; and
- provide a reliable source of water to meet Project requirements (e.g. dust suppression).

To meet these objectives, the Project water management system would generally be based on the existing water management system with augmentations (e.g. additional up-catchment diversion structures, sediment dams and contained water storages) undertaken progressively over the life of the Project.

The progressive development of water storages for the Project is described in Appendix A.

A predictive assessment of the performance of the Project water management system for a range of different climatic scenarios is presented in Appendix A.

The existing Site Water Management Plan has been updated to incorporate the Project, and is provided as Attachment 2.
**Up-catchment Runoff Control**

Temporary and permanent up-catchment diversion structures would be constructed over the life of the Project to divert runoff from undisturbed areas around the open cut pits and waste rock emplacements. These diversion structures would include operational flood levees and drainage line diversions.

The development of the approved Cameby Downs Mine includes the diversion of Drainage Line 1 around the open cut extent within ML 50233. As the Project would extend the open cut extent, and includes the construction of a new water management dam within MLA 50258, the diversion of Drainage Line 1 would be required to commence further upstream, within MLA 50258 (Figure 1.3).

A conceptual design for the Drainage Line 1 diversion is provided in Appendix B.

Syntech Resources is seeking approval of the diversion of Drainage Line 1 proposed as part of the Project through a major amendment of EA EPML00900113 in accordance with Chapter 5, Part 7 of the EP Act as part of the Project.

In addition, three new up-catchment diversion structures (CWD1 to CWD3) would be required to divert runoff from undisturbed areas around Project areas (Appendix A).

Other minor drains and bunds would also be required to divert runoff from undisturbed areas around Project areas.

Conceptual designs of the up-catchment diversion structures are provided in Appendix A.

**Surface Water Runoff Collection**

Runoff collected within the active waste rock emplacement areas would be directed to sediment dams via surface water drains.

The water collected in the sediment dams would be used for dust suppression, pumped to the CHPP for use in processing, or released in accordance with EA EPML00900113.

Runoff collected in active open cut pits and infrastructure areas would be directed to either water storages or open cut pit storages.

The water collected in the water storages or open cut pits would be used for dust suppression or pumped to the CHPP for use in processing.

Erosion and sediment control for the Project is described in detail in Appendix A and the Site Water Management Plan (Attachment 2). Syntech Resources will also continue to implement, and update as required, the existing Erosion & Sediment Control Management Plan.

**Water Storage**

Water storages for the Project would include the four existing storages and additional five storages as mining progresses over the Project life. Inactive open cut pits (e.g. Central Pit [Pit 1]) would be used to temporarily store water during the Project life if required (Appendix A), however the potential likelihood of needing to use inactive pits as a water storage is very low and would only be required following extremely wet periods. The water balance assessment (Appendix A) shows that the proposed out-of-pit storage (WMD2) will sufficiently store all surplus water while maintaining a low risk of overflows to the receiving environment (<1% annual exceedance probability [AEP]).

The Rejects Dam 2 structure may be used for water storage from Years 3 to 20 if required, prior to its use for fine rejects emplacement.

The Water Management Dam (Figure 2.4) would be also used as required for the management of surplus waters on-site, particularly during the mid to latter years of the Project life.

Consistent with the consequence category assessment of the existing water storages at the Cameby Downs Mine, the Project water storages are considered to have a ‘low’ consequence for both ‘Failure to contain – overtopping’ and ‘Failure to contain – dam break’ based on a preliminary assessment undertaken in accordance with the Manual for assessing consequence categories and hydraulic performance of structures (DEHP, 2016a) (Appendix A). A consequence category assessment of the new water storages would be conducted in accordance with the Manual for assessing consequence categories and hydraulic performance of structures (DEHP, 2016a) following completion of the detailed design.

The new water storages would be designed by a suitably qualified and experienced person in accordance with good engineering practice and the requirements of the relevant version of DES’S Manual for assessing consequence categories and hydraulic performance of structures (DEHP, 2016a) and Structures which are dams or levees constructed as part of environmentally relevant activities (DEHP, 2017a). The certified design plans and the consequence category assessment would be submitted to DES prior to construction.
Significant and high consequence storages would be operated such that the appropriate design storage allowances (DSA) volume is available on 1st November each year. This may be achieved by transferring water to other on-site storages (e.g. water management dam) or temporarily within inactive pits (e.g. Central Pit [Pit 1]). The DSA requirements for open pits would be provided within water management dams during mining operations and if required temporarily within inactive pits (Appendix A). However, the potential likelihood of needing to use inactive pits as a water storage is very low and would only be required following extremely wet periods.

The Surface Water Assessment (Appendix A) concludes that the surface water management system is robust and has adequate storage capacity to manage surface water runoff contained on-site for a wide range of possible climatic conditions, including extended wet and dry periods. The assessment also concludes that the potential for ‘worked’ water in the surface water management system overflowing to receiving waters is very low (i.e. <1% annual exceedance probability).

**Water Releases**

Water stored in the Project water management system would be released in accordance with EA EPML00900113 as required. The existing five release points would continue to be used for the Project, as well as new release points from sediment dams and containment storages as the structures are built throughout the mine life.

The proposed release points for the Project are described in Appendix A. Water is released via pipelines from the dams to downstream areas as overland flow. Releases off-site would be conducted in a manner to avoid causing erosion at discharge points.

**Operational Flood Levees and Final Landforms**

Operational flood levees would be used to protect key Project components such as the open cut pits and mine infrastructure area from inundation and to divert runoff from undisturbed areas around the open cut pits and waste rock emplacements during operations. A conceptual design of the operational flood levees is shown on Figure 2.12.

A total of seven operational flood levees would be required over the Project life (Appendix B). The operational flood levees would be designed in accordance with the Manual for assessing consequence categories and hydraulic performance of structures (2016a) and Structures which are dams or levees constructed as part of environmentally relevant activities (DEHP, 2017a).

Operational flood levees and waste rock emplacements would be designed and constructed to provide 1:1,000 AEP flood protection to open cut voids and 1:100 AEP protection to operational mine infrastructure.

At the completion of mining the operational flood levees in the south and south-east would be removed or be integrated with the final landforms where required to provide flood immunity up to the probable maximum flood (PMF).

The final landform design plans and sections for the two final voids post-mining are shown on Figures 2.13 and 2.14.

The conceptual designs for the final landforms (including erosion protection) are shown on Figure 2.12.

Further details on final landforms is provided in Sections 3.2.2, 3.2.3 and 4.

**2.8.3 Water Demand and Supply**

The sources of water used at the Project would be consistent with the current operations, and would be supplied subject to the following priority:

- water supplied from pit dewatering (including any groundwater inflows);
- recycled process water recovered from the CHPP and reject streams;
- surface water runoff captured from disturbed areas and stored within the water management system; and
- external water supplied from CSG operators or other licensed external sources.

Syntech Resources currently holds a specific Beneficial Use Approval (BUA) (under the Waste Reduction and Recycling Act 2011) to source water from CSG operators to the Cameby Downs Mine for use in the CHPP or for dust suppression. In November 2016, the BUA framework was replaced by an End of Waste (EOW) framework under the Waste Reduction and Recycling Act 2011. Under transitional provisions, an existing specific BUA is taken to be an EOW approval.
Operational Phase

Post-mining

Final landform - Final void flood protection

Final landform - waste rock emplacement erosion protection

Notes
(1) Indicative width range from 2 to 10 m depending on material used. To be determined based on geotechnical advice during detailed design.
(2) Indicative width range up to 50 m depending on material used and available space. To be determined during rehabilitation planning.
(3) Width/depth to be determined/confirmed during detailed design and construction.
(4) Indicative level only - Typically the Probable Maximum Flood (PMF) level against the final landform embankment is about 3 to 4 times higher than 1,000 year ARI flood level against the embankment.

SYNTECH RESOURCES PTY LTD
Conceptual Design of the Operational Flood Levees and Final Landforms (including Erosion Protection)

FIGURE 2.12
Final Void (Pit 1) -
Final Landform Design Plan and Sections
Cameby Downs Mine Continued Operations Project

Conceptual design cross sections Life of mine Pit 3 final landform

Cameby Downs Mine Continued Operations Project

Conceptual design cross sections Final Void 3 landform
It is anticipated that this water supply would remain available to the Project while CSG operators’ mining and exploration activities are conducted in the area (subject to obtaining a new EOW approval). If the supply becomes unavailable during the life of the Project, an alternative external water supply from other CSG operations in the region, or potentially from licensed groundwater extraction, would be secured to provide a reliable make-up water source, where required.

The Surface Water Assessment (Appendix A) concludes that the site is predicted to be a net consumer of water during the existing (Stage 0) conditions, and over the long-term, a net producer of water. All water demands for the Project would be met through a combination of on-site water sources, water recycled and re-used from the rejects dams and in-pit disposal areas, and water imported from the QGC Glen Eden Pond.

2.9 ROAD CLOSURES

As the open cut footprint expands, the progressive closure of sections of some local roads would be required over the life of the Project (Table 2.1 and Figure 2.15).

To enable ongoing access to the Warrego Highway from properties surrounding the Project, new sections of road would be constructed within existing unformed road easements (Table 2.1 and Figure 2.15).

The closure of a section of Grahams Road would not require an alternative route as this section of road does not provide access to any privately-owned properties.

The new roads would be constructed to a Rural Access 2 standard as detailed in the WDRC Standard Drawing – Roads Typical Rural Road Cross Sections (WDRC, 2010) in consultation with the WDRC.

<table>
<thead>
<tr>
<th>Local Road</th>
<th>Approximate Closure Timing</th>
<th>Length of Closure</th>
<th>Alternative Route</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boort-Koi Road</td>
<td>2025</td>
<td>8.0 km</td>
<td>Tennysons Road to Davies Road (3.3 km)</td>
</tr>
<tr>
<td>Grahams Road</td>
<td>2025</td>
<td>1.8 km</td>
<td>No alternative route required</td>
</tr>
<tr>
<td>Ryalls Road</td>
<td>2030</td>
<td>5.6 km</td>
<td>Kerwicks Road (9 km)</td>
</tr>
</tbody>
</table>

2.10 REALIGNMENT OF EXISTING 132 KV ELECTRICITY TRANSMISSION LINE

The southern extent of the open cut footprint includes an existing 132 kV ETL (Figure 1.3). The existing 132 kV ETL would therefore be realigned to avoid interaction with the Project (Figure 1.3).

The realigned ETL would be constructed in accordance with the requirements of Power Link.

2.11 INFRASTRUCTURE AND SERVICES

The existing infrastructure and services at the Cameby Downs Mine would continue to be utilised throughout the life of the Project, with minor additions, upgrades and maintenance over the life of the Project.

Mine Infrastructure Area

The existing mine infrastructure area would continue to be used with some minor upgrades during the life of the Project.

The existing mine infrastructure area comprises workshops, stores, administration buildings, toilet complexes, vehicle wash bays, CHPP and control room and coal testing laboratory, ROM coal and product stockpiles, rejects emplacement, train loadout, rail loop and diesel fuel storage area.

The existing administration buildings may be relocated to the southern boundary of ML 50233 to facilitate improved accessibility during wet conditions.

In addition, satellite mine service and infrastructure areas would be progressively developed to support mining activities in the open cut mining areas. These satellite mine service and infrastructure areas would include facilities such as mobile crib huts, ablution facilities, mobile vehicle maintenance facilities and fuel storages.

Table 2.1
Summary of Proposed Road Closures

<table>
<thead>
<tr>
<th>Local Road</th>
<th>Approximate Closure Timing</th>
<th>Length of Closure</th>
<th>Alternative Route</th>
</tr>
</thead>
<tbody>
<tr>
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<td>2025</td>
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<td>2025</td>
<td>1.8 km</td>
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</tr>
<tr>
<td>Ryalls Road</td>
<td>2030</td>
<td>5.6 km</td>
<td>Kerwicks Road (9 km)</td>
</tr>
</tbody>
</table>
The existing and new hydrocarbon storage facilities would continue to be operated in accordance with Australian Standard (AS) 1940:2004 *The Storage and Handling of Flammable and Combustible Liquids* for the Project.

**Access Roads and Internal Roads**

The existing mine access road off Ryalls Road would remain the primary site access (Figure 1.3).

There would also be use of ancillary site accesses from Kerwicks Road, Grahams Road, Boort-Koi Road and Tennysons Road for environmental monitoring, general land management, exploration activities, some limited local deliveries and other ancillary activities.

Wherever practicable, existing internal roads would be used to service the Project. Temporary internal roads would be constructed as required. The use of internal access roads would be restricted to mine personnel only.

**Electricity Supply and Distribution**

The electricity demand for the Project when fully operational would be approximately 7,600 megawatt-hours per annum.

The existing Power Link 33 kV ETL and existing 33 kV/11 kV substation would remain as the power supply for the Project. Power would be transferred either by overhead cable or underground cable where necessary.

For redundancy purposes, a parallel 33 kV/11 kV transformer and associated switchgear would be constructed adjacent the existing substation. Power would be distributed at 11 kV to the major load centres around the Project site where it would be further transformed to 415 Volts for plant operations.

**Potable Water**

Potable water for the Project would continue to be provided by town water supply delivered by tanker truck.

The existing potable water supply reticulation system would continue to be used to service the appropriate areas around the site (e.g. office buildings, crib rooms and maintenance areas).

### 2.12 WASTE MANAGEMENT

**Sewage Management**

A summary of the expected sewage wastewater production at the Project is provided in Table 2.2.

**Table 2.2**

<table>
<thead>
<tr>
<th>Location</th>
<th>Production (L/Day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining Crib</td>
<td>540</td>
</tr>
<tr>
<td>CHPP</td>
<td>175</td>
</tr>
<tr>
<td>Workshop</td>
<td>270</td>
</tr>
<tr>
<td>Administration Buildings</td>
<td>130</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,115</strong></td>
</tr>
</tbody>
</table>

L/Day = Litres per day.

The Project would result in an approximate 15% increase in sewage generation associated with the proposed increase in workforce (Section 2.13).

Sewage generated at the Project would continue to be treated at the on-site package STP.

**Sewage Treatment Plant**

The existing STP is a biological nutrient reduction type which utilises the following treatment processes:

- coarse screening;
- initial flow balance chamber;
- anoxic chamber;
- aerobic chamber;
- aeration;
- clarification; and
- final tank chlorination.

The STP has a design capacity of 25,000 L/day\(^3\) of raw sewage. It has been calculated that the sewage generated at the Project would be in the order of approximately 1,115 L/day (Table 2.2) and therefore the existing approved STP would not need upgrading.

The STP is operated in accordance with the Sewerage Treatment Plant Operating Procedure.

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\(^3\) The daily peak design capacity as defined in the *Environment Protection Regulation 2008* of the STP is an EP equal to 200.
Irrigation

Treated wastewater from the STP would continue to be pumped to the existing irrigation area for disposal. The STP is expected to produce approximately 1,100 L/day of treated wastewater.

The existing approved irrigation area is approximately 0.6 hectares (ha) in size and is located in the mine infrastructure area to the north of the ROM coal stockpiles (Figure 2.16).

The treated wastewater from the STP would meet the pH and faecal coliform criteria in Condition G2 of EA EPML00900113.

Consistent with existing operations, if the treated wastewater does not meet the requirements of Condition G2 of EA EPML00900113, the treated wastewater would be stored in a tank rather than be irrigated. The treated waste water would then be collected and transported by a licensed regulated waste contractor to a licensed offsite location for treatment and disposal.

Irrigation would continue to be undertaken in accordance with the requirements of Schedule G – Sewage Treatment of EA EPML00900113:

- treated wastewater would be applied so that no pooling, ponding and/or runoff would occur;
- no spray drift or over spray would occur;
- environmental harm and/or environmental nuisance would be minimised or avoided; and
- treated wastewater would not be released to any waterway or drainage line.

The irrigation area is located inside the water management system (i.e. any runoff is stored on-site) and would only be released in accordance with EA EPML00900113 as required.

Non-mining Waste Streams

Table 2.3 lists non-mining waste streams and the general control strategies that would be implemented for the Project.

General waste minimisation principles would be applied at the Project in accordance with the Waste Reduction and Recycling Act 2011 waste management hierarchy to minimise the quantity of wastes that require off-site disposal.

The existing Waste Management Plan required by Condition C3 of EA EPML00900113 would be revised to incorporate the Project where required. Consideration would be given to the DES Guideline Application Requirements for Activities with Waste Impacts (DES, 2018a) as part of the revision of the Waste Management Plan.

The quantity of non-mining waste streams to be generated at the Project would be outlined in the Waste Management Plan.

Disposal of Bulky Non-putrescible General Waste

Up to 10,000 tonnes per annum (tpa) of bulky non-putrescible general waste (e.g. heavy vehicle tyres, timber pallets, air filters, conveyor belts) would be disposed offsite by a licensed contractor or in the open cut pit as part of the Project.

The bulky non-putrescible general waste would be placed in trenches within the backfilled open cut voids and it would be covered with waste rock as mining progresses. Records of the amount and type of waste disposed in and the location of each trench would be kept for the life of the Project.

Given the nature of the waste to be disposed in the backfilled open cut pit voids (i.e. inert, non-putrescible waste), it is not expected to generate any leachate, odour or vermin impacts.

2.13 EMPLOYMENT AND COMMUNITY INITIATIVES

Employment

The Cameby Downs Mine currently employs a total workforce of approximately 140 personnel and is approved to operate 24 hours per day, 7 days per week over an approximate 45 year life. The Project would result in an increase of the existing workforce to approximately 160 personnel over an approximate 75 year life.

The Project would therefore facilitate continued employment of approximately 140 persons at the Cameby Downs Mine and provide for an additional 20 positions over the Project life. Syntech Resources would seek to maximise the number of workers who reside in the Project area and does not support the use of a fly-in-fly-out workforce.

Additional workers may be required during short-term construction activities (Section 2.3).
Table 2.3
Non-mining Waste Streams Generated by the Project

<table>
<thead>
<tr>
<th>Waste Category</th>
<th>Waste Type</th>
<th>Waste Treatment Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulated</td>
<td>Oily rags</td>
<td>Oil, fuel drums and solvents would be collected by a licensed contractor for recycling or reuse.</td>
</tr>
<tr>
<td></td>
<td>Oil filters</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grease</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oily water</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Solvents/chemicals, etc.</td>
<td></td>
</tr>
<tr>
<td>Waste oil</td>
<td></td>
<td>Collected in a purpose-built tank and removed by a licensed regulated waste management contractor and transported to licensed facility for recycling.</td>
</tr>
<tr>
<td>Septic</td>
<td></td>
<td>Directed to the on-site STP; processed through the plant and treated water is used for onsite irrigation. Residual sludge is removed by a licensed regulated waste management contractor and transported to a licensed facility for recycling.</td>
</tr>
<tr>
<td>Tyres</td>
<td></td>
<td>Waste tyres would be stockpiled and then transported to an area of the open cut pit which has been mined and the tyres buried in accordance with Condition C8 of EA EPML00900113.</td>
</tr>
<tr>
<td>Batteries</td>
<td></td>
<td>Waste batteries would be collected by a licensed contractor for recycling or reuse.</td>
</tr>
<tr>
<td>General</td>
<td>Food scraps</td>
<td>Putrescible and general waste would be collected within the rubbish bins provided throughout the Project site and regularly collected by a waste disposal contractor and disposed of offsite at a licensed facility.</td>
</tr>
<tr>
<td>General waste</td>
<td></td>
<td>Non-putrescible general waste would be regularly collected by a waste disposal contractor and disposed of offsite at a licensed facility.</td>
</tr>
<tr>
<td>Bulky non-putrescible general waste (e.g. timber pallets, air filters, conveyor belts)</td>
<td>Collected by a waste disposal contractor and disposed of offsite at a licensed facility or disposed in the open cut pit.</td>
<td></td>
</tr>
<tr>
<td>Recyclable</td>
<td>Paper, cardboard, bottles, etc.</td>
<td>Cardboard, glass, plastic and aluminium containers would be collected by a licensed contractor for recycling or reuse.</td>
</tr>
</tbody>
</table>

Community Initiatives

Syntech Resources makes financial and in-kind contributions to a number of community organisations in Miles and Chinchilla. Syntech Resources financial contributions (in the form of sponsorships, donations and in-kind support) to various education, community development, sport, health, arts, culture and youth services causes in the region totalled approximately $100,000 between 2015 and 2017.

Past recipients of financial contributions have included:

- Chinchilla Netball Association;
- Chinchilla Chamber of Commerce;
- Saints Weightlifting Club;
- Toastmasters District 69;
- Chinchilla Historical Society;
- Columboola Environment School;
- Chinchilla Clay Target Club;
- Chinchilla Chamber of Commerce;
- Chinchilla Christian School;
- Miles Branch Queensland Country Women’s Association;
- Miles Back to the Bush Festival;
- Kowguran Rural Fire Brigade;
- Western Downs Youth Hub;
- Youth In search;
- Miles State School;
- Chinchilla Historical Society;
• Chinchilla Netball Association;
• Chinchilla State High school;
• Chinchilla State Parents and Citizens Association;
• Chinchilla Trail Ride;
• Relay for Life;
• Youth in Search; and
• Chinchilla Rugby League Club.

The Project would continue supporting the local and regional community through sponsorships and donations.

Syntech Resources engages contractors and suppliers from the region at the existing Cameby Downs Mine. The Project would continue to identify opportunities to source goods and services from local businesses were practicable.

The Project would also enable the continued payment of royalties and taxes to the Queensland and Commonwealth Governments.
3 ENVIRONMENTAL ASSESSMENT

This section presents the environmental assessment of the Project to address the requirements of the DES’ Information Request.

3.1 LAND

Section 3.1.1 provides a description of the relevant environmental values, including a description of the existing environment relating to land resources. Section 3.1.2 describes the potential impacts of the Project on land and Section 3.1.3 outlines the proposed mitigation measures, management and monitoring.

3.1.1 Environmental Values

The environmental values relevant to land at the Project site have been identified with consideration of the DES Guideline Application requirements for activities with impacts to land (DES, 2018b).

Landforms and Topography

Terrain within the Project area is comprised of low sandstone hills in the north and gently undulating plains in the south associated with drainage lines. Elevation in the Project area ranges from approximately 320 m Australian Height Datum (AHD) in the vicinity of Drainage Line 1, to approximately 370 m AHD in the north (Figure 3.1).

Land Use

The major land uses within the Surat Basin include agriculture, coal mining, CSG production and power generation.

The Project is located within a rural area that is predominately used for low intensity cattle grazing on unimproved pasture. Other land uses on the Project site include the existing Cameby Downs Mine, CSG production, rural residences and remnant and regrowth vegetation.

Soils

A number of soil investigations have been undertaken at the Project site and these are summarised in the Soil Resources Review (Appendix I).

Three broad soil units have been mapped on the Project site (Appendix I):

- Binkey Soil Unit – predominantly shallow sandy duplex soils on low sandstone ridges at the northern side of the Project site with low levels of plant nutrients and high levels of sodicity in the subsoil.
- Braemar Soil Unit – shallow sandy duplex soils on sandstone derived undulating plains with low levels of plant nutrients and high levels of sodicity in the subsoil.
- Tara Soil Unit – strongly structured deep cracking clays soils developed on the gently undulating plains at the southern side of the Project site with low to moderate levels of plant nutrients but the surface soils are considered sodic and thus with potential for dispersion.

The soil unit mapping is presented in Appendix I.

The State Planning Policy 2/02 Planning and Managing Development involving Acid Sulfate Soils (Queensland Government, 2002) states that acid sulphate soils occur predominantly on coastal lowlands with elevations generally below 5 m AHD. The elevation in the Project area ranges from approximately 320 m AHD to approximately 370 m AHD. In addition, soil investigations undertaken at the Project site indicated that the pH is moderately acidic to neutral and included no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water-logged soils.

Environmental Earth Sciences (Appendix J) concluded that the geology, elevation and soil type indicate no risk of acid sulfate soil occurrence at the Project site (Appendix J).

Agricultural Resources

As described above, agricultural land uses on the Project site include low intensity cattle grazing on unimproved pasture. No horticulture or cropping occurs on the Project site.

Strategic Cropping Land (SCL) Validation Applications for properties on the Project site mapped on the DNRME SCL Trigger Map as containing potential SCL were submitted to the DNRME with cropping history assessments in January 2013. The assessment identified that no cropping events had been conducted on any of the land mapped as potential SCL between 1 January 1999 and 31 December 2010. DNRME issued Cropping History Decision notices on 8 March 2013 which determined that these areas are non-SCL.
At that time there was no avenue to include land that was not mapped as SCL on the DNRME SCL Trigger Map in the SCL Validation Application. As such, various lots on the Project site were not included in the SCL Validation Application, as the SCL Trigger Mapping at that time did not show land within those lots to be SCL.

In June 2014, the DNRME updated the SCL Trigger Map to include new areas of SCL on the Project site (parts of MLAs 50258 and 50260) on lots not included in the 2013 Validation Applications.

Under the RPI Act, the SCL mapped within the MLAs 50258 and 50260 are areas of regional interest (i.e. strategic cropping areas) and a RIDA may be required to carry out a resource activity in these areas.

Under section 99 of the RPI Act, a resource activity is an ‘exempt resource activity’ for strategic cropping areas if the EA or ML was issued or granted as a result of an application that was excluded under Chapter 9, Part 3, Division 2 or 3 of the repealed Strategic Cropping Land Act 2011 (SCL Act). Syntech Resources considers that Chapter 9, Part 3, Division 3 of SCL Act applies to the Project and therefore no RIDA is proposed to be sought for the Project. Table 3.1 provides a breakdown of the elements of Chapter 9, Part 3, Division 3, section 288 of the SCL Act and identifies how each element is satisfied by the Project.

**Contaminated Land**

A Site Investigation was undertaken for the Project by Environmental Earth Sciences (Appendix J) in accordance with the National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (National Environment Protection Council [NEPC], 2013) and the Queensland Auditor Handbook for Contaminated Land Module 5 (DEHP, 2015a).

The Site Investigation determined that the majority of the Project site is suitable for the land use proposed by the Project (Appendix J).

The Site Investigation did however identify evidence of contamination or historical contaminating activities on five properties on the Project site. All of these locations were considered to be suitable for the land use proposed by the Project with the implementation of management measures (Section 3.1.3) (Appendix J).

Notwithstanding the above, the locations where evidence of contamination or historical contaminating was identified are not considered to be causing or are likely to cause or constitute serious or material environmental harm in their current state (Appendix J).

The location of the areas where evidence of contamination or historical contaminating activities was identified is provided in Appendix J.

**Visual Amenity**

The Project site comprises a number of distinct land use types and landscape units including the agricultural activities (grazing on unimproved pasture), the existing Cameby Downs Coal Mine, CSG operations, rural residences, drainage lines and remnant and regrowth vegetation.

The visual character of the Project area and surrounds reflects these distinct land use types and landscape units.

Topographic features in the vicinity of the Project are described above.

**3.1.2 Potential Impacts**

**Landforms and Topography**

The Project would alter the landforms and topography within the Project site. Some topographic changes would be temporary (e.g. temporary infrastructure) and some would be permanent (e.g. final mine landforms).

The Project would increase the extent of the existing approved open cut mining areas (Figure 1.3).

Waste rock mined during the development of the Project would be placed in in-pit waste rock emplacements and/or out-of-pit waste rock emplacements consistent with the existing Cameby Downs Mine operations (Section 2.4.4).

At the cessation of mining two final voids would remain (Section 4.2).

Eight out-of-pit waste rock emplacements would be developed over the Project life. The maximum elevation of these out-of-pit waste rock emplacements would range from approximately 35 m to 45 m above natural ground level (Figure 2.6).

In addition, one additional out-of-pit rejects emplacement would be developed as part of the Project (Figure 2.6).
## Table 3.1
Summary of Section 288 of the Strategic Cropping Land Act 2011 Requirements

<table>
<thead>
<tr>
<th>Section 288 Requirement</th>
<th>MLA 50258</th>
<th>MLA 50259</th>
<th>MLA 50260</th>
<th>MLA 50269</th>
<th>Requirement Satisfied?</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) a mining lease application is or was made for any of the area of the EP or MDL; and</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(ii) a certificate of application is or was issued for the mining lease application; and</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1(c)(i) on 23 August 2010, the applicant was—</td>
<td>Authorised holders of EPC 732 (as at 23 August 2010): Syntech Resources.</td>
<td>Authorised holders of EPC 732 (as at 23 August 2010): Syntech Resources.</td>
<td>Authorised holders of EPC 732 (as at 23 August 2010): Syntech Resources.</td>
<td>Authorised holders of EPC 732 (as at 23 August 2010): Syntech Resources.</td>
<td>Yes</td>
</tr>
<tr>
<td>(i) the holder of the mining lease and also—</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(A) the holder of the EP or MDL; or</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(B) a party to a joint venture or partnership agreement with the holder of the EP or MDL about resource activities for the proposed mining lease the subject of the application; or</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(C) a subsidiary of the holder of the EP or MDL, as defined under the Corporations Act, section 46; or</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1(c)(ii) on 23 August 2010, the applicant was—</td>
<td>Under section 288(1)(c) of the SCL Act, the applicant only needs to be: - the holder of the ML and the holder of the Exploration Permit (EP) or Mining Development License (MDL); or - the holder of the EP or MDL and a subsidiary of the holder of the ML, as at 23 August 2010. As Syntech Resources satisfies section 288(1)(c)(i), section 288(1)(c)(ii) is not relevant.</td>
<td></td>
<td></td>
<td></td>
<td>NA</td>
</tr>
</tbody>
</table>
The Project would alter the landforms and topography within the Project area (e.g. rehabilitated out-of-pit waste rock emplacement landforms, out-of-pit rejects emplacements and final voids), however, these landforms would be similar in elevation to the existing/approved mine landform and existing topography across the Project area (Section 3.1.1).

A range of lesser topographic changes would be associated with the construction of access roads, hardstands, water management infrastructure over the life of the Project.

Further description of the proposed post-mining final landform for the Project is provided in Section 4.2.

**Soils**

Potential impacts of the Project on soils would relate primarily to:

- disturbance of in situ soil resources within additional disturbance areas (e.g. development of new open cut mining areas);
- alteration of soil structure beneath infrastructure items, hardstand areas and roads;
- possible soil contamination resulting from spillage of fuels, lubricants and other chemicals;
- increased erosion and sediment movement due to exposure of soils during construction; and
- alteration of physical and chemical soil properties (e.g. structure, fertility, permeability and microbial activity) due to soil stripping and stockpiling operations.

A review of the physical and chemical properties of the soils has established that there are soil resources present that would be suitable as a rehabilitation medium on the Project site post-mining (Section 4.3.2) (Appendix I).

**Land Use – Agricultural Resources**

The Project would result in the long-term disturbance or alteration of some existing low intensity grazing areas.

The rehabilitation strategy for the Project would however include the restoration of agricultural land suitable for grazing (Section 4.2.3). These agricultural lands would be progressively re-established as a component of the Project rehabilitation program.

**Contaminated Land Potential**

The Project would potentially disturb areas where evidence of contamination or historical contaminating activities has occurred (Section 3.1.1).

In addition, land uses that may result in land becoming contaminated are known as ‘Notifiable Activities’ and are listed in Schedule 3 of the EP Act. The following Notifiable Activities are relevant to the Project:

- Notifiable Activity 7 – Chemical storage;
- Notifiable Activity 15 – Explosives production and storage;
- Notifiable Activity 20 – Landfill, disposing of waste (excluding inert construction and demolition waste);
- Notifiable Activity 24 – Mine wastes; and
- Notifiable Activity 29 – Petroleum product or oil storage, storing petroleum products or oil.

The locations of the Notifiable Activities would be described in the Plan of Operations.

**Visual Amenity**

The development of additional out-of-pit waste rock emplacements, out-of-pit reject emplacement, other infrastructure and associated vegetation clearing would alter the visual landscape of the Project area similar to the impacts associated with the existing operation. However, given the generally flat topography, the existing dense vegetation surrounding the Project and that dwellings typically have vegetation surrounding them, it is anticipated that potential impacts on visual amenity at privately owned dwellings associated with the Project would not be significant.

The Project would be visible from parts of the road network around the Project, particularly where vegetative screening is limited. Although the Project would result in a change in visual appearance from these locations, the viewer sensitivity from the road network is not considered to be high, and as such, potential impacts are not considered to be significant.

Night-lighting sources would extend into new mining areas as part of the Project. Consequently, there would be a potential increase in night-lighting impacts associated with night-glow and mobile vehicle-mounted lights. Notwithstanding the above, the nature of the night-lighting for the Project would be similar to the existing night-lighting at the Cameby Downs Mine and the change in potential night-lighting impacts would be minor.
3.1.3 Mitigation Measures, Management and Monitoring

Land Use – Agricultural Resources

Agricultural land resource management at the Project would include the following key components:

- minimisation of disturbance to agricultural lands, where practicable;
- continued use of adjoining Syntech Resources-owned land within the Project area for agricultural uses, where practicable;
- management of soil resources at the Project site so that they can be used for rehabilitation; and
- inclusion of low intensity grazing areas in the Project rehabilitation strategy (Section 4.2.3).

Soils

Topsoil salvage would continue to be conducted in accordance with procedures outlined in the Plan of Operations (Syntech Resources, 2017).

Topsoil would be stripped prior to excavation of underlying overburden. Where the topsoil cannot be directly used for progressive rehabilitation (i.e. placed directly onto waste rock emplacement areas) it would be stockpiled for use at a later date.

The objectives of soil resource management for the Project site would be to:

- identify and quantify potential soil resources for rehabilitation;
- optimise the recovery of usable soil reserves during soil stripping operations;
- preferentially replace stripped soil directly on completed sections of the final landform;
- manage soil reserves so as not to degrade the resource when stockpiled; and
- establish effective soil amelioration procedures to maximise the availability and suitability of soil reserves for future rehabilitation works.

Specific measures that would be implemented to manage soil resources include:

- Areas of disturbance to be stripped would be clearly defined so the dozer operator clearly understands the boundaries of the area to be stripped.
- During the topsoil stripping:
  - visual inspections would be conducted to confirm that appropriate soil stripping depth is being recovered; and
  - small areas (e.g. 1 m by 1 m) would be left unstripped at approximate 100 m intervals to allow to confirm stripping depth, record soil profile observations and collect soil sample for analysis.
- Topsoil would be placed directly on completed sections of the final landform or placed in topsoil stockpiles.
- The perimeter of topsoil stockpiles would be marked and appropriately signed.
- The topsoil stockpile locations and volume would be surveyed for inclusion in the topsoil inventory.

Any long-term soil stockpiles would be managed to maintain long-term soil viability through the implementation of the following management practices as listed below:

- Topsoil stockpiles would be retained at a maximum height of 3 m and would not be double stacked to avoid compaction and damage to the topsoil.
- Topsoil stockpiles would be constructed to minimise erosion (e.g. roughened surface maintained), encourage drainage, and promote revegetation.
- Wherever practicable, soil stockpiles would not be trafficked, deep ripped or removed in wet conditions to avoid breakdown in soil structure.
- All topsoil stockpiles would be protected with a non-persistent cover crop to reduce erosion potential as soon as practicable after completion of stockpiling.
- Soil stockpiles would be located in positions to avoid surface water flows. Silt stop fencing would be placed immediately down-slope of stockpiles until stable vegetation cover is established.
- An inventory of soil resources (available and stripped) would be maintained and regularly reconciled with rehabilitation requirements.

The Plan of Operations would describe the detailed soil resource management measures that would be used during the Project life.
Contaminated Land

As described in Section 3.1.1, a Site Investigation was undertaken for the Project and it identified five properties on the Project site where evidence of contamination or historical contaminating activities would be suitable with implementation of management measures. Syntech Resources would implement the following management measures prior to disturbance of these areas:

- Former sheep dips and races – further investigation would be undertaken to determine the extent of contamination prior to undertaking Project activities in these areas. The requirement for remediation or off-site disposal of potentially contaminated soil would be determined based on the findings of the investigation.

- Hydrocarbon contaminated areas – the areas of soil would be excavated and disposed at a licensed facility.

- Burnt-out sheds – would be demolished and disposed at a licensed facility.

- Asbestos – all buildings to be demolished would be assessed for asbestos containing materials prior to demolition. Any asbestos containing materials would be removed by a licensed contractor prior to demolition.

General measures to reduce the potential for contamination of land would include the following:

- Contractors transporting dangerous goods loads would be appropriately licensed in accordance with the provisions of the Australian Code for the Transport of Dangerous Goods by Road and Rail (National Transport Commission, 2017).

- On-site consumable storage areas would be designed with appropriate bunding and would be operated, where applicable, in compliance with the requirements of AS 1940-2017 The Storage and Handling of Flammable and Combustible Liquids and AS 2187.1 Explosives – Storage, Transport and Use – Storage.

- Fuel and explosive storage areas would be regularly inspected and maintained.

- Procedures for storage and use of chemicals and hydrocarbons on site.

- General waste would be removed to a licensed waste facility.

In addition, the two properties that could not be assessed as part of the Contaminated Land Assessment (i.e. Lots 17 and 19 RP187207) would be inspected by a Suitably Qualified Person prior to undertaking Project activities in these properties.

Visual Amenity

Progressive rehabilitation of Project landforms would be undertaken in order to reduce the contrast between the Project landforms and the surrounding environment. This would include progressive rehabilitation with selected tree and pasture species (endemic where practicable).

Whilst ensuring that operational safety is not compromised, Syntech Resources would minimise light emissions from the Project by select placement, configuration and direction of lighting so as to reduce off-site nuisance effects where practicable. All external lighting at the Project would be operated in accordance with AS 4282 (INT):1997 Control of Obtrusive Effects of Outdoor Lighting.

3.2 SURFACE WATER

Section 3.2.1 provides a description of the relevant environmental values, and includes a description of the regional and local hydrology, surface water management system and updated site water balance model. Section 3.2.2 describes the potential impacts of the Project on surface water resources (including potential releases to receiving environment and flooding impacts) and Section 3.2.3 outlines the proposed mitigation measures, management and monitoring, including conceptual designs of the drainage feature diversions.

The assessment of potential surface water impacts is supported by the Cameby Downs Continued Operations Project Surface Water Assessment (WRM, 2018a) and Flood Study (WRM, 2018b), with integration of the outcomes of the Groundwater Assessment (AGE, 2018), and are included in Appendices A, B and C, respectively.

3.2.1 Environmental Values

The environmental values relevant to surface water at the Project site have been identified with consideration of the Application requirements for activities with impacts to water (DEHP, 2018c).
The EP Act seeks to protect Queensland’s water resources while allowing ecologically sustainable development through the *Environmental Protection (Water) Policy 2009* (EPP Water). The EPP Water achieves this within a framework that includes:

- Identifying environmental values for aquatic ecosystems and for human uses; and
- Determining water quality guidelines (WQGs) and water quality objectives (WQOs) to enhance or protect the environmental values.

Environmental values are the qualities of waterways to be protected from activities in the catchment. Protecting environmental values aims to ensure healthy aquatic ecosystems and waterways that are safe and suitable for community use. Environmental Values reflect the ecological, social and economic values and uses of the waterway (such as stock water, swimming, fishing and agriculture).


Environmental values and WQOs for the Maranoa-Balonne (and Lower Condamine) Sub-basin have been under development by the DES. The DEHP (now DES) have been developing the environmental values and WQOs in collaboration within the Queensland Murray Darling Committee (QMDC). DEHP republished a draft report by QMDC titled *Draft Environmental Values and Community Consultation Report* (DEHP, 2017b). Although this document is only in draft form, it is likely to be used to inform the subsequent development of environmental values, WQOs and future WQGs under the EPP Water in pending Healthy Waters Management Plans.

Based on DEHP (2017b), the receiving surface waters downstream of the Cameby Downs Mine are located in the Dogwood Creek water quality zone. The surface water environmental values that can potentially be listed under the EPP Water for this zone are:

- aquatic ecosystems;
- irrigation crops;
- farm use;
- stock watering;
- aquaculture;
- human consumption;
- primary recreation;
- secondary recreation;
- visual appreciation;
- raw water drinking;
- industrial use; and
- cultural and spiritual values.

Draft documentation has since been released by the DES in 2018 and is currently the subject of final consultation under the EPP Water on the environmental values, aquatic ecosystem protection mapping and WQOs for all surface water and groundwater of the Queensland Murray-Darling Basin (QMDB). As these draft environmental values, mapping and WQOs are yet to be finalised, no further consideration is made in this EVA.

The indicators and WQGs relevant to the above environmental values are listed in the Queensland WQGs and ANZECC & ARMCANZ (2000). The conditions of waterways located in the vicinity of the Cameby Downs Mine are classified as Level 2: slightly to moderately disturbed ecosystems under the *Queensland Water Quality Guidelines 2009* (DEHP, 2013a). Default trigger values for aquatic ecosystem protection at Cameby Downs Mine and surrounds are tabulated in Table 3.2.

However, as described in Section 3.2.2, indicative locally derived trigger values or other site-specific or guideline values are proposed to be adopted for select parameters for the Project.

**Regional and Local Hydrology**

The Project is located within the mid-reach of the Condamine-Balonne River Basin, which is part of the headwaters of the Murray-Darling Basin. Locally, the majority of the Project area is located within the upper catchment of Columboola Creek, a tributary of Dogwood Creek.

The remaining part of the Project area is located within the upper catchment of Punch-bowl Creek, which is also a tributary of Dogwood Creek. Dogwood Creek is a major tributary of the Balonne River.
Table 3.2
Default Trigger Values for Cameby Downs Mine and Surrounds

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Trigger Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>pH Units</td>
<td>6.0 (lower) 7.5 (upper)</td>
</tr>
<tr>
<td>Electrical Conductivity (EC)</td>
<td>μS/cm</td>
<td>350 (1,000)</td>
</tr>
<tr>
<td>Turbidity</td>
<td>NTU</td>
<td>25</td>
</tr>
<tr>
<td>Total Nitrogen</td>
<td>mg/L</td>
<td>0.25</td>
</tr>
<tr>
<td>Nitrite + Nitrate</td>
<td>mg/L</td>
<td>0.015 (1.1)</td>
</tr>
<tr>
<td>Nitrate</td>
<td>mg/L</td>
<td>1.1</td>
</tr>
<tr>
<td>Total Phosphorus</td>
<td>mg/L</td>
<td>0.02</td>
</tr>
<tr>
<td>Ammonia</td>
<td>mg/L</td>
<td>0.9</td>
</tr>
<tr>
<td>Aluminium (pH&gt;6.5)</td>
<td>mg/L</td>
<td>0.055</td>
</tr>
<tr>
<td>Aluminium (pH&lt;6.5)</td>
<td>mg/L</td>
<td>ID</td>
</tr>
<tr>
<td>Arsenic (As III)</td>
<td>mg/L</td>
<td>0.024</td>
</tr>
<tr>
<td>Arsenic (As V)</td>
<td>mg/L</td>
<td>0.013</td>
</tr>
<tr>
<td>Boron</td>
<td>mg/L</td>
<td>0.37</td>
</tr>
<tr>
<td>Cadmium</td>
<td>mg/L</td>
<td>0.0002</td>
</tr>
<tr>
<td>Chromium (Cr VI)</td>
<td>mg/L</td>
<td>0.001</td>
</tr>
<tr>
<td>Cobalt</td>
<td>mg/L</td>
<td>(0.09)</td>
</tr>
<tr>
<td>Copper</td>
<td>mg/L</td>
<td>0.0014 (0.002)</td>
</tr>
<tr>
<td>Iron</td>
<td>mg/L</td>
<td>0.3</td>
</tr>
<tr>
<td>Lead</td>
<td>mg/L</td>
<td>0.0034 (0.004)</td>
</tr>
<tr>
<td>Manganese</td>
<td>mg/L</td>
<td>1.9</td>
</tr>
<tr>
<td>Mercury (inorganic)</td>
<td>mg/L</td>
<td>0.0006</td>
</tr>
<tr>
<td>Nickel</td>
<td>mg/L</td>
<td>0.0011</td>
</tr>
<tr>
<td>Selenium</td>
<td>mg/L</td>
<td>0.0011 (0.01)</td>
</tr>
<tr>
<td>Silver</td>
<td>mg/L</td>
<td>0.000005 (0.001)</td>
</tr>
<tr>
<td>Zinc</td>
<td>mg/L</td>
<td>0.008</td>
</tr>
</tbody>
</table>

Source: After WRM (2018a).

* ANZECC & ARMCANZ (2000) Trigger Values for ‘Upland Streams’ (above 150 m AHD) in South-east Australia for protection of 95% of species.

ID  Insufficient data.

()  Model Mining Conditions (rounded) where different.

μS/cm  microSiemens per centimetre.

NTU  Nephtelmic Turbitdity Unit

mg/L  milligrams per litre.

The northern portion of the Project area drains to Punch-bowl Creek via three headwater drainage features, namely: Drainage Lines 5, 6, and 7. At its confluence with Dogwood Creek, Punch-bowl Creek has a total catchment area of approximately 124 km².

Given the ephemeral nature of the drainage features within the Project area and downstream watercourses, surface water use is generally restricted to stock watering when water is available.

**Surface Water Management System**

**Up-catchment (Diverted) Water**

Up-catchment water will be kept separate from the mine water management system by the clean water diversions and diversion of Drainage Line 1. Conceptual design details for the diversions are provided in Section 3.2.3.

**Surface and Worked (Mine Affected) Water**

In addition to the up-catchment ‘diverted’ water drains to allow drainage from undisturbed areas around the development to report directly to downstream (receiving) waters, the surface water management system includes:

- runoff from ‘worked’ areas on-site contained and managed in mine water storages;
- sediment-laden runoff from disturbed areas captured and managed in ‘surface’ water drains and sediment management structures; and
- runoff from rehabilitated mine areas and suitable releases from sediment management structures.

The objectives of the surface water management system are as follows:

- separate ‘diverted’, ‘surface’ and ‘worked’ water runoff as much as possible;
- manage the area of surface disturbance, thus limiting the volume of ‘surface’ and/or ‘worked’ runoff and at the same time limit external water supply requirements;
- manage ‘surface’ water on site via containment storages or sediment dams dependant on the quality of water likely to be generated;
- controlled release of ‘surface’ water following sediment removal through a sediment management structure (e.g. sediment dams), provided water quality is within the EA EPML00900113 water quality release limits;
segregate, collect and contain all ‘worked’ water runoff as much as possible on site via adequately sized containment storages;

provide permanent pumping infrastructure to allow transfer of ‘worked’ water between containment storages as required, to limit the potential for ‘worked’ water overflows to the receiving environment and limit interruptions to operations in active open pits; and

limit ‘diverted’ and ‘external’ water consumption and maximise reuse of ‘surface’ and ‘worked’ water within the mine site (e.g. for coal washing).

Water from the QGC Glen Eden Pond would continue to be sourced externally (via a pipeline to the Cameby Downs Mine) to meet shortfalls for the on-site water demands for the Project.

A description of the water management measures adopted for the Project, including the containment and management systems is provided in Section 3.2.3.

Site Water Balance Model Updates

The OPSIM water balance model has been updated and used with a daily-time step over the Project life, using 128 years of climatic data to simulate the long-term behaviour of the surface water management system, including consideration of the site water demands, external supply (e.g. QGC water), and other inputs (e.g. groundwater inflows).

The results of the OPSIM site water balance model were analysed for the following mine stages for the purposes of the assessment:

- Year 1 (Stage 0) – Existing Conditions;
- Year 29 (Stage 1);
- Year 48 (Stage 2); and
- Year 75 (Stage 3) – End of Mine.

All water demands for the Project would be met through a combination of on-site water sources, water recycled and re-used from the rejects dams and in-pit disposal areas, and water imported from the QGC Glen Eden Pond.

The OPSIM water balance model results indicate that:

- The site is a net consumer of water during the existing (Stage 0) conditions. (NB: Under 50th percentile (median) climate conditions the site will require 183 ML of external water, without harvesting from on-site sediment dams).
- The Project would be, over the long-term, a net producer of water. (NB: If site water is preferentially harvested from on-site sediment dams, external water supply from QGC Glen Eden Pond would likely only be required during periods of significantly low rainfall and existing [Stage 0] conditions).
- Periodic releases of water from sediment dams would occur via the dam spillways. (NB: Such releases are predicted to only occur during significant flow events in the upper catchments and associated drainage lines of Columboola Creek).
- No predicted exceedances in end of pipe release limits or downstream water quality for salinity from sediment dam releases.

In conclusion, the OPSIM water balance modelling results indicate that:

- the surface water management system is robust and has adequate storage capacity to manage surface water runoff contained on-site for a wide range of possible climatic conditions, including extended wet and dry periods; and
- the potential for ‘worked’ water in the surface water management system overflowing to receiving waters is very low (i.e. <1% annual exceedance probability).

For conservative assessment purposes, the OPSIM water balance model did not account for releases direct to the receiving environment. Notwithstanding, pumped releases to the receiving environment would be undertaken as required subject to the water quality complying with the end-of-pipe and downstream receiving environment limits specified in EA EPML00900113.

3.2.2 Potential Impacts

Source, Quality and Quantity of Mine Affected Water

Sources of water and activities at Cameby Downs Mine which may potentially impact on the receiving environment have been identified as follows:

- runoff from disturbed land (e.g. from stockpiles, overburden and open pit);
- saline or acidic leachate from waste rock emplacements;
- groundwater inflows to the pits;
- coal washing/processing in the CHPP;
- runoff from chemical or fuel/oil spills; and
- external water.
Runoff from disturbed land at Cameby Downs Mine is collected in the various site storages and pits. Monitoring of water quality (including concentrations of metals, etc.) in the site storages and pits has occurred since 2010 and a summary of the historical results are presented in the Surface Water Assessment (Appendix A).

A waste characterisation report produced by SRK Consulting (SRK, 2012) for the Cameby Downs Mine concluded that the majority of overburden could be managed as non-acid forming material. Monitoring of runoff from waste rock emplacements in the past at Cameby Downs Mine appear to have been generally neutral pH and not saline.

The available groundwater monitoring results indicate the following:

- pH ranges from 5.5 to 8.0; and
- EC ranges from 10,000 to 35,000 μS/cm.

Monitoring of rejects from the CHPP washing / processing (including reject dam cells and seepage) has occurred at Cameby Downs Mine and a summary of the past results are presented in Appendix A. The available monitoring results for an active reject dam cell indicates:

- pH ranges from 4.5 to 8.5; and
- EC ranges from 1,870 to 3,890 μS/cm.

All refuelling activities would occur in appropriately managed areas and with provision for immediate clean-up of spills.

Available monitoring data indicates that ‘external’ water ranges from QGC Glen Eden Pond is as follows:

- pH: 8.5 - 9.7; and
- Total dissolved solids (TDS): 1,100 mg/L - 4,300 mg/L.

Releases to the Receiving Environment

Based on the site water balance updates (Section 3.2.1), the potential for ‘worked’ water in the surface water management system overflowing to receiving waters is very low (i.e. <1% annual exceedance probability). Notwithstanding, pumped releases to the receiving environment would be undertaken as required subject to the water quality complying with the end-of-pipe and downstream receiving environment limits specified in EA EPML00900113.

The existing five release points would continue to be used for the Project, as well as new release points from sediment dams and containment storages as the structures are built throughout the mine life. The proposed release points for the Project are described in Appendix A. Water would continue to be released via pipelines from the dams to downstream areas as overland flow.

A review of available receiving waters water quality data has therefore been undertaken to determine indicative local water quality trigger values for the Project cognisant of the requirements of Deriving local water quality guidelines (DEHP, 2014a).

With the exception of those considered and discussed below, the Model Mining Conditions for parameters would be adopted until local or regional data is available to revise alternate trigger values.

Metals

Based on a review of available historical monitoring data (WRM, 2018a) (Appendix A), and comparison of local and regional water quality data at reference sites on Drainage Lines 1 and 2 (WS2, WS4 and WS5) up-catchment of Cameby Downs Mine with the Model Mining Conditions (Table F3), it was identified that the 80th percentile dissolved concentration values for some metals (i.e. Chromium, Copper, Lead and Zinc) in the receiving waters may be greater than the Model Mining Conditions/default trigger values (dissolved).

Indicative 80th percentile dissolved concentrations have therefore been derived by adopting conversion factors and comparison to the default trigger values (from Table 3.2) is provided in Table 3.3. It is noted that further monitoring of dissolved metal concentrations in receiving waters would be undertaken to determine the final trigger values.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Trigger Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chromium</td>
<td>mg/L</td>
<td>0.001</td>
</tr>
<tr>
<td>Copper</td>
<td>mg/L</td>
<td>0.002</td>
</tr>
<tr>
<td>Lead</td>
<td>mg/L</td>
<td>0.004</td>
</tr>
<tr>
<td>Zinc</td>
<td>mg/L</td>
<td>0.008</td>
</tr>
</tbody>
</table>

Source: WRM (2018a).

Until such time as adequate monitoring data is collected, the default trigger values would be adopted.
Total Suspended Solids

The adopted total suspended solids trigger level has been determined in accordance with the relevant guidelines (QMDC Draft Environmental Values and Community Consultation Report for the Maranoa-Balonne 2017). These guidelines recommend that the 80th percentile value is adopted where suitable monitoring data is available.

The 80th percentile total suspended solids concentration derived from the up-catchment reference sites on Drainage Lines 1 and 2 is 216 mg/L (Appendix A) and would be adopted for the Project or the current receiving waters trigger level (background +20%) stipulated in the EA (whichever is greater).

Electrical Conductivity and Sulphate

The proposed receiving waters flow criteria for the Project, derived in accordance with the Model Mining Conditions and Department of Environment and Resource Management (2011) Industry Briefing Notes (Appendix A), are provided in Table 3.4 with corresponding release limits for EC and Sulphate.

Table 3.4
Mine Affected Water Release Rates and EC / Sulphate Limit

<table>
<thead>
<tr>
<th>Flow</th>
<th>Receiving Water Flow Rate (m³/s)</th>
<th>Maximum Release Rate* (m³/s)</th>
<th>Release Limit EC (µS/cm)</th>
<th>SO₄ (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>&lt;350</td>
<td>250</td>
</tr>
<tr>
<td>Medium</td>
<td>&gt;0.2</td>
<td>&gt;0.2</td>
<td>&gt;1,500</td>
<td>500</td>
</tr>
<tr>
<td>Medium</td>
<td>&gt;0.5</td>
<td>&gt;0.1</td>
<td>&gt;3,500</td>
<td>1,200</td>
</tr>
<tr>
<td>Medium</td>
<td>&gt;0.5</td>
<td>&gt;0.4</td>
<td>&gt;1,500</td>
<td>500</td>
</tr>
<tr>
<td>Medium</td>
<td>&gt;0.9</td>
<td>&gt;0.8</td>
<td>&gt;1,500</td>
<td>500</td>
</tr>
<tr>
<td>High</td>
<td>&gt;1.0</td>
<td>&gt;0.2</td>
<td>&gt;3,500</td>
<td>1,200</td>
</tr>
<tr>
<td>High</td>
<td>&gt;1.7</td>
<td>&gt;1.5</td>
<td>&gt;1,500</td>
<td>500</td>
</tr>
<tr>
<td>High</td>
<td>&gt;2.5</td>
<td>&gt;0.6</td>
<td>&gt;3,500</td>
<td>1,200</td>
</tr>
<tr>
<td>High</td>
<td>&gt;4</td>
<td>&lt;0.2</td>
<td>&gt;10,000</td>
<td>3,400</td>
</tr>
</tbody>
</table>

Source: WRM (2018a).
* Daily during release (within 2 hours Of commencement).

m³/s = cubic metres per second.

pH Units

The release limits for pH at the Cameby Downs Mine (6.5 – 9.0) would be retained.

Receiving Environment Description and Potential Impacts of Releases

The drainage features within the Project area and downstream watercourses are ephemeral in nature and therefore subject to compliance with the downstream receiving environment limits specified in EA EPML00900113 (and considering locally derived trigger levels), the potential impacts of releases (as required) would be negligible.

The potential impact of periodic surface water releases from sediment dams on water quality downstream to Columboola Creek was assessed and showed that TDS concentrations in Columboola Creek did not exceed the downstream water quality trigger for all 128 modelled realisations assessed for the Project. The results also show that TDS concentrations in releases from the sediment dams did not exceed the end-of-pipe TDS concentration trigger values.

Flooding Impacts

Hydrologic and hydraulic modelling of local catchments have been completed to:

- assess the existing and proposed flood behaviour at the Cameby Downs Mine and surrounds at the completion of the Project;
- assist in the development of conceptual designs for clean water drains and drainage features diversions; and
- assess the conceptual design of flood protection measures for the open cut pits and mine infrastructure.

The XP-RAFTS runoff-routing model was used to estimate design flood discharges for the drainage features across the Project area and surrounds.

A two-dimensional hydraulic model (TUFLOW) was also used to investigate the flood behaviour for the mine stages as follows:

- Existing Conditions (Stage 0);
- Year 29 (Stage 1);
- Year 48 (Stage 2);
- Year 75 (Stage 3); and
- End of Mine.
A range of average recurrence interval (ARI) flood events were modelled including:

- 2-year ARI – to assess the behaviour of the proposed diversion of Drainage Line 1;
- 50-year ARI – to assess the behaviour of the proposed diversion of Drainage Line 1;
- 100-year ARI – to assess the mine infrastructure flood immunity and potential flood impacts of the Project; and
- 1,000-year ARI – to assess the open cut pit flood immunity (Figure 3.2).

A PMF event was also modelled to assess the final void flood immunity at the end of mine (Figure 3.3).

The flood modelling results indicate that with the proposed flood management measures (i.e. operational flood levees and drainage line diversion) the open cut pits, and the mine infrastructure area would be protected and would not be inundated for all mine stages for the 100-year ARI and 1,000-year ARI flood events, respectively.

Other key conclusions made from the results of the flood modelling on nearby infrastructure (i.e. Warrego Highway and Western Railway) are as follows:

- comparisons with the existing condition modelling show there would be no impact to the flood immunity at the drainage features crossings of the Warrego Highway and Western Railway;
- the Western Railway will continue to have a 100-year ARI flood immunity at both Drainage Line 1 and Drainage Line 3 crossings;
- flood velocities for the 100-year ARI event along the Western Railway embankment are generally less than 1 metres per second (m/s) outside of drainage feature crossings (i.e. no impact); and
- the peak 100-year ARI flood velocities are generally similar along Drainage Line 1 and Drainage Line 3 (i.e. negligible change).

Based on the final landform designs (WRM, 2018c) (refer Figures 2.13 and 2.14), with the operational flood levees removed, the flood modelling demonstrates that the two final voids are beyond the predicted 1,000-year ARI flood and probable maximum flood event extents for the local drainages (Appendix B).

For comparison purposes, the remaining two final voids are also located beyond the Queensland Floodplain Assessment Overlay extents (Appendix B).

### 3.2.3 Mitigation Measures, Management and Monitoring

#### Containment, Management and Disposal Systems for Mine Affected Water

Up to 16 sediment dams would be used over the life of the Project to manage ‘surface’ water runoff around the perimeter of the active waste rock emplacements. Surface water drains would be progressively constructed to capture and direct the runoff to these sediment dams. The sediment dams would be sized to provide sufficient volume to capture runoff from the 5-year ARI 24-hour rainfall event.

Up to 12 existing and proposed new containment storages would be used to collect and manage ‘worked’ water on-site. Each containment storage would be classified (i.e. low, significant or high consequence storages) in accordance with the Manual for assessing consequence categories and hydraulic performance of structures (DEHP, 2016a) and DSA and extreme storm storage volumes for significant and high consequence storages calculated accordingly.

Significant and high consequence storages would be operated such that the appropriate DSA volume is available on 1 November each year. This may be achieved by transferring water to other on-site storages (e.g. water management dam) or inactive pits if required. The DSA requirements for open pits would be provided within water management dams during mining operations and if required temporarily within inactive pits (Appendix A). However as described in Section 2.8.2, the potential likelihood of needing to use inactive pits as a water storage is very low and would only be required following extremely wet periods.

When the combined open pit water inventory exceeds 50 million litres, water will be pumped to a sacrificial pit (e.g. Central Pit [Pit 1]). Water stored in the sacrificial pit would then be used as an on-site water source.

Water sourced externally from the Glen Eden Pond from QGC would be pumped via pipeline to ‘worked’ water containment storages as required.

The water disposal system (i.e. releases to the receiving environment) and the potential impacts are described in Section 3.2.1 and 3.2.2.
Modelled Probable Maximum Flood (PMF) Extent – End of Mine
**Operational Flood Levees**

At different stages of the mine life, a portion of the open cut pit extents may, at times, be affected by a 1,000-year ARI flood event. The hydrological and hydraulic models developed as part of the Flood Study (WRM, 2018b) have been used to estimate the flood extents and required operational flood levee locations and crest heights (including a suitably designed freeboard of 0.5 m) to provide flood immunity for the 1,000-year ARI flood event during operations. Details of the proposed operational flood levees are provided in Table 3.5.

**Conceptual Design of Drainage Feature Diversions**

**Drainage Line 1**

The proposed drainage feature diversion for Drainage Line 1 has been designed and assessed using the Australian Coal Association Research Program (ACARP) stream diversion design criteria (Project C8030 – Maintenance of Geomorphic Processes in Bowen Basin River Diversions).

The objective of the proposed diversion of Drainage Line 1 is to:

- realign the drainage feature to maximise coal extraction;
- provide flood immunity for the open cut pit and mine infrastructure for flood events of at least 1,000-year ARI and 100-year ARI flood events respectively;
- limit ponding upstream of the operational flood levees; and
- provide a self-sustaining landform at the end of the mine life so that the diversion channel functions like a natural drainage similar to the hydraulic and geomorphic characteristics of the existing Drainage Line 1 channel within the Project area.

The Drainage Line 1 diversion channel would be approximately 7.6 km in length and comprise:

- a low flow channel with a base width of 5 m with 1V:2H side (bank) slopes and a depth of 0.5 m;
- an adopted sinuosity design of 1.2;
- a waterway corridor width of approximately 50 m for catchment flows over the low flow channel bank; and
- variable longitudinal slope of the channel along four delineated reaches:
  - Reach 1 – 0.45%;
  - Reach 2 – 0.16%;
  - Reach 3 – 0.35%; and
  - Reach 4 – 0.05%.

The confluence (outflow) of the diversion low flow channel with the existing downstream channel would be designed to:

- minimise the disruption to existing bank vegetation;
- avoid outflows being directed onto the existing banks of Drainage Line 1; and
- transition the diversion channel bed elevation to be the same as Drainage Line 1 (so drop structure would not be required).

**Table 3.5**

**Summary Details of Proposed Operational Flood Levees**

<table>
<thead>
<tr>
<th>ID</th>
<th>Indicative Stage Timing</th>
<th>1,000-Year ARI Flood Depth* (m)</th>
<th>Estimated Length (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pit 1 North</td>
<td>Year 1</td>
<td>1.4</td>
<td>0.25</td>
</tr>
<tr>
<td>Mine Infra</td>
<td>Year 1</td>
<td>1.6</td>
<td>1.0</td>
</tr>
<tr>
<td>Pit 1 West</td>
<td>Year 10</td>
<td>2.9</td>
<td>1.35</td>
</tr>
<tr>
<td>Pit 1 South^ (a / b)</td>
<td>Year 20</td>
<td>0.7</td>
<td>1.2 / 0.2</td>
</tr>
<tr>
<td>Pit 2 North</td>
<td>Year 25</td>
<td>2.0</td>
<td>1.75</td>
</tr>
<tr>
<td>Pit 2 South</td>
<td>Year 35</td>
<td>1.85</td>
<td>4.8</td>
</tr>
<tr>
<td>Pit 3 South^</td>
<td>Year 65</td>
<td>1.85</td>
<td>2.25</td>
</tr>
</tbody>
</table>

Source: WRM (2018b).

* Maximum model predicted flood depth, excluding additional 0.5 m freeboard design.

^ Details of upgrades to the final landform for the protection of final voids are provided separately in Table 3.7.
The final detailed design for the low flow (in-stream) channel would also consider the provision of dry season refuge including deeper pools with a compacted clay base (or similar) and appropriate measures to exclude direct access by cattle. The waterway corridor width would also consider other site considerations (e.g. geotechnical, ecological and transport) as part of the final detailed design.

The HEC-RAS hydraulic model (Figure 3.4) was used to assess the performance of the proposed diversion of Drainage Line 1 for 2-year ARI and 50-year ARI design discharges and based on the results, satisfied the ACARP design criteria.

**Clean Water Drains**

Three clean water drains are proposed during the mine life to provide flood immunity to the open cut pits and drain low-lying areas in the upper catchment around the mine operations.

Details of the proposed clean water drains are provided in Table 3.6.

<table>
<thead>
<tr>
<th>ID</th>
<th>Indicative Stage Timing</th>
<th>Approximate Width (m)</th>
<th>Estimated Length (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CWD1*</td>
<td>Year 1</td>
<td>15</td>
<td>2.0</td>
</tr>
<tr>
<td>CWD2</td>
<td>Year 29</td>
<td>10</td>
<td>3.7</td>
</tr>
<tr>
<td>CWD3</td>
<td>Year 29</td>
<td>10</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Source: WRM (2018b).

*CWD1 is an extension of an existing clean water drain but will not be permanent (as the majority of its length is mined later in the mine life).

The permanent clean water drains would be vegetated and designed to limit erosion during high flows.

**Final Landforms**

At the completion of mining the operational flood levees in the south and south-east would be removed or integrated with the final landforms where required to provide flood immunity up to the PMF.

Details of the proposed final landform for PMF protection are provided described in Section 2.8.2 and summarised in Table 3.7.

<table>
<thead>
<tr>
<th>ID</th>
<th>PMF Flood Depth (Average) (m)</th>
<th>PMF Flood Depth (Maximum) (m)</th>
<th>Estimated Length (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Final Void (Pit 1) South Landform [Figure 2.13]</td>
<td>1.5</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Western Final Void (Pit 3) South Landform [Figure 2.14]</td>
<td>2.3</td>
<td>4.0</td>
<td>0.85</td>
</tr>
</tbody>
</table>

Source: WRM (2018b).

The Central Final Void (Pit 1) South landform would be approximately 2 m high on average and have a crest width of at least 50 m wide (WRM, 2018c).

The Western Final Void (Pit 3) South landform would be constructed from the haul road between the Western Final Void (Pit 3) and the Drainage Line 1 diversion. The proposed Western Final Void (Pit 3) South landform would extend from the in-pit landform to the east to fill in a “topographic low spot” up to a minimum of 4 m above natural surface (WRM, 2018c).

In addition to the final landforms to protect the final voids, in pit landforms would also be raised above natural surface to prevent floodwaters from flowing over backfilled areas, where practicable. The locations associated with the Central Pit (Pit 1) and Eastern Pit (Pit 2) backfill areas are described in Appendix B and are shown on Figure 3.3.

**Surface Water Monitoring**

An extensive surface water monitoring network has been established at the Cameby Downs Mine which includes automatic and manual surface water level (flow) and quality monitoring stations within and surrounding the mine site (Figure 3.1).

All surface water quality monitoring and associated sampling and analysis would continue to be undertaken in accordance with relevant Australian Standards.
Routine surface water quality monitoring would continue to be undertaken for receiving waters and additional locations monitored as advancing mining operations enter respective catchments. Specifically, the additional surface water monitoring required for the Project would include (Figure 3.5):

- relocation of the downstream monitoring location on Drainage Line 1 to downstream of the Drainage Line 1 Diversion;
- two additional monitoring locations installed on Drainage Line 3 (upstream and downstream);
- an additional monitoring location installed downstream of Drainage Lines 5, 6 and 7 on Punchbowl Creek (upstream of the confluence with Dogwood Creek); and
- the additional release point monitoring locations (as required).

Routine surface water quality monitoring of ‘worked’ and ‘surface’ waters would continue, with augmentation as required. Surface water quality parameters would include nutrients (Ammonia and Nitrate) as well as total and dissolved (field filtered) metals (Al, As, Cd, Cr, Cu, Fe, Pb, Hg, Ni, Zn, B, Co, Mn, Mo, Se, Ag, U and Va). The quality of ‘external’ QGC water would also continue to be monitored during its use (i.e. dust suppressant) on-site.

Further, for continued refinement and validation of the site water balance model predictions to assist with the management of surface water on-site, the program would include:

- monitoring of dust suppression usage at all fill points;
- monitoring of volume and water quality in all site storages;
- recording of the volumes of water which are pumped between storages; and
- recording of spill volumes and dates from all dams.

Monitoring of the Drainage Line 1 Diversion once commissioned would also be conducted (including geomorphic characterisation) and downstream surface waters as described above.

**Receiving Environment Monitoring Program**

A Receiving Environment Monitoring Program for the Project is provided as Attachment 3.

### 3.3 GROUNDWATER

Section 3.3.1 provides a description of the relevant groundwater environmental values, including a description of the hydrogeological systems, groundwater users and the 2018 calibrated numerical groundwater model. Section 3.3.2 describes the potential impacts of the Project on groundwater resources (including groundwater levels, quality, users and associated impacts to surface water resources) and Section 3.3.3 outlines the proposed mitigation measures, management and monitoring, including proposed groundwater trigger values.

The assessment of potential groundwater impacts is supported by the Cameby Downs Continued Operations Project Groundwater Assessment (AGE, 2018) included in Appendix C and the Cameby Downs Coal Mine Groundwater Bore Census (ENRS, 2017).

The Groundwater Assessment was peer reviewed by Mr Peter Dundon (Dundon Consulting Pty Limited, 2018). The peer review report is presented in Attachment 4.

#### 3.3.1 Environmental Values

The environmental values relevant to groundwater at the Project site have been identified with consideration of the DES Guideline Application requirements for activities with impacts to water (DES, 2018c).

The EPP Water provides a framework to protect and / or enhance the environmental values and hence suitability of Queensland waters (including groundwater) for various beneficial uses.

Groundwater resources within the Project area lie within the Condamine and Balonne water resource plan which is part of the Murray-Darling and Bulloo Basins. A subordinate document to the EPP Water which will provide the environmental values and WQO for the Murray-Darling Basin is currently under development. The Condamine and Balonne sub-basin is however not listed in Schedule 1 of the EPP Water, therefore the environmental values relevant to the Project, as outlined in Part 3, section 6(2) of the EPP Water, include:

- aquatic ecosystem;
- aquaculture and aquatic foods for human consumption;
- agricultural purposes;
- recreational purposes;
Proposed Surface Water Monitoring Locations

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drinking water;
industrial purposes; and

cultural and spiritual values.

The EPP Water provides general WQO to support and protect the various environmental values identified for waters. The WQO are long-term goals for water quality management. Each of the environmental values listed above were considered during the assessment and are discussed in the following subsections.

Draft environmental values established for the Condamine catchment have since been prepared by the Condamine Alliance (2017). These are currently in draft form for comment, with a recommendation to support their finalisation in the EPP Water and include environmental values for:

- stock watering within areas that have >75% grazing use for the Northern Alluvia sub-aquifer; and
- agriculture, aquaculture, drinking water, stock watering and industrial purposes for the Walloon Coal Measures sub-aquifer.

**Environmental Values – Aquatic Ecosystem**

There are no known springs or seeps within the Project area and no aquatic Groundwater Dependent Ecosystems (GDEs) have been identified in field studies within the Project area.

Groundwater flow within the underlying aquifers is towards the southwest becoming deeper and confined as it moves further from the Project area. Groundwater levels are generally in excess of 35 m below ground surface and separated from surface waters, limiting potential to support GDEs. There are no springs from these deep confined aquifers within the Project area or surrounds that would support aquatic GDEs.

**Environmental Values – Aquaculture and Aquatic Foods for Human Consumption**

Groundwater is not used for aquaculture within (or neighbouring) the Project area.

**Environmental Values – Agricultural Purposes**

There is no significant groundwater usage for agricultural purposes within (or neighbouring) the Project area. The primary agricultural purpose of land within and surrounding the Project area has been low intensity stock (cattle) grazing. No known irrigation bores are located within 10 km of the Project area.

Without site specific WQOs, the EPP Water refers to the livestock drinking water guidelines presented in ANZECC & ARMCANZ (2000). Comparison with the groundwater quality data collected from the site monitoring bores has identified that groundwaters are unsuitable for stock watering based on the elevated TDS levels. Time series plots of groundwater quality data are presented in the Groundwater Assessment (Appendix C).

Groundwater quality results from the site monitoring bores for dissolved metals were below the ANZECC & ARMCANZ (2000) guidelines for trace metal concentrations in livestock (beef cattle) drinking water.

This limited value for agricultural use was also reflected during a bore census conducted by ENRS on behalf of Syntech Resources in October 2017. The bore census report is included in the Groundwater Assessment (Appendix C). The census of 30 privately-owned properties surrounding the Cameby Downs Mine, across an area of more than 150 km², resulted in identification of only one stock bore in use (located approximately 6.5 km south of the Project) and monitoring bores at the Cameby Downs Mine.

**Environmental Values – Recreation**

Groundwater is not used for recreational purposes within (or neighbouring) the Project area.

**Environmental Values – Drinking Water**

Groundwater is not used for drinking water purposes within (or neighbouring) the Project area, and was confirmed during the bore census in October 2017 (ENRS, 2017).

Groundwater quality data collected from the site monitoring bores indicates that groundwater quality in the Project area is brackish to saline and not suitable for human consumption.

**Environmental Values – Industrial Purposes**

Groundwater inflows and seepage in the advancing open cut pit sumps will be pumped to mine water storages for preferential use on-site as part of the mine water balance.

The EPP Water does not specify a suite of parameters that are applicable for industrial use. Whilst ANZECC & ARMCANZ (2000) does not provide guidelines to protect industries, it indicates that industrial water quality requirements need to be considered on a case-by-case basis. Based on this approach, groundwater accessed by the Project would provide a beneficial industrial use.
QGC has developed 25 CSG wells within ML 50233, and within 10 km of the Project, a total of 332 registered CSG or petroleum wells have been drilled. Responses to CSG extraction predict that declines of more than 5 m within the next 3 years, or at any time, are expected Immediately Affected Areas (IAA) and Long Term Affected Areas (LAA) respectively. The Project is located within the Walloon Coal Measures IAA and LAA (OGIA, 2016).

As described in Section 3.2, water from the QGC Glen Eden Pond (Figure 1.3) would continue to be sourced externally (via a pipeline to the Cameby Downs Mine) to meet shortfalls for the on-site water demands for the Project.

**Environmental Values – Cultural and Spiritual Values**

There are no known environmental values in relation to cultural and spiritual values of groundwater within the Project area.

**Hydrogeological Systems**

The Project is located on the eastern flank of the northern Surat Basin, which stratigraphically overlies the Bowen Basin. The Surat Basin comprises Jurassic to Cretaceous aged sandstones, siltstones, and mudstones deposited in a predominantly fluvio-lacustrine depositional environment.

The stratigraphic units occurring within the Project area and immediate surrounds, from youngest to oldest, and corresponding hydrogeological systems include (Figure 3.6):

- **Quaternary / Tertiary (unconsolidated alluvial sediments)** – ephemeral groundwater where present.
- **Late Jurassic (Springbok Sandstone [i.e. lowermost unit of the Kumbarilla Beds])** – unsaturated in the Project area.
- **Middle Jurassic (Walloon Coal Measures)** – confined aquifer associated with coal seams between overburden/interburden aquitards.
- **Early/Middle Jurassic (Hutton Sandstone and Precipice Sandstone)** – confined aquifers at depth.

The physical and chemical properties of each of the above hydrogeological systems (where available) are described in the following sub-sections.

**Quaternary Sediments**

Exploration drilling data indicates that, where present, the Quaternary sediments across the Project area are thin and unsaturated. The Quaternary sediments comprise silty clay to sandy clay. Groundwater recharge to the Quaternary sediments occurs via direct rainfall. Where saturated, groundwater discharge is via downward leakage to the underlying hydrogeological systems.

Localised disconnected zones of saturated Quaternary alluvium may be present along Columboola Creek, approximately 1 km south-west of the Project area. Where groundwater is present in the alluvium, the flow direction is from north to south and follows topography away from the Project area.

Quaternary sediments are also associated with the Condamine River and its associated tributaries approximately 17 km south of the Project area. The Quaternary sediments in the Project area are disconnected from the Condamine River alluvium. No groundwater supply bores target the Quaternary sediments in the Project area or surrounds, this is due to the limited extent, general lack of saturation or reliable water supply in these sediments.

**Tertiary Sediments**

Tertiary sediments are present in the north-east part of the Project area (Figure 3.6) and unconformably overlie the older Jurassic units of the Surat Basin.

The Tertiary cover is generally thin in the Project area and comprises deeply weathered clayey sub-labile to quartzose sandstone, sandy claystone, laminated siltstone, and minor conglomerate.

Groundwater recharge to the Tertiary sediments also occurs via direct rainfall. Where saturated, groundwater discharge is via downward leakage to the underlying hydrogeological systems.

No groundwater supply bores target the Tertiary sediments in the Project area or surrounds, which is due to the limited extent, general lack of saturation or reliable water supply in these sediments.
**Springbok Sandstone**

The Springbok Sandstone (i.e. lowermost unit of the Kumbarilla Beds) outcrops in the north-eastern corner of the Project area and sub-crops below the Quaternary sediments elsewhere. The Springbok Sandstone gently dips and thickens to the south-west and comprises clayey lithic sub-labile to very lithic sandstone, calcareous in part, interbedded with carbonaceous mudstone and siltstone. Pre-Tertiary weathering has chemically altered the sediments resulting in silicified, kaolinised and ferruginised sandstone.

Exploration drilling indicates the Springbok Sandstone is generally unsaturated within the Project area. The Springbok Sandstone will become saturated as the unit dips below the regional water table to the south-west of the Project area.

Recharge of the Springbok Sandstone occurs via direct rainfall in outcropping areas and diffuse rainfall seepage through the thin overlying Quaternary sediments. Regional groundwater flow in the Springbok Sandstone is down dip, towards the south-west. Where saturated, discharge is via downward leakage to underlying sediments and down gradient of the Project area.

There were no known groundwater users identified within the Project area or surrounds during the bore census targeting the Springbok Sandstone.

**Walloon Coal Measures**

The Walloon Coal Measures are separated into three stratigraphic units. The uppermost unit in the Project area is the Juandah Coal Measures which contain the main economic coal seams for the Project (Figure 2.1).

The Juandah Coal Measures comprise lithic, labile sandstone interbedded with siltstone, mudstone and coal.

Coal deposition is more frequent towards the top of the unit. The Taroom Coal Measures and the Tangalooma Sandstone underlie the Juandah Coal Measures and form a thick confining aquitard between the Juandah Coal Measures and the underlying Hutton Sandstone and Precipice Sandstone.

Regionally, the overlying Springbok Sandstone is separated from the coal seams of the Walloon Coal Measures by an aquitard approximately 15 m thick (OGIA, 2016).

The main water bearing units of the Walloon Coal Measures are the coal seams which comprise approximately 10% of the total thickness of the unit (OGIA, 2016). Hydraulic conductivity within the Walloon Coal Measures is generally associated with secondary porosity through fractures, and cleats within the coal seams.

A review of 103 groundwater samples was completed for the Project. This data includes data provided by Syntech Resources and from selected exploration bores across the Project area as part of ongoing studies for the Surat Cumulative Management Area by the OGIA. The samples were collected between April 2009 and June 2017 from the five monitoring bores within the Project area and the five exploration bores selected as part of ongoing studies for the Surat Cumulative Management Area in 2017.

Groundwater in the coal seams is brackish to highly saline (median EC of 13,790 µS/cm) and, on this basis, is generally unsuitable for livestock watering. Concentrations of dissolved metals were either below the laboratory limit of reporting, or below the respective livestock watering (cattle) or drinking waters guidelines.

**Groundwater Users**

**Bore Census – October 2017**

A bore census was completed at the Cameby Downs Mine and surrounds in October 2017 by ENRS (2017).

The census of 30 privately-owned properties surrounding the Cameby Downs Mine, across an area of more than 150 km², resulted in identification (and inspection) of only one stock bore in use (RN123511). Two of the existing monitoring bores at the Cameby Downs Mine were also recorded during the bore census (Figure 3.7):

- Monitoring bore (RN168040 – CD036R); and
- Monitoring bore (RN168041 – CD018).

The other existing monitoring bores at the Cameby Downs Mine were not targeted during the bore census (as they were already known to exist).

In conclusion, the October 2017 bore census identified that there is no significant use of groundwater by landholders surrounding the Project area, with the nearest water supply bore located approximately 6.5 km south of the Project and beyond the predicted zone of groundwater drawdown from the Project (Section 3.3.2).
Landholder bores within predicted maximum zone of drawdown during mining

Groundwater Impact Assessment - Cameby Downs (G1361)

Groundwater Users and Drawdown Predictions – Walloon Coal Measures

Legend:
- ML / MLA boundary
- 10 km ML / MLA buffer
- Watercourse
- Drainage
- Maximum zone of drawdown contour (m)
- Walloon Coal Measures (Layer 2)

Registered bore:
- Westbourne Formation
- Walloon Coal Measures
- Hutton Sandstone
- Mine monitoring bore
- unknown
- CSG bore
- * Bore no longer in use

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3.7
Other groundwater users based on the registered groundwater bore database records maintained by DNRME beyond the extent of the bore census are also shown on Figure 3.7 (e.g. “Butchers Bore”, “Golden Valley Bore”).

QGC CSG Operations

Extensive CSG development has resulted in significant depressurisation of the coal seams within the Walloon Coal Measures. Groundwater pressures drop rapidly in the higher permeability coal seams but fall more slowly in the lower permeability interburden (siltstones and sandstone) and disconnected coal seams (OGIA, 2016).

Generally, the pressure impacts from CSG extraction are limited to the immediate vicinity of the active CSG extraction areas by QGC (OGIA, 2016).

Groundwater modelling by OGIA (2016) predicts that regionally, CSG extraction from the Walloon Coal Measures will result in some depressurisation in the Springbok Sandstone. However, at present this is minimal.

The OGIA (2016) groundwater model predicts there will be no impact to the Hutton Sandstone from CSG extraction.

2018 Calibrated Numerical Groundwater Model

A 3D numerical groundwater flow model was developed for the Project based on historic models developed for the approved operations at the Cameby Downs Mine. The peer review of the Groundwater Assessment (Attachment 4) concluded the model has an appropriate level of complexity, is generally in accordance with the Australian Groundwater Modelling Guidelines (Barnett et al., 2012) and the groundwater impact assessment is ‘fit-for-purpose’.

The Project 2018 calibrated numerical groundwater model is classified as between a Class 2 and Class 3 model based on classifications developed by Barnett et al., (2012) and is suitable for predicting groundwater responses to changes in applied stress or hydrological conditions, making it suitable for the evaluation and management of potential impacts (Appendix C).

The model represents the key geological units as three layers, and is aligned in a general north-easterly direction. The model extends approximately 35 km from northwest to southeast, and 23 km from northeast to southwest comprising up to 102,400 cells per layer.

Calibration

The model was calibrated and verified to existing groundwater levels, using reliable measurements from representative bores within the model domain.

The objective of the calibration was to replicate the observed groundwater levels in accordance with the modelling guidelines developed by Barnett et al., (2012) and utilise available data and information obtained from:

- the October 2017 Bore Census;
- the OGIA groundwater monitoring data collected in 2017 at the Cameby Downs Mine exploration holes;
- available QGC drilling information; and
- Syntech Resources groundwater monitoring data.

Utilising the available datasets, the 2018 transient calibration achieved an 8.9% scaled root mean square (SRMS) error, which complies with the <10% SRMS error suggested by the modelling guidelines as constituting a calibrated model.

Groundwater Inflow Predictions

The magnitude of groundwater inflow is a function of the size of the open cut pit, position of the mine relative to the depth of the coal seams and the size of the previously mined areas. Groundwater inflow is very low when mining occurs near the sub-crop area in the north / northeast of the model area. This is due to the base of workings in this area being close to the natural groundwater table, and when this area becomes partially dewatered from previous mining of adjacent strips, the local hydraulic gradients are low (Appendix C).

The predicted inflow into the open cut pits increases as the mine develops and advances in a down-dip direction. Predicted inflows to the open cut pits show some variability and inflows tend to be greatest when the open cut pit extends into areas where groundwater has not already been significantly depressurised by mining. As a result of this process, increased groundwater inflow is evident for periods in modelled Years 2042-2044, 2062-2063 and 2087-2089.

The average predicted pit inflow rate is 0.51 million litres per day (ML/day) (188 ML/year), but ranges between 0.21 ML/day and 0.97 ML/day (76 ML/year and 355 ML/year) (Appendix C).
Groundwater Drawdown Predictions

As a result of the Project, the depressurised zone in the Walloon Coal Measures is predicted to extend up to approximately 5 km towards the south-west of the Project area (Appendix C). The potential impacts associated with the modelled groundwater drawdown predictions are described in Section 3.3.2.

Groundwater Recovery

The groundwater modelling predicts the final pit voids would act as long-term groundwater sinks post mining, with pit void water levels expected to recover to a quasi-equilibrium level that is between approximately 20 m to 25 m below the pre-mining groundwater levels (Appendix C).

3.3.2 Potential Impacts

The Project does not intersect any existing alluvial aquifers or watercourses. It does however, intersect mapped drainage features within the Project area, which are ephemeral and only flow during, and shortly after heavy rainfall events. Similarly, the impacts that occur through the depressurisation of the underlying Walloon Coal Measures do not extend and impact upon any alluvial aquifer and connected streams associated with the Condamine River which is located greater than 17 km south of the Project.

Groundwater Levels

Cumulative impacts in the region of the Project extend across much of the model domain, and are solely due to impacts from CSG development, which partially overlaps with the Project area. Logically, the drawdown that is attributable to the Project is adjacent to the open cut pits, with the influence reducing with distance from the Project area.

As such, the groundwater modelling indicates the Project will only add a small to moderate ‘water take’ that is predicted to be comparatively low compared to the already approved impacts from CSG operations.

Groundwater Quality

There is limited potential for groundwater contamination to occur as a result of hydrocarbon and chemical contamination. All refuelling activities would occur in appropriately managed areas and with provision for immediate clean-up of spills.

All chemicals will be transported, handled and stored in accordance with relevant Australian Standards. These controls represent standard practice and a legislated requirement at mine sites for preventing the contamination.

Although the majority of overburden would be non-acid forming material, some carbonaceous units in the overburden may have a capacity to generate acid (SRK Consulting, 2012). Overburden will continue to be placed within the open cut pits and progressively rehabilitated during mining.

Groundwater will be drawn in from the surrounding geological units (and backfilled mine areas) towards the voids.

Evaporation from the void lake surfaces will maintain a water level below the surrounding aquifer water levels, forming a groundwater sink in the local environment. Evaporation from the lake surfaces will also slowly concentrate salts in the pit lake over time. The increasing salinity will not pose a risk to other aquifers and surface water features as the final void will remain a permanent sink.

Coal rejects will be managed to control formation and release of acid drainage (SRK Consulting, 2012). Additionally, it is anticipated that placement of coarse and fine reject materials hydraulically up-gradient of the final void will result in any seepage from the emplaced rejects reporting to the final voids. As the final voids are predicted to become sinks, any resultant seepage from the emplaced rejects will be captured and contained within the final voids.

The fine rejects within the Central Pit (Pit 1) void will reach a relative level (RL) of approximately 301 m. The void will then be infilled and rehabilitated to a final surface level of approximately 330 mAHHD. As the fine rejects level of 301 mAHHD is less than the pre-mining groundwater level of 305 mAHHD, any infiltration of water that comes into contact with the buried rejects is expected to remain within the void and is not expected to impact on the groundwater quality of the regional groundwater system (Appendix K).

As concluded by the supporting assessments, given the poor quality of the existing groundwater resource it is unlikely that groundwater could be suitable or used for agriculture, aquiculture, stock or domestic purposes post mine closure in any case.

Groundwater Users

No landholder water supply bores are located within the predicted drawdown extents attributable to the Project.
As a result of the Project, the depressurised zone in the Walloon Coal Measures extends a maximum of 5 km towards the south-west of the Project area (Figure 3.7). In contrast, cumulative drawdown impacts attributable principally (up to 100%) to CSG impacts extend across much of the model domain (towards the southeast, south and west). Only two existing registered bores on the groundwater database were identified within the predicted zone of depressurisation for the Project. These are RN168040 and RN168041, which are the Cameby Downs Mine monitoring bores CD036R and CD018 (respectively) and located within the Project area.

Groundwater Dependent Ecosystems

There are no aquatic GDEs associated with drainage features, watercourses, wetlands or springs in the Project area or surrounds based on the desktop review and site inspections by AGE (2013).

The Project is unlikely to adversely impact any aquatic or terrestrial GDEs since there are no aquatic GDEs and terrestrial GDEs are unlikely to occur either within, or surrounding, the Project area (Section 3.5.3).

There is a potential for thin, discontinuous and temporal alluvial aquifers to occur (which may be used by localised areas of terrestrial vegetation), however these would consist of a perched groundwater system hydraulically separated from the underlying Walloon Coal Measures by the very low permeability, approximately 15 m thick aquitard overburden that separates the Springbok Sandstone and the upper Walloon Coal Measures (AGE, 2018).

Therefore, it is assessed that there will be no impact from mining on localised shallow alluvial or perched aquifers or any GDEs that may be associated with these groundwater systems.

Stygofauna

The presence of stygofauna in groundwater within the Project area was assessed by Ecowise Environmental (2012). A total of seven monitoring bores were sampled and no evidence of stygofauna was found. The high EC of groundwater in the area suggests there is unlikely to be stygofauna communities in the Project area.

3.3.3 Mitigation Measures, Management and Monitoring

Groundwater Monitoring and Trigger Values

A groundwater monitoring network has been established at the Cameby Downs Mine, which includes groundwater level and quality monitoring stations within and surrounding the mine site, in accordance with EA (EPML00900113). Based on the Project mine plan, all existing monitoring bores would eventually be mined through (i.e. are located within the pit extent). Installation of additional bores (MB1 to MB5) are therefore proposed outside of the current mine area to target groundwater associated with the deepest coal seams proposed to be mined in the area (Figure 3.8).

These bores would be supplemented by additional groundwater monitoring locations adjacent the final voids (MB6, MB7 and MB9) as well as the out-of-pit and in-pit reject emplacement areas (MB8A/MB8B, MB10A/B, MB11A/B and MB12A/B) (Figure 3.8). Details of the proposed groundwater monitoring network and objectives (e.g. to allow for continuation of groundwater monitoring after the existing bores are mined through) are provided in Appendix C.

The peer review of the Groundwater Assessment (Attachment 4) concluded the groundwater monitoring strategy/program is appropriate, particularly as there are no landholder water supply bores located within the predicted drawdown extents by the Project alone and recognising the existing poorer groundwater quality (i.e. brackish to highly saline).

The new monitoring bores would be installed within twelve months of the EA amendment being approved to ensure the baseline data is collected prior to mine operations commencing in the areas, unless otherwise agreed with the DES.

All groundwater monitoring, water level measurements and sample collection, storage and transportation would be undertaken in accordance with the procedures outlined by the Murray Darling Basin Commission (1997) and DES (2018c).

Groundwater Levels

Groundwater level monitoring would continue to be undertaken at an appropriate frequency (e.g. monthly to quarterly) to establish baseline datasets for groundwater levels in each monitoring bore, and will be extended to the additional bores proposed upon installation.
Water level loggers would also be installed in select monitoring bores to record groundwater level measurements at regular intervals (e.g. 6 hourly).

The frequent intervals would enable continuous measurement of groundwater level fluctuations to determine to what extent these are attributable to rainfall recharge, CSG pumping or from potential water level declines from depressurisation resulting from open cut mining.

**Groundwater Triggers – Levels**

The aim of trigger levels is to provide advanced warning of water level (and quality) trends that may be departing from historical or predicted values. Groundwater trigger values will continue to be developed and refined as required during the course of operations.

As described above, all existing monitoring bores would eventually be mined through (i.e. are located within the pit extent).

Notwithstanding, initial groundwater level change trigger thresholds for five (5) monitoring bores, outside of normal seasonal fluctuations, have been developed for the Project and are summarised in Table 3.8.

**Table 3.8**

<table>
<thead>
<tr>
<th>Monitoring Location</th>
<th>Groundwater Level Trigger Threshold (Drawdown from Baseline)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD034C</td>
<td>5 m (total)</td>
</tr>
<tr>
<td>CD036R</td>
<td>32 m (total)</td>
</tr>
<tr>
<td>CD037C</td>
<td>18 m (total)</td>
</tr>
<tr>
<td>CD056</td>
<td>50 m (total)</td>
</tr>
<tr>
<td>CD065</td>
<td>6 m (total)</td>
</tr>
</tbody>
</table>


Groundwater level triggers for the proposed monitoring bores MB1 to MB12 will be determined after these bores are installed, and their locations and aquifer intersected confirmed.

When groundwater level monitoring results are compared to the groundwater level trigger thresholds the following is proposed:

- if the results do not exceed the level trigger thresholds then no further action is required; or
- if the results exceed the level thresholds, an appropriate hydrogeological investigation will be initiated.

The results of the hydrogeological investigation may, for example, initiate the development of appropriate groundwater level triggers to be developed at the additional monitoring bores proposed.

**Groundwater Quality**

Groundwater quality sampling of existing monitoring bores would continue to be undertaken to provide long-term baseline groundwater quality, and to detect any changes in groundwater quality during and post-mining.

**Groundwater Triggers – Quality**

Groundwater quality trigger values developed for the Project provide a threshold, above which some further consideration of the data should be given. The trigger values are not a pass or fail assessment, but act as a warning system initiating further investigation and response where required.

The trigger values have been assessed by analysing the water quality datasets collected between April 2009 and November 2016. This dataset identifies the water is typically saline making it unsuitable for stock watering, and supports the 2017 bore census which identified no significant use of groundwater by landholders surrounding the Project.

The ANZECC & ARMCANZ aquatic ecosystems protection toxicity triggers (ANZECC & ARMCANZ, 2000) apply to fresh and marine water environments, both of which are not representative of the saline aquifer hosted within the Walloon Coal Measures. Adopting these values as trigger levels for Cameby Downs Mine is therefore not considered appropriate, and would result in persistent and repeated exceedances for nearly all the parameters analysed.

The proposed groundwater quality trigger values for all monitoring bores at the Cameby Downs Mine are presented in Table 3.9.

Groundwater trigger values will continue to be refined as required during the course of operations, and subsequent processes to the EA Amendment (e.g. application for an associated water licence).

**Mine Groundwater Inflows**

The groundwater pit inflow monitoring program would include:

- recording of any unexpected or significantly increased groundwater inflows directly to the pits;
measurement of water pumped from the pits; sampling of water quality pumped from the pits; and monitoring of rainfall (to allow for correlation with pumping/pit inflow records).

Table 3.9
Initial Groundwater Quality Trigger Thresholds

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Trigger Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>5.7 to 7.5 (range)</td>
</tr>
<tr>
<td>EC</td>
<td>27,880 μS/cm</td>
</tr>
<tr>
<td>Sulfate</td>
<td>1,000 mg/L</td>
</tr>
<tr>
<td>Arsenic</td>
<td>0.024 mg/L</td>
</tr>
<tr>
<td>Cadmium</td>
<td>0.0009 mg/L</td>
</tr>
<tr>
<td>Chromium</td>
<td>0.016 mg/L</td>
</tr>
<tr>
<td>Copper</td>
<td>0.042 mg/L</td>
</tr>
<tr>
<td>Lead</td>
<td>0.018 mg/L</td>
</tr>
<tr>
<td>Mercury</td>
<td>0.002 mg/L</td>
</tr>
<tr>
<td>Nickel</td>
<td>0.026 mg/L</td>
</tr>
<tr>
<td>Zinc</td>
<td>0.703 mg/L</td>
</tr>
</tbody>
</table>


Monitoring of groundwater pit inflows would be undertaken routinely, particularly to identify inflow/seepage rates and quality. The frequency of this monitoring would be undertaken in consultation with a suitably qualified person, e.g. daily to weekly for up to one month following an abrupt increase in pit inflows. The frequency would then be reviewed and where appropriate adjusted accordingly.

Post-Mining Recovery

Post closure conditions were simulated for a period of 500 years to predict the void lake level recovery following cessation of mining.

Based on the modelled predictions, the final voids will gradually fill over time from direct rainfall occurring across each void and groundwater seepage before reaching an equilibrated level between approximately 20 to 25 m below the pre-mining groundwater levels. The modelling demonstrates that the voids will act as permanent sinks and therefore any overburden with the capacity to generate acid that is placed within the open cut pits will not pose a risk to other aquifers.

Annual Reporting

Annual report would include:

- records of groundwater levels and quality in the monitoring bores of the approved groundwater monitoring network; and

Water Licensing

Under the Water Act, the Project will require an associated water licence for this EA amendment application. The purpose of an associated water licence is provided in section 1250C, Division 2 of the Water Act which states:

An associated water licence authorises the taking of or interference with underground water in the area of a mining tenure if the taking or interference happens during the course of, or results from, the carrying out of an authorised activity for the tenure.

Syntech Resources will apply separately for an associated water licence for the authorised take for the Project.

3.4 TERRESTRIAL ECOLOGY

3.4.1 Background

Regional and Local Setting

The Project area is located in the Barakula subregion of the Brigalow Belt Bioregion. This bioregion extends from Townsville in Queensland to the south of Dubbo in central-western New South Wales. There are no Bioregional (vegetated) corridors within the Project area, however Barakula State Forest, located approximately 12 km to the north of the Project area, is associated with a Bioregional (vegetated) corridor (DEHP, 2015b) (Appendix D). There is also another Bioregional (vegetated) corridor to the east of the Project area (DEHP, 2015b) (Appendix D).
In a local context, the Project area is situated predominantly in the catchment area of Drainage Line 1. The low-lying portions of the Project area are extensively cleared for grazing livestock with patches of remnant and regrowth woodland vegetation. The elevated portions of the Project area are vegetated with woodland (Appendix D).

Background Terrestrial Ecology Studies

The terrestrial flora and fauna in the Project area and surrounds has been subject to multiple studies since 2004. The first suite of surveys were undertaken by Biodiversity Assessment and Management Pty Ltd (BAAM) within the ML 50233 in April and May 2004 and January, October and November 2005 (BAAM, 2006). These surveys were complimented with surveys undertaken by AustralAsian Resource Consultants Pty Ltd (AARC) in February, April, June and October 2009 (AARC, 2013).

A range of standard survey methods were undertaken during both surveys, including: Elliott traps, cage traps, pitfall traps, bird surveys, active searching, nocturnal spotlighting, ultrasonic bat call detection, funnel traps and call playback (AARC, 2013; BAAM, 2006).

3.4.2 Environmental Values

Terrestrial Ecology Surveys

Ecosure Pty Ltd (Ecosure) and DPM Envirosiences undertook additional flora and fauna surveys for the Project in accordance with contemporary State and Commonwealth survey guidelines (Appendices D, E and F). Fauna surveys were undertaken in July and October 2016 and December 2017 and the flora surveys were undertaken in October 2016 and March 2017 (Appendices D, E and F).

The field survey methodologies included a range of techniques to target conservation significant flora and fauna species listed under the Nature Conservation Act, 1992 (NC Act) and EPBC Act (Appendices D, E and F).

Regional Ecosystems

Due to past and ongoing agricultural activities (e.g. clearing, grazing, logging, thinning), the Project area predominately comprises grasslands and regrowth vegetation (non-remnant) (approximately 78%, 3,270 hectares [ha]) (Figure 3.9) (Appendix D).

A total of nine individual regional ecosystems were ground-truthed within the Project Area (Table 3.10; Figure 3.9), represented by Eucalypt woodlands (mostly Ironbark woodlands) and small occurrences of acacia dominated woodlands (RE 11.4.3, RE 11.4.10 and RE 11.7.2) (Appendix D).

The most predominant regional ecosystem is RE 11.7.7 (Appendix D). A detailed description of each vegetation community is provided in Appendix D, along with datasheets and photos.

Endangered and Of Concern Regional Ecosystems

Of the nine regional ecosystems within the Project area, two have a conservation status of ‘Endangered’ and two have a conservation status of ‘Of Concern’ under the Vegetation Management Act 1999 (VM Act) (Table 3.11; Figure 3.10) (Appendices D and E).

RE 11.4.3 (Brigalow Shubby Open Forest) was ground-truthed in 2016 by Ecosure (2018a) (Appendix D) within ML 50233 as a narrow stand (50 to 80 m wide and 23.5 ha in area) along Ryall’s Road (Figure 3.10). Although not mapped by the Department of Science, Information Technology and Innovation (DSITI) (2018a) on the Remnant Regional Ecosystem Map as remnant, this community conforms to RE 11.4.3 (Appendix D). This RE also represents the only threatened ecological community listed under the EPBC Act to have been recorded in the Project area or surrounds, namely, the Brigalow (Acacia harpophylla Dominant and Co-dominant) Threatened Ecological Community (Brigalow TEC) (Appendix D).

RE 11.4.10 (Eucalyptus woollsiana Woodland) was ground-truthed in 2017 by Ecosure (2018a) (Appendix D) as a single small patch (approximately 24 ha) (Figure 3.10) (Appendix D). This patch of RE 11.4.10 was previously mapped as regrowth (non-remnant) by DSITI (2018a), BAAM (2006) and AARC (2013) but vegetation in ML 50233 has continued to mature since stock was removed from mining areas, hence it is now remnant as per the definition in Neldner et al. (2017).

RE 11.4.10 can in other cases represent Brigalow TEC, however, Brigalow (Acacia harpophylla) occurs very sparsely in this occurrence so it does not represent Brigalow TEC (Appendix D).
<table>
<thead>
<tr>
<th>Regional Ecosystem</th>
<th>Short Description</th>
<th>BVG</th>
<th>VM Act Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE 11.3.2</td>
<td>Eucalyptus populnea woodland on alluvial plains</td>
<td>17a</td>
<td>Of Concern</td>
</tr>
<tr>
<td>RE 11.3.4</td>
<td>Eucalyptus tereticornis and/or Eucalyptus spp. woodland on alluvial plains</td>
<td>16c</td>
<td>Of Concern</td>
</tr>
<tr>
<td>RE 11.3.25</td>
<td>Eucalyptus tereticornis or E. camaldulensis woodland fringing drainage lines</td>
<td>16a</td>
<td>Least Concern</td>
</tr>
<tr>
<td>RE 11.4.3</td>
<td>Acacia harpophylla and/or Casuarina cristata shrubby open forest on Cainozoic clay plains</td>
<td>25a</td>
<td>Endangered</td>
</tr>
<tr>
<td>RE 11.4.10</td>
<td>Eucalyptus populnea or Eucalyptus woolissiana, Acacia harpophylla, Casuarina cristata open forest to woodland on margins of Cainozoic clay plains</td>
<td>25a</td>
<td>Endangered</td>
</tr>
<tr>
<td>RE 11.5.1</td>
<td>Eucalyptus crebra and/or E. populnea, Callitris glaucophylla, Angophora leiocarpa, Allocasuarina luehmannii woodland on Cainozoic sand plains and/or remnant surfaces</td>
<td>17a</td>
<td>Least Concern</td>
</tr>
<tr>
<td>RE 11.7.2</td>
<td>Acacia spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone</td>
<td>24a</td>
<td>Least Concern</td>
</tr>
<tr>
<td>RE 11.7.4</td>
<td>Eucalyptus decorticans and/or Eucalyptus spp., Corymbia spp., Acacia spp., Lysicarpus angustifolius woodland on Cainozoic lateritic duricrust</td>
<td>12a</td>
<td>Least Concern</td>
</tr>
<tr>
<td>RE 11.7.7</td>
<td>Eucalyptus fibrosa subsp. nubila +/- Corymbia spp. +/- Eucalyptus spp. woodland on Cainozoic lateritic duricrust</td>
<td>12a</td>
<td>Least Concern</td>
</tr>
</tbody>
</table>

Source: Appendix D.

* The vegetation patch is 0.4 ha in size comprising 50% RE11.3.25 and 50% RE11.3.4. As such, 0.2 ha has been assigned to each of RE11.3.25 and RE11.3.4 (Ecosure, 2018a).

A Listed as Brigalow (Acacia harpophylla Dominant and Co-dominant) Threatened Ecological Community under the EPBC Act.

BVG = Broad Vegetation Group.

<table>
<thead>
<tr>
<th>Regional Ecosystem</th>
<th>Short Description</th>
<th>BVG</th>
<th>VM Act Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE 11.4.3</td>
<td>Acacia harpophylla and/or Casuarina cristata shrubby open forest on Cainozoic clay plains (Brigalow shrubby open forest)</td>
<td>25a</td>
<td>Endangered</td>
</tr>
<tr>
<td>RE 11.4.10</td>
<td>Eucalyptus populnea or Eucalyptus woolissiana, Acacia harpophylla, Casuarina cristata open forest to woodland on margins of Cainozoic clay plains (Eucalyptus woolissiana woodland)</td>
<td>25a</td>
<td>Endangered</td>
</tr>
<tr>
<td>RE 11.3.2</td>
<td>Eucalyptus populnea woodland on alluvial plains (Poplar Box Woodland)</td>
<td>17a</td>
<td>Of Concern</td>
</tr>
<tr>
<td>RE 11.3.4</td>
<td>Eucalyptus tereticornis and/or Eucalyptus spp. woodland on alluvial plains (Red Gum Woodland)</td>
<td>16c</td>
<td>Of Concern</td>
</tr>
</tbody>
</table>

Source: Appendix D.

A Listed as Brigalow (Acacia harpophylla Dominant and Co-dominant) Threatened Ecological Community under the EPBC Act.
Endangered and Of Concern Regional Ecosystems

ML 50233
ML 50258
MLA 50259

MLA 50259

Regulated Vegetation (Data Source - Ecosure 2018)

* This RE is only present in a mixed polygon

**(i) Mining Lease Application
(ii) Existing/Approved Extent of Operations
(iii) Indicative Extent of Additional Surface Development

SYNTECH RESOURCES PTY LTD
Cameby Downs Continued Operations Project

Reference:

- **11.3.1**
- **11.3.2**
- **11.3.4**
- **11.4.3**
- **11.4.10**

"Endangered and Of Concern Regional Ecosystems" section

"Regulated Vegetation" section

"SYNTECH RESOURCES PTY LTD Cameby Downs Continued Operations Project" section
Conservation Significant Flora Species

No conservation significant flora species listed under the NC Act or EPBC Act were recorded in the Project area (Appendix D). One conservation significant flora species listed under the NC Act was identified outside of the Project area, namely a woody herb *Rutidosis lanata* which is listed as ‘Near Threatened’ (Appendix D). This plant was found in RE 11.5.1 (an Ironbark [*Eucalyptus crebra*] Woodland) (Appendix D).

Groundwater Dependent Ecosystems – Terrestrial Vegetation

Desktop mapping of potential GDEs through-out Queensland (DSITI, 2018b and Bureau of Meteorology [BoM], 2018) indicates that areas of terrestrial vegetation and aquatic ecosystems in the Project area and surrounds may be GDEs. Specifically, the desktop GDE mapping (DSITI, 2018b; BoM, 2018) indicates (Appendix D):

- drainage features in the north of the Project area (mainly Drainage Lines 5 and 6 [and associated minor drainage features]) potentially receive surface expression of groundwater (possibly supporting an aquatic ecosystem) and are potentially associated with subsurface presence of groundwater (possibly supporting terrestrial riparian vegetation);
- a patch of terrestrial vegetation in ML 50233 (groundtruthed by Ecosure as RE 11.5.1) is potentially associated with subsurface presence of groundwater; and
- patches of terrestrial vegetation south of ML 50233 are potentially associated with the subsurface presence of groundwater.

The desktop GDE mapping (DSITI, 2018b and BoM, 2018) of the Project locality is not based on site specific work and has a moderate confidence level in regard to the potential for GDEs along the drainage features and a low confidence level in regard to the patches of terrestrial vegetation inside and south of ML 50233 (Appendix D).

Based on findings of the site survey it has been established that there are no aquatic GDEs associated with watercourses, wetlands or springs in the Project area or surrounds based on the desktop review (Appendix D).

Terrestrial Fauna Habitat

The Project area predominantly comprises grasslands and regrowth vegetation (non-remnant) (78%) (Appendix D). Most of the regrowth consists of juveniles of the dominant species which occurred prior to clearing and fast growing species such as Acacias and grasses (Appendix D).

Amongst the cleared land are scattered patches of remnant woodland habitat, much of which has been disturbed by past logging and livestock grazing. Some of these remnant woodland patches are Brigalow habitat, although the Brigalow provides limited fauna habitat as it is small, narrow and isolated (Appendix D).

Elevated areas contain the less disturbed woodland habitat (mostly RE 11.7.4) on stony soils with occasional rocky outcrops (Appendix D). Abundant fallen timber occurs in this habitat type.

All waterways in the vicinity of the Project area are ephemeral, including Drainage Lines 1 to 7. Riparian woodland habitat is mostly confined to the lower reaches of Drainage Line 1, represented mainly by RE 11.3.25 (River Red Gum Woodland) (Appendix D). The upper reaches of Drainage Line 1 have been subject to previous clearance and thinning.

No natural lacustrine waterbodies or wetlands are present in the Project area. As described in Section 3.5.2, DPM Envirosiences (2018) (Appendix F) ground-truthed lacustrine waterbodies mapped by *Queensland Wetlands Mapping* (DSITI, 2018c) as being either farm dams or mine water dams. These dams provide limited habitat for fauna.

Conservation Significant Fauna Species listed under the NC Act

BAAM (2006) recorded four threatened fauna species and one Special Least Concern species listed under the NC Act within the Project area and surrounding locality. The identified species were (Figure 3.11) (Appendix E):

- Yakka Skink (*Egernia rugosa*) - Vulnerable (EPBC Act) Vulnerable (NC Act);
- Grey Snake (*Hemiaspis damelii*) - Endangered (NC Act);
- Short-beaked Echidna (*Tachyglossus aculeatus*) - Special Least Concern (NC Act);

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4 Note: Bureau of Meteorology (2017) mapping is based on the DSITI (2018b) mapping as of June 2017.
Conservation Significant Species Records

SYNTech ResouRces Pty Ltd
Cameby Downs Continued Operations Project

3.11

REFERENCE

- Mining Lease
- Mining Lease Application
- Existing/Approved Extent of Operations
- Indicative Extent of Additional Surface Development
- Glossy Black Cockatoo
- Koala
- Grey Snake
- Yakka Skink
- Evidence of Glossy Black Cockatoo (4-Relevant Source)

Threatened Species - Relevant Source
1. Ecosure (2018)
4. BAAM (2006)
Glossy Black-cockatoo (*Calyptorhynchus lathami*) - Vulnerable (NC Act); and

Koala (*Phascolarctos cinereus*) - Vulnerable (EPBC Act), Vulnerable (NC Act).

During the recent surveys by Ecosure (2018b) (Appendix E), all of the above species were re-recorded except the Yakka Skink. DPM Envirosciences (2018) (Appendix F) also recorded the Brigalow Woodland Snail (*Adclarkia cameroni*) during targeted surveys. The above species are MSES and are further discussed below.

**Matters of State Environmental Significance**

MSES prescribed under the *Environmental Offsets Regulation 2014* are listed in Table 3.12 along with an assessment of the relevance to the Project area (Appendix D and E).

**Environmentally Sensitive Areas**

The Environmentally Sensitive Areas (ESA) mapping tool (DEHP, 2014b) does not identify any Category A or C ESAs within the Project area. However as described above, two ‘Endangered’ REs were recently groundtruthed in the Project area (i.e. RE 11.4.3 Brigalow Shubby Open Forest and RE 11.4.10 *Eucalyptus woolsliana* Woodland) (Figure 3.10) (Appendix D).

### 3.4.3 Potential Impacts

The Terrestrial Flora Assessment (Appendix D) and Terrestrial Fauna Assessment (Appendix E) provide an assessment of the potential impacts on terrestrial ecology. The assessments were prepared in consideration of the DES Information Request and DES Guideline *Application Requirements for Activities with Impacts to Land* (DES, 2018b).

Potential impacts on terrestrial ecology were considered in terms of: land clearance; GDEs; weeds and animal pests; noise, dust and artificial lighting; vehicular traffic and cumulative impacts, as described below.

#### Land Clearance

Over the 75 year life of the Project, a total of approximately 910 ha of remnant vegetation would be progressively cleared as the mine expands (Table 3.13; Figure 3.9) (Appendix D). As described in Section 4.5, the impacts would be staged over four time periods.

All of the native vegetation communities/regional ecosystems to be cleared occur more widely in the surrounding landscapes and subregions (Appendix D).

The regional ecosystems which are ‘Endangered’ or ‘Of Concern’ (i.e. RE 11.4.3, RE 11.4.10, RE 11.3.2, RE 11.3.4) or are within the defined distance of a vegetation management watercourse are MSES (Figure 3.10) (Appendix D) and further discussed below. Of note, all remnant vegetation represents ‘Protected Wildlife Habitat’ (MSES) and would therefore be offset as part of the Project (Section 4.5).

**Groundwater Dependent Ecosystems – Terrestrial Vegetation**

The Project is unlikely to adversely impact any aquatic or terrestrial GDEs since there are no aquatic GDEs and terrestrial GDEs are unlikely to occur either within, or surrounding, the Project area (Appendix D).

**Weeds and Animal Pests**

Ecosure (2018a) (Appendix D) describes that the Project area is relatively weed free with the exception of introduced pasture grasses in the paddocks.

Prickly Pear (*Opuntia stricta*), Velvety Tree Pear (*Opuntia tomentose*) and Mother-of-millions (*Bryophyllum delagoense*) which are restricted/prohibited under the *Biosecurity Act, 2014* are present (Appendix D). Syntech Resources would aim to restrict or reduce existing infestations and avoid introducing new weeds to the Project area.

A number of animal pests have been recorded in the Project area, such as the European Red Fox (*Vulpes vulpes*), Feral Cat (*Felis catus*), European Rabbit (*Oryctolagus cuniculus*), Feral Pig (*Sus scrofa*), Cane Toad (*Rhinella marina*), European Hare (*Lepus capensis*) and House Mouse (*Mus domesticus*) (Appendix E). Some of these are invasive animals under the *Biosecurity Act, 2014*.

**Noise, Dust and Artificial Lighting**

As described above, the mine would progressively expand over the 75 year life of the Project. The Project would result in an increase in noise, dust and artificial lighting on habitats inside the overall surface disturbance area and outside (where disturbance areas adjoin existing woodland habitat).
### Table 3.12
Matters of State Environmental Significance

<table>
<thead>
<tr>
<th>Matters of State Environmental Significance</th>
<th>Relevance to the Project Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulated Vegetation</td>
<td></td>
</tr>
<tr>
<td>'Endangered' or 'of concern' regional ecosystems&lt;sup&gt;a&lt;/sup&gt;, RE 11.4.3</td>
<td>This Brigalow Shrubby Open Forest occurs within ML 50233 as a narrow stand (50 to 80 m wide and 23.5 ha in area) along Ryall’s Road (Figure 3.10).</td>
</tr>
<tr>
<td>'Endangered' RE 11.4.10</td>
<td>This 'Eucalyptus wooliisiana' Woodland occurs within ML 50233 as a single small patch (approximately 24 ha) (Figure 3.10).</td>
</tr>
<tr>
<td>'Of Concern' RE 11.3.2</td>
<td>This Poplar Box Woodland occurs as a single patch on a tributary of Drainage Line 6 (Figure 3.10).</td>
</tr>
<tr>
<td>'Of Concern' RE 11.3.4</td>
<td>This Red Gum Woodland occurs in combination with RE 11.3.25 (River Red Gum Woodland) along Drainage Line 2 (Figure 3.9).</td>
</tr>
<tr>
<td>Regional ecosystems within mapped vegetation management wetlands</td>
<td>The Project area does not contain any mapped vegetation management wetlands (Appendix D).</td>
</tr>
<tr>
<td>Regional ecosystems within the defined distance of a vegetation management watercourse</td>
<td>Drainage Lines 1, 2 and 6 (and some related tributaries) in the Project area are vegetation management watercourses with remnant riparian vegetation (Appendix D).</td>
</tr>
<tr>
<td>Connectivity Areas</td>
<td>Remnant vegetation in the Project area connects to remnant vegetation outside of the Project area (Appendix D) (Figure 3.10).</td>
</tr>
<tr>
<td>Wetlands and Watercourses</td>
<td>The Project area does not contain any wetlands or watercourses that are MSES (Appendix D).</td>
</tr>
<tr>
<td>Designated Precinct in a Strategic Environmental Area</td>
<td>The Project area is not in a designated precinct in a strategic environmental area (Appendix D).</td>
</tr>
<tr>
<td>Protected Wildlife Habitat&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Brigalow Woodland Snail</td>
<td>The Brigalow Woodland Snail has been recorded at three locations within the Project area, and a further 22 locations in the wider locality (Appendix F).</td>
</tr>
<tr>
<td>Yakka Skink</td>
<td>A single Yakka Skink was recorded by BAAM (2006) in 2005 (Figure 3.11). Most remnant woodland areas in the Project area represent potential habitat for the Yakka Skink (Figure 3.9).</td>
</tr>
<tr>
<td>Grey Snake</td>
<td>The Grey Snake has been recorded at a number of locations in the Project area (Figure 3.11). Potential habitat for this snake in the Project area is limited to the riparian areas and patches of Brigalow (Figure 3.10).</td>
</tr>
<tr>
<td>Glossy Black-cockatoo</td>
<td>The Glossy Black-cockatoo is relatively common in the wider locality and has been recorded in the Project area (Figure 3.11).</td>
</tr>
<tr>
<td>Short-beaked Echidna</td>
<td>The Short-beaked Echidna is relatively common in the wider locality and has been recorded in the Project area (Figure 3.11).</td>
</tr>
<tr>
<td>Koala</td>
<td>The Koala has been recorded in the more productive habitats (with primary koala food trees) associated with riparian vegetation (e.g. lower reaches of Drainage Line 1) (Figures 3.10 and 3.11).</td>
</tr>
<tr>
<td>Protected Areas</td>
<td>There are no protected areas in the Project area.</td>
</tr>
<tr>
<td>Highly Protected Zones of State Marine Parks</td>
<td>There are no State marine parks in the Project area.</td>
</tr>
<tr>
<td>Fish Habitat Areas</td>
<td>There are no areas of declared fish habitat in the Project area (Appendix F).</td>
</tr>
<tr>
<td>Waterways Providing for Fish Passage</td>
<td>Drainage Line 1 provides fish movement (Section 3.5).</td>
</tr>
<tr>
<td>Marine Plants</td>
<td>Marine plants do not occur in the Project area.</td>
</tr>
<tr>
<td>Legally Secured Offset Areas</td>
<td>No legally secured offset areas occur in the Project area.</td>
</tr>
</tbody>
</table>

Source: Appendices D, E and F.

<sup>a</sup> RE 11.4.3 equates to the Brigalow TEC listed under the EPBC Act.

<sup>b</sup> The Yakka Skink and Koala are also listed under the EPBC Act.
### Regional Ecosystems

<table>
<thead>
<tr>
<th>Regional Ecosystem</th>
<th>Short Description</th>
<th>BVG</th>
<th>VM Act Status</th>
<th>Clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE 11.3.2</td>
<td><em>Eucalyptus populnea</em> woodland on alluvial plains</td>
<td>17a</td>
<td>Of Concern</td>
<td>17.5</td>
</tr>
<tr>
<td>RE 11.3.4&lt;sup&gt;a&lt;/sup&gt;</td>
<td><em>Eucalyptus tereticornis</em> and/or <em>Eucalyptus</em> spp. woodland on alluvial plains</td>
<td>16c</td>
<td>Of Concern</td>
<td>0.2</td>
</tr>
<tr>
<td>RE 11.3.25&lt;sup&gt;a&lt;/sup&gt;</td>
<td><em>Eucalyptus tereticornis</em> or <em>E. camaldulensis</em> woodland fringing drainage lines</td>
<td>16a</td>
<td>Least Concern</td>
<td>1.7</td>
</tr>
<tr>
<td>RE 11.4.3&lt;sup&gt;b&lt;/sup&gt;</td>
<td><em>Acacia harpophylla</em> and/or <em>Casuarina cristata</em> shrub open forest on Cainozoic clay plains</td>
<td>25a</td>
<td>Endangered</td>
<td>3</td>
</tr>
<tr>
<td>RE 11.4.10</td>
<td><em>Eucalyptus populnea</em> or <em>Eucalyptus woollsiana</em>, <em>Acacia harpophylla</em>, <em>Casuarina cristata</em> open forest to woodland on margins of Cainozoic clay plains</td>
<td>25a</td>
<td>Endangered</td>
<td>17</td>
</tr>
<tr>
<td>RE 11.5.1</td>
<td><em>Eucalyptus crebra</em> and/or <em>E. populnea</em>, <em>Calittris glaucophylla</em>, <em>Angophora leioarpa</em>, <em>Allocasuarina luehmannii</em> woodland on Cainozoic sand plains and/or remnant surfaces</td>
<td>17a</td>
<td>Least Concern</td>
<td>69</td>
</tr>
<tr>
<td>RE 11.7.2</td>
<td><em>Acacia</em> spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone</td>
<td>24a</td>
<td>Least Concern</td>
<td>30.5</td>
</tr>
<tr>
<td>RE 11.7.4</td>
<td><em>Eucalyptus decorticans</em> and/or <em>Eucalyptus</em> spp., <em>Corymbia</em> spp., <em>Acacia</em> spp., <em>Lysicarpus angustifolius</em> woodland on Cainozoic lateritic duricrust</td>
<td>12a</td>
<td>Least Concern</td>
<td>200.5</td>
</tr>
<tr>
<td>RE 11.7.7</td>
<td><em>Eucalyptus fibrosa</em> subsp. <em>nubila</em> +/- <em>Corymbia</em> spp. +/- <em>Eucalyptus</em> spp. woodland on Cainozoic lateritic duricrust</td>
<td>12a</td>
<td>Least Concern</td>
<td>570</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>910</strong></td>
<td></td>
</tr>
</tbody>
</table>

Source: Appendix D.

<sup>a</sup> The vegetation patch is 0.4 ha in size comprising 50% RE11.3.25 and 50% RE11.3.4. As such, 0.2 ha has been assigned to each of RE11.3.25 and RE11.3.4 (Ecosure, 2018a).

<sup>b</sup> Listed as Brigalow (*Acacia harpophylla* Dominant and Co-dominant) Threatened Ecological Community under the EPBC Act.

<sup>c</sup> Number has been rounded.

The indirect noise impacts on the woodland habitat outside the overall surface disturbance area is likely to be temporary and any adverse impact from noise on other fauna is likely to be localised and comparatively minor compared to the main impact of habitat loss (Appendix E).

Ecosure (2018b) (Appendix E) describes that dust from the Project is unlikely to significantly degrade surrounding habitats given habitats in the locality are already subjected to dust from exposed soils in the cleared landscape. It is also likely that seasonal rainfall in the locality would help wash dust from the vegetation and/or encourage new growth.

The current mine uses lighting extensively for safety and work at night. The Project would increase the areas where artificial lighting is present, however, this is unlikely to significantly impact native fauna species (Appendix E).

### Changes to Natural Fire Regimes

A change in natural fire frequency can impact natural ecosystems. Accidental bushfires could potentially start in a variety of ways if not appropriately managed (e.g. from machinery or human error) (Appendix D).

### Matters of State Environmental Significance

Ecosure (2018a and b) and DPM Envirosiences (2018) (Appendices D, E and F) have assessed the likely significance of residual impacts of the Project on MSES. The MSES that would likely be significantly impacted by the Project are identified in Table 3.14 and shown on Figures 3.12a and 3.12b, however these impacts would be offset to reduce the impact of the Project (Section 4.5).

The locations in which RE 11.4.3 (Brigalow shrubby open forest) and RE 11.4.10 (*Eucalyptus woollsiana* open forest to woodland) were recently ground-truthed by Ecosure (2018a) (Appendix D) were originally proposed to be cleared for the Project. However, Syntech Resources re-designed the Drainage Line 1 Diversion such that the majority of RE 11.4.3 would be avoided (81%) and 6 ha of the 23 ha patch of RE 11.4.10 would be avoided. Complete avoidance of RE 11.4.3 and RE 11.4.10 would not be possible without significantly reducing the open cut pit extent and therefore the amount of recoverable coal.
It is reasonable to clear and offset RE 11.4.3 (Brigalow shrubby open forest) considering:

- a minor area (approximately 3 ha) of a small and narrow patch would be cleared;
- the patch is not mapped by DSITI (2018a) and therefore would not decrease the extent of the RE in the Barakula subregion reported by Accad et al., (2017) (approximately 5,666 ha); and
- the clearance would be offset with a greater area of similar vegetation that is conserved.

It is also reasonable to clear and offset RE 11.4.10 (Eucalyptus woollsiana open forest to woodland) considering:

- the patch has only recently matured since stock was removed from mining areas (previously mapped as regrowth by BAAM [2006] and AARC [2013];
- the patch is not mapped by DSITI [2018a]) and therefore clearance of the area does not decrease the remnant extent of the RE in the Barakula subregion reported by Accad et. al. (2017) (approximately 170 ha); and
- the clearance would be offset with a greater area of similar vegetation that is conserved.

RE 11.3.2 (Poplar Box Woodland) in the Project area cannot be avoided, however the area to be cleared (approximately 17.5 ha) is relatively minor compared to the wider occurrence of regional ecosystem in the Barakula subregion reported by Accad et. al. (2017) (approximately 10,500 ha). RE 11.3.4 (Red Gum Woodland) has been mostly avoided except for 0.2 ha which occurs as part of a mix patch with RE 11.3.25 listed as ‘Least Concern’ (Figure 3.12a).

It is reasonable to clear and offset the clearance of habitat for the Yakka Skink, Grey Snake and Koala because potential habitat for all of these species is more abundant in the wider locality.

---

### Table 3.14

Residual Significant Impacts on Matters of State Environmental Significance

<table>
<thead>
<tr>
<th>Matters of State Environmental Significance</th>
<th>Total (ha)</th>
<th>DEHP (2014c) Residual Significant Impact Test</th>
<th>Significant Impact?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulated Vegetation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘Endangered’ or ‘of concern’ regional ecosystems; or</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RE 11.4.3</td>
<td>3</td>
<td>&gt;0.5 ha</td>
<td>Yes</td>
</tr>
<tr>
<td>RE 11.4.10</td>
<td>17</td>
<td>&gt;0.5 ha</td>
<td>Yes</td>
</tr>
<tr>
<td>RE 11.3.2</td>
<td>17.5</td>
<td>&gt;0.5 ha</td>
<td>Yes</td>
</tr>
<tr>
<td>RE 11.3.4</td>
<td>0.2</td>
<td>&lt;0.5 ha</td>
<td>No</td>
</tr>
<tr>
<td>Regional ecosystems within the defined distance of a vegetation management watercourse</td>
<td>2.5</td>
<td>Within 5 m of defining bank</td>
<td>Yes</td>
</tr>
<tr>
<td>Connectivity Areas</td>
<td>910</td>
<td>Refer to footnote C</td>
<td>Yes</td>
</tr>
<tr>
<td>Protected Wildlife</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brigalow Woodland Snail</td>
<td>20</td>
<td>Project likely to result in any of the significant impact criteria outlined in DEHP (2014b)</td>
<td>No</td>
</tr>
<tr>
<td>Yakka Skink</td>
<td>899.4</td>
<td>Project likely to result in any of the significant impact criteria outlined in DEHP (2014b)</td>
<td>Yes</td>
</tr>
<tr>
<td>Grey Snake</td>
<td>72</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Glossy Black-cockatoo</td>
<td>734</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Short-beaked Echidna</td>
<td>2,499.5</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Koala</td>
<td>899.5</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Waterways Providing for Fish Passage</td>
<td>0</td>
<td>Project likely to result in any of the significant impact criteria outlined in DEHP (2014b)</td>
<td>No</td>
</tr>
</tbody>
</table>

Source: Appendices D and E.

A RE 11.4.3 equates to the Brigalow TEC listed under the EPBC Act.

B The Yakka Skink and Koala are also listed under the EPBC Act.

* The REs and species habitats overlap (i.e. the REs and habitats are not mutually exclusive).

C Application of the DEHP (2016b) Landscape Fragmentation and Connectivity Tool showed that impacts of the Project on landscape connectivity would be significant.
Matters of National Environmental Significance

Syntech Resources will lodge a referral under the EPBC Act that will describe the impacts relevant to the action.

Environmentally Sensitive Areas

As described above, RE 11.4.3 Brigalow Shrubby Open Forest and RE 11.4.10 *Eucalyptus woolliana* Woodland are equivalent to Category B ESAs (Figure 3.12a). The clearance of these Endangered’ REs would therefore be offset as part of the Project (Section 4.5).

Cumulative Impacts

The native vegetation communities/regional ecosystems to be cleared during the life of the Project occur in surrounding landscapes and subregions (Accad *et al.*, 2017). There is approximately 729,600 ha of remnant vegetation in the Barakula subregion reported by Accad *et al.*, (2017). The proposed clearance equates to 0.00003% of all remnant vegetation within 50 km of the Project area (Appendix D).

3.4.4 Mitigation Measures and Management

Refinement of the Mine Design to Avoid Land Clearance

Syntech Resources has made refinements to the Project layout/design to minimise impacts to RE 11.3.1 (Brigalow woodland), RE 11.4.3 (Brigalow Shrubby Open Forest) and RE 11.4.10 (*Eucalyptus woolliana* open forest to woodland) (listed as ‘Endangered’ under the VM Act and also Category B ESAs) (Appendix D).

These refinements included a re-alignment of the Drainage Line 1 Diversion to completely avoid RE 11.3.1 and minimise clearance of RE 11.4.3 and RE 11.4.10 which were to be disturbed by the original Project design (Appendix D). Indirect impacts on these regional ecosystems would be mitigated through controlling dust, erosion and sediment.

RE 11.3.4 (Red Gum Woodland) (listed as ‘Of Concern’ under the VM Act) has been mostly avoided except for 0.2 ha which occurs as part of a mix patch with RE 11.3.25 listed as ‘Least Concern’ (Figure 3.12a) (Appendix D). This is not considered to result in a significant impact to this community (Table 3.14).

Land Clearance Procedures

Existing surface disturbance procedures at the Cameby Downs Mine (Yancoal, 2016) would be implemented for vegetation clearance activities including:

- consideration of timing of land clearance;
- pre-clearance surveys;
- delineation of clearing areas (particularly in relation to RE 11.4.3 and RE 11.4.10);
- application of appropriate erosion and sediment controls; and
- clearing conducted under a permit to disturb systems.

The Project would potentially disturb animal breeding places and therefore Syntech Resources would implement a Species Management Program under section 332 of the Nature Conservation [Wildlife Management] Regulation 2006 as required (Appendix E).

Invasive Plant Prevention and Control

Syntech Resources would aim to contain existing invasive plant infestations and prevent the introduction of new invasive plant species to the Project area, in order to reduce their potential impact on native vegetation. This would include the implementation of the following (Appendix D):

- appropriate techniques for controlling weeds of concern in accordance with local management practice and / or agency guidelines, in particular for *Bryophyllum delagoense* and *Opuntia spp.*;
- monitoring of treated areas to assess the success of declared weed management;
- monitoring of revised Project area to identify any new infestations of weeds;
- information on identifying declared weeds; and
- use of wash-down facilities for earthmoving equipment entering or leaving the Project area.

Invasive Animal Prevention and Control

All bins and waste containers onsite are completely enclosed to reduce the food supply to feral animals. Syntech Resources would implement feral animal control strategies to reduce animal pest populations.
Dust Management

Management of dust is detailed in Section 3.6 and Appendix G.

Erosion and Sediment Controls

Management of erosion and sediment is detailed in Section 3.2 and Appendix A.

Bushfire Management

Syntech Resources would aim to maintain vegetation structure and composition, protect mine assets and safeguard human life through the implementation of bushfire management techniques, including (Appendix D):

- physical protection of assets through clean firebreaks;
- active fire suppression of unplanned and potentially destructive fires (to vegetation and built assets); and
- pro-active fuel and ecosystem management to sustain ecological fire regimes as much as possible.

Project Rehabilitation

Project rehabilitation is described in Section 4.

3.4.5 Environmental Offset Strategy

The environmental offset strategy is described in Section 4.5. With the impact avoidance, mitigation and offset measures proposed there would be no residual significant impacts on terrestrial ecology from the Project.

3.5 AQUATIC ECOLOGY

Background information relevant to aquatic ecosystems is provided in Section 3.5.1 and Section 3.5.2 provides a review of the aquatic ecosystems in the Project Area. Section 3.5.3 describes the potential impacts of the Project on aquatic ecology, while Section 3.5.4 outlines relevant mitigation measures, management and monitoring.

3.5.1 Background

Regional and Local Setting

The Project is in the far-upper reaches of the Balonne River drainage sub-basin, within the Balonne-Condamine drainage basin of the broader Queensland Murray-Darling Basin. The surface water drainage in the local area is shown on Figure 3.1. The majority of the landscape in the Project area drains into Drainage Line 1 to the south. The northern extent drains into Punch-Bowl Creek, and then Dogwood Creek, which passes through Miles (Appendix F).

Previous Aquatic Ecology Studies

Wet season' surveys were undertaken across the Project area by AARC over the period 19-23 January 2010 (AARC, 2013). Aquatic surveys were undertaken at five locations by AARC (2013).

3.5.2 Environmental Values

Aquatic Ecology Assessment

DPM Envirosciences (2018) (Appendix F) undertook supplementary aquatic ecology surveys for the Project in July 2016, falling within the AusRivAS 'late wet' sampling season (May to July). Survey techniques included a combination of AusRivAS protocols to establish descriptions of aquatic habitats and macroinvertebrate communities; presence/absence surveys for aquatic plants (macrophytes); assessment of aquatic habitat attributes, measurement of in-situ physico-chemical water quality, fish survey, turtle survey, and ground-truthing mapped lacustrine waterbodies. Further information on aquatic sampling sites and survey effort is presented in Appendix F.

Aquatic Habitat/Ecosystems

Riverine Habitats

All waterways in the Project area are ephemeral, with some pools expected to hold water for extended periods (Appendix F). DPM Envirosciences (2018) describes that the waterways in the Project area provide only marginal aquatic habitat (with a low aquatic habitat rating), with the exception of Drainage Line 1 (and associated pools) which provides moderate aquatic habitat.
DPM Envirosiences (2018) ground-truthed the lacustrine waterbodies mapped by Queensland Wetlands Mapping (DSITI, 2018c) in the Project area as being either farm dams or mine water dams (Figure 3.13). No wetlands occur in the Project area (Appendix F).

**Groundwater Dependent Ecosystems**

There are no aquatic GDEs associated with drainage features, watercourses, wetlands or springs in the Project area or surrounds based on the desktop review and site inspections by AGE (2013).

There is a potential for thin, discontinuous and temporal alluvial aquifers to occur (which may be used by localised areas of terrestrial vegetation), however these would consist of a perched groundwater system hydraulically separated from the underlying Walloon Coal Measures by the very low permeability, approximately 15 m thick aquitard overburden that separates the Springbok Sandstone and the upper Walloon Coal Measures (AGE, 2018).

**Conservation Significant Aquatic Species**

No conservation significant aquatic species listed under the NC Act or EPBC Act, were detected within the Project area by AARC (2013) or DPM Envirosiences (2018). DPM Envirosiences (2018) concluded that aquatic flora and fauna species listed as conservation significant under the NC Act are unlikely to occur due to a lack of preferred habitat and/or the distributional range of the species.

**Matters of State Environmental Significance**

MSES prescribed under the Environmental Offsets Regulation 2014 are listed in Table 3.12 along with an assessment of relevance to the Project area.

The only MSES relevant to aquatic ecology and the Project is ‘waterway for fish passage’ as Drainage Line 1 is recognised to provide fish movement (DAFF, 2013), primarily in the wet season when flows occur following heavy rainfall in the catchment (Appendix F).

Fish recorded in Drainage Line 1 commonly occur throughout the Balonne-Condamine drainage basin (Appendix F).

**3.5.3 Potential Impacts**

The Aquatic Ecology Assessment (Appendix F) provides an assessment of the potential impacts on aquatic ecology, including an aquatic ecological risk assessment. The assessments were prepared in consideration of the DES Information Request and DES Guideline Application Requirements for Activities with Impacts to Land (DES, 2018b).

Potential impacts on aquatic ecology were considered in terms of: aquatic habitat removal, obstruction to fish passage, surface water quality and flow impacts, drawdown and contamination of groundwater resources, and mine rehabilitation MSES, as described below.

**Aquatic Habitat Removal**

The Project would remove aquatic habitat in the Project area, comprising ephemeral drainage lines, sections of Drainage Line 1 and farm dams (Figure 3.1). None of these habitats are expected to support aquatic species of conservation significance listed under the NC Act or EPBC Act (Appendix F).

A longer diversion of Drainage Line 1 is proposed as part of the Project (Figure 1.3).

**Obstruction of Fish Passage**

Drainage line crossings have the potential to obstruct fish passage, however drainage line crossings would be designed and constructed so as not to cause an obstruction to fish passage and mitigating measures are described in Section 3.5.4.

**Surface Water Quality Impacts**

A potential impact of the Project is the sedimentation of waterways as stormwater washes loose or dispersive sediment into the creeks. The Project water management system (Section 2.8.2) would protect the environmental values by separating runoff from disturbed, rehabilitated and undisturbed catchments (Appendix F).

The existing water management system would be progressively augmented to incorporate the Project, including construction of new water management infrastructure (e.g. sediment basins, water storage dams, clean water and mine-affected water diversions) (Section 2.8.2).
"L1-L11 were identified as Constructed Dams during the aquatic ecology survey."

"Biodiversity Offset Stage"

- Stage 1
- Stage 2
- Stage 3
- Stage 4

"Ground-truthed Wetlands"

"SynTech Resources Pty Ltd"

"Cameby Downs Continued Operations Project"

"Reference"

- Mining Lease
- Mining Lease Application
- Existing/Approved Extent of Operations
- Indicative Extent of Additional Surface Development
- Lacustrine Waterbodies (DSITI, 2018)
Surface Water Flow Impacts

Surface water hydrology would be altered by the Project as a result of capturing runoff in dams, water loss due to use for Project operation or pond evaporation, and releasing water during flow events. The ephemeral nature of the waterways of the Project area is likely to remain unchanged, as no permanent or semi-permanent water releases from the site are proposed (Appendix F).

Given the low likelihood of aquatic Endangered, Vulnerable and Near Threatened species or Threatened Ecological Communities occurring in the Project area, any impact is highly unlikely to affect a threatened aquatic species or ecological community (Appendix F).

Discharge of mine-affected water would continue to be managed in accordance with the Site Water Management Plan.

Drawdown and Contamination of Groundwater Resources

The Project is unlikely to adversely impact any aquatic or terrestrial GDEs since there are no aquatic GDEs and terrestrial GDEs are unlikely to occur either within, or surrounding, the Project area (Appendix F). There is a potential for thin, discontinuous and temporal alluvial aquifers to occur (which may be used by localised areas of terrestrial vegetation), however these would consist of a perched groundwater system hydraulically separated from the underlying Walloon Coal Measures by the very low permeability, approximately 15 m thick aquitard overburden that separates the Springbok Sandstone and the upper Walloon Coal Measures (AGE, 2018).

Project Rehabilitation and Final Voids

Project rehabilitation is described in Section 4. The final voids are not expected to result in any impacts to aquatic ecology as discharges to surface waters are not anticipated.

Matters of State Environmental Significance

With implementation of measures to maintain fish passage, the Project is unlikely to impede fish passage through the Project area. There are no MSES relevant to aquatic ecology and the Project which require offset.

3.5.4 Mitigation Measures and Management

Land Clearance Procedures

Where practical, land clearance associated with waterways would occur during the dry season when the extent of wetted habitat is greatly reduced, and when waterways are expected to support the lowest diversity and abundance of aquatic species. Where possible, land disturbance within stream beds and adjacent to their bank would be minimised and stabilised as soon as practicable, prior to work equipment demobilising from the work area (Appendix F).

The Project would potentially disturb animal breeding places and therefore Syntech Resources would implement a Species Management Program under section 332 of the Nature Conservation [Wildlife Management] Regulation 2006 as required.

Extension to the Drainage Line 1 Diversion

The Drainage Line 1 diversion would be revegetated with species naturally occurring along Drainage Line 1 (Appendix F). Where possible, snags would be placed along the diversion. The establishment of the aquatic and riparian zones would be monitored (Appendix F).

Management of Fish Passage

Creek crossings would be designed and constructed so as not to cause an obstruction to fish passage (Appendix F). Waterway crossings would be constructed with consideration of the Fish passage in streams: Fisheries guidelines for design of stream crossings (Cotterell, 1998) (Appendix F).

Management of Surface Water Quality, Flow and Drawdown and Groundwater Contamination

Management of surface water and groundwater is detailed in Sections 3.2 and 3.3.

Project Rehabilitation

Project rehabilitation is described in Section 4.

3.6 AIR QUALITY

An Air Quality and Greenhouse Gas Assessment for the Project was undertaken byKatestone Environmental and is presented in Appendix G.
The environmental values for air quality are provided in Section 3.6.1. Section 3.6.2 describes the potential air quality impacts of the Project, and Section 3.6.3 outlines proposed air quality mitigation measures, management and monitoring.

Estimated greenhouse gas (GHG) contributions as a result of the Project are discussed in Section 3.6.4.

### 3.6.1 Environmental Values

The Project is located within a rural area predominantly used for low intensity cattle grazing. Rural residences (i.e., sensitive places) surround the existing Cameby Downs Mine (Figure 1.4), however Syntech Resources has implemented a near-neighbour engagement strategy (including seeking compensation or purchase agreements) to manage and/or mitigate the impacts of the mine on surrounding sensitive receivers.

The *Environmental Protection (Air) Policy, 2008* (EPP [Air]) lists the environmental values and the air quality objectives to enhance or protect the environmental values. As described in the EPP (Air), environmental values for air have been developed to protect the health and biodiversity of ecosystems, human health and wellbeing, aesthetics and agricultural use.

Consistent with the EPP (Air) and the DES *Guideline Application Requirements for Activities with Impacts to Air* (DES, 2018d), the following environmental values for air relevant to the Project have been identified:

- The qualities of the air environment that are conducive to human health and wellbeing.
- The qualities of the air environment that are conducive to protecting the health and biodiversity of ecosystems.
- The qualities of the air environment that are conducive to protecting the aesthetics of the environment, including the appearance of buildings, structures and other property.
- The qualities of the air environment that are conducive to protecting agricultural use of the environment.

### Existing Air Quality Management System

A dust monitoring network has been established at the Cameby Downs Mine (Figure 3.14). The dust monitoring network currently consists of seven dust deposition gauges and a real-time Beta Attenuation Monitor, installed to the south-west of the site in mid-March 2018.

When recorded particulate matter concentrations reach certain trigger levels, site operations are modified, as required, to reduce the potential for exceedances of the EA EPML00900113 air quality goals. Modifications to site operations include implementation of additional control measures (e.g., application of water), operating plant in a different manner, relocating equipment or temporarily shutting down equipment.

### Air Quality Objectives

The sections below identify the potential air emissions generated by the Project and the applicable air quality objectives.

#### Concentrations of Suspended Particulate Matter

Mining activities during the life of the Project have the potential to generate particulate matter (i.e., dust) emissions in the form of:

- total suspended particulate matter (TSP);
- particulate matter with an equivalent aerodynamic diameter of 10 micrometres (µm) or less (PM$_{10}$) (a subset of TSP); and
- particulate matter with an equivalent aerodynamic diameter of 2.5 µm (PM$_{2.5}$) (a subset of TSP and PM$_{10}$).

Mining activities generate particles in all of the above size categories, with the majority generally larger than 2.5 µm. Fine particulate matter (less than 2.5 µm) is typically generated through combustion processes (Appendix G).

In Queensland, air quality is managed under the EP Act, the *Environment Protection Regulation 2008* and the EPP (Air).

Table 3.15 summarises the air quality objectives in the EPP (Air) for protection of human health and wellbeing that are relevant to the Project.

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Averaging Period</th>
<th>Objective *</th>
<th>Objective **</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM$_{10}$</td>
<td>24 hours</td>
<td>50 µg/m³</td>
<td></td>
</tr>
<tr>
<td>PM$_{2.5}$</td>
<td>24 hours</td>
<td>25 µg/m³</td>
<td></td>
</tr>
<tr>
<td>TSP</td>
<td>Annual</td>
<td>90 µg/m³</td>
<td></td>
</tr>
</tbody>
</table>

* Each objective is for total impacts (i.e., including background levels).

b Five allowable exceedance days each year.
The air quality objectives typically relate to the total dust burden in the air and not just the dust generated from the Project. Background particulate matter levels therefore need to be considered when using these goals to assess potential cumulative impacts.

Dust Deposition

Although the EPP (Air) does not specify an objective for deposited matter, the DES recommends a deposited dust objective, relevant to coal dust, of 133 milligrams per square meter per day (mg/m²/day) (DEHP, 2013b).

Other Air Pollutants

Emissions of other air pollutants would also arise from mining operations associated with diesel powered equipment used on-site and on-site blasting (Appendix G). Emissions from these operations generally include carbon monoxide (CO), nitrogen dioxide (NO₂) and other pollutants, such as sulfur dioxide (SO₂) (Appendix G).

These emissions are transient and are expected to be negligible in comparison to dust emissions and have therefore not been quantified or assessed further (Appendix G).

EA EPML00900113 Criteria

The Cameby Downs Mine currently operates in accordance with EA EPML00900113. Schedule B of EA EPML00900113 includes the following criteria for air quality:

- 24 hour average PM₁₀ concentration – 150 µg/m³; and
- dust deposition – 120 mg/m²/day, averaged over a month.

As the EPP (Air) PM₁₀ 24 hour average criterion is more stringent than EA EPML00900113 criterion, the EPP (Air) criterion has been adopted in this assessment.

The EA EPML00900113 dust deposition criterion is more stringent than the DES objective; therefore the EA EPML00900113 criterion has been adopted in this assessment.

3.6.2 Potential Impacts

Assessment Methodology

Emission Inventories and Dispersion Modelling

Key activities that would generate emissions include waste rock removal, ROM coal extraction, truck haulage emissions, blasting, wind erosion from exposed areas and materials handling (Appendix G). Non-mining background dust contributions have been considered along with Project dust emissions for a comprehensive cumulative assessment (Appendix G).

Background dust deposition levels have been determined based on the Cameby Downs Mine dust monitoring network. Insufficient data was available from the newly-installed real-time monitor at the time of assessment to characterise background air quality. Background concentrations of TSP, PM₁₀ and PM₂.₅ have therefore been derived based on long-term monitoring undertaken by the DES in Toowoomba, which is considered likely to provide a conservative representation of the background dust levels at the Cameby Downs Mine.

An air quality inventory was prepared for the assessment in consideration of the anticipated mining activities. The estimated dust emissions in the emission inventory reflect the dust mitigation measures being implemented at the Cameby Downs Mine. These measures are described in Appendix G and Section 3.6.3.

Dispersion modelling was conducted in general accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (NSW Environment Protection Authority, 2016). The DES Guideline Application Requirements for Activities with Impacts to Air (DES, 2018d) identifies that the DES refers to the guidance given in the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales for air dispersion modelling. A full description of the dispersion model, emission inventories and modelling outputs is provided in Appendix G.

Modelling Scenarios

Potential air quality impacts were assessed for Years 1, 29, 42, 48 and 75 of the Project. These scenarios were selected based on the proximity of mining activities to sensitive receivers and the maximum ROM coal and overburden extraction rates (Appendix G).
**Suspended Particulate Matter**

*Predicted Maximum 24 hour Average PM$_{2.5}$ Concentrations*

All privately-owned receivers that do not have an existing agreement in place with Syntech Resources are predicted to experience cumulative maximum 24 hour average PM$_{2.5}$ concentrations below the objective of 25 µg/m$^3$ (Appendix G).

*Predicted Annual Average PM$_{2.5}$ Concentrations*

All privately-owned receivers are predicted to experience cumulative annual average PM$_{2.5}$ concentrations below the objective of 8 µg/m$^3$ (Appendix G).

*Predicted 6$^{th}$ Highest 24 hour Average PM$_{10}$ Concentrations*

All privately-owned receivers that do not have an existing agreement in place with Syntech Resources are predicted to experience cumulative 6$^{th}$ highest 24 hour average PM$_{10}$ concentrations below the objective of 50 µg/m$^3$ (Appendix G).

*Predicted Annual Average TSP Concentrations*

All privately-owned receivers are predicted to experience cumulative annual average TSP concentrations below the objective of 90 µg/m$^3$ (Appendix G).

A range of particulate matter isopleth diagrams are presented in Appendix G.

**Dust Deposition**

All privately-owned receivers that do not have an existing agreement in place with Syntech Resources are predicted to comply with the dust deposition objective (Appendix G). Dust deposition isopleths are presented in Appendix G.

3.6.3 Mitigation Measures, Management and Monitoring

Syntech Resources would continue to implement the near-neighbour engagement strategy (including seeking compensation or purchase agreements) to manage and/or mitigate the impacts of the mine on surrounding sensitive receivers.

In addition, general dust mitigation measures that would continue to be implemented for the Project include:

- watering unsealed haul roads;
- controlling drilling dust (i.e. use of a cyclone or watering);
- using water sprays on product, ROM coal and rejects stockpiles as well as conveyors and bypass crushers; and
- rehabilitating areas as they become available to reduce the overall area of exposed soil.

Syntech Resources would also continue to implement the existing air quality management system, including the use of real-time particulate matter monitoring and associated proactive/reactive mitigation measures as described in Section 3.6.1, for the Project. The air quality monitoring system would be periodically reviewed as the mine progresses, and monitors may be relocated to reflect changes to mining operations. Once operations expand to the north-west (e.g. Year 42), an additional real-time monitor would be installed near sensitive receivers to the north-west.

In addition to the above, in the event of an air quality-related complaint, air quality monitoring may be conducted at the relevant sensitive receiver (if requested by the DES) to inform the implementation of additional air quality mitigation measures, if required, where objectives are exceeded. In this instance, air quality mitigation measures would be investigated in consultation with the landholder and could include modification of Project operations or at-receiver mitigation measures.

3.6.4 Greenhouse Gases

**Emission Scopes**

The National Greenhouse Accounts (NGA) Factors document published by the DEE defines three scopes (Scope 1, 2 and 3) for different GHG emission categories. These categories are based on whether the GHG emissions generated are from “direct” or “indirect” sources.

Scope 1 GHG emissions encompass the direct sources from the Project, defined as (DEE, 2017):

... from sources within the boundary of an organisation and as a result of that organisation’s activities.
Scope 2 and 3 GHG emissions occur due to the indirect sources from the Project defined as (DEE, 2017):

... emissions generated in the wider economy as a consequence of an organisation’s activities (particularly from its demand for goods and services), but which are physically produced by the activities of another organisation.

National GHG reporting requires the quantification of Scope 1 and Scope 2 emissions only. As such, for the purpose of this assessment, emissions generated in Scopes 1 and 2 have been quantified (Appendix G). Therefore Scope 3 emissions associated with the end-use of product coal have not been considered.

**Estimating Greenhouse Gas Emissions**

Estimated quantities of material contributing to GHG emissions for the Project are presented in Appendix G.

To quantify the amount of carbon dioxide equivalent (CO₂-e) material generated from the Project, emission factors obtained from the NGA Factors (DEE, 2017) and other sources are required. They are presented in Appendix G.

**Contribution of Greenhouse Gas Emissions**

The estimated annual average Scope 1 and 2 GHG emissions for the life of the Project are 50.1 kilotonnes of carbon dioxide equivalent (kt CO₂-e). This represents a contribution of approximately 0.01% to the annual Australia GHG emissions for the year ending 30 June 2016 and approximately 0.06% of the estimated annual Queensland GHG emissions for 2015 (Appendix G).

**Management, Mitigation and Monitoring**

Syntech Resources would continue to implement measures to minimise the generation of GHG emissions including procurement policies that require the selection of energy efficient equipment and vehicles, monitoring and maintenance of mobile equipment and optimisation of diesel consumption through logistics analysis and planning.

### 3.7 NOISE AND VIBRATION

A Noise and Vibration Assessment for the Project was undertaken by Simpson Engineering Group and is presented in Appendix H.

The Noise and Vibration Assessment was peer reviewed by Mr Shane Elkin (SLR Consulting), who concluded that the report addresses the DES Information Request. The peer review report is presented in Attachment 4.

The environmental values relevant to noise and blasting are provided in Section 3.7.1. Section 3.7.2 describes the potential noise and blasting impacts of the Project, and Section 3.7.3 outlines proposed noise and blasting mitigation measures, management and monitoring.

As the Project would involve only a minor increase in road traffic (associated with a minor increase to employees), road traffic noise has not been assessed in the Noise and Vibration Assessment (Appendix H).

As the Project would not increase the maximum number of trains per day (Section 2.6), rail noise has not been assessed in the Noise and Vibration Assessment (Appendix H).

#### 3.7.1 Environmental Values

As described in Section 3.6.1, the Project is located within a rural area predominantly used for low intensity cattle grazing. Rural residences (i.e. sensitive places) surround the existing Cameby Downs Mine (Figure 1.4), however Syntech Resources has implemented a near-neighbour engagement strategy (including seeking compensation or purchase agreements) to manage and/or mitigate the impacts of the mine on surrounding sensitive receivers.

The Environmental Protection (Noise) Policy, 2008 (EPP [Noise]) lists the environmental values and the acoustic quality objectives to enhance or protect the environmental values. As described in the EPP (Noise), environmental values of the acoustic environment have been developed to protect the health and biodiversity of ecosystems, human health and wellbeing and community amenity.

Consistent with the EPP (Noise) and the DES Guideline Application Requirements for Activities with Noise Impacts (DES, 2018e), the following environmental values for the acoustic environment relevant to the Project have been identified:

- The qualities of the acoustic environment that are conducive to human health and wellbeing, including by ensuring a suitable acoustic environment for individuals to sleep, study or learn, be involved in recreation, including relaxation and conversation.
The qualities of the acoustic environment that are conducive to protecting the amenity of the community.

The qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystems.

**Existing Noise Management System**

A noise monitoring network has been established at the Cameby Downs Mine (Figure 3.14). The monitoring network comprises three real-time directional noise loggers. When recorded noise levels reach certain trigger levels, site operations are modified, as required, to reduce the potential for exceedances of the EA EPML00900113 noise goals. Modifications to site operations include operating plant in a different manner, relocating equipment or temporarily shutting down equipment.

Since its implementation, the existing real-time monitoring and management system has been effective in managing noise from the mine and compliance with the EA EPML00900113 noise goals has been maintained (Appendix H).

**Noise and Blasting Objectives**

Potential noise and blasting emissions generated by the Project and the relevant noise objectives are described below.

**Operational Noise**

The Noise and Vibration Assessment has been prepared in general accordance with the DES Guideline Application Requirements for Activities with Noise Impacts (DES, 2018e), which outlines how noise impacts at nearby sensitive receptors should be identified, quantified and evaluated (Appendix H).

For noise impact assessment, the DES Guideline Application Requirements for Activities with Noise Impacts (DES, 2018e) states the acoustic quality objectives outlined in the EPP (Noise) should be adopted.

The noise goals stated in EA EPML00900113 include more stringent daytime and evening criteria for sensitive receivers than the acoustic quality objectives outlined in the EPP (Noise). As such, the EA EPML00900113 noise goals have been adopted for assessment (Appendix H).

Table 3.16 presents the EA EPML00900113 noise goals that have been adopted for assessment.

**Table 3.16**

<table>
<thead>
<tr>
<th>Location</th>
<th>Time Period*</th>
<th>Monday to Saturday</th>
<th>Sundays and Public Holidays</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L_{Aeq,adj,1hr} (dBA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All residential</td>
<td>Day</td>
<td>45</td>
<td>40</td>
</tr>
<tr>
<td>receivers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evening</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Night</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>Commercial</td>
<td>Day</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>receivers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evening</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>Night</td>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>

Source: after EA EPML00900113.

* Day (7 am to 6 pm), Evening (6 pm to 10 pm), Night (10 pm to 7 am).

dBA A-weighted decibels.

The EPP (Noise) also provides for the control of background creep aimed at managing cumulative noise impacts from multiple noise generating activities in an area.

As there are no other significant noise generating activities in the vicinity of the Project, no significant cumulative impacts associated with the Project are expected. It is therefore considered that the background creep objectives are not relevant to the Project and they have not been considered further (Appendix H).

The assessment has also considered the Guideline Assessment of Low Frequency Noise, which provides an indoor low frequency noise guideline of 50 linear decibels (dB[Linear]). This guideline has been adjusted to an outdoor guideline of 55 dB(Linear) (Appendix H).

**Blasting**

Blasting activities at the Project would generate potential overpressure and ground vibration impacts. Overpressure (or airblast) is reported in dB(Linear) and is the measurable effect of a blast on air pressure, including generated energy that is below the level of human hearing. Ground vibration is the measurable movement of the ground surface caused by a blast and is measured in millimetres per second (mm/s).

As the DES Guideline Application Requirements for Activities with Noise Impacts (DES, 2018e) does not recommend overpressure or vibration levels and the EPP (Noise) does not include vibration levels, the EA EPML00900113 blast limits have been adopted for assessment.
Table 3.17 presents the EA EPML00900113 blast limits that have been adopted for assessment.

**Table 3.17**  
**EA EPML00900113 Blast Limits**

<table>
<thead>
<tr>
<th>Blasting Noise Limits</th>
<th>Monday to Friday 6 am to 6 pm</th>
<th>Sundays and Public Holidays</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Airblast overpressure</strong></td>
<td>115 dB(Linear) Peak for 9 out of 10 consecutive blasts initiated and not greater than 120 dB(Linear) Peak at any time.</td>
<td>No blasting will occur on Sundays or Public Holidays without notification to sensitive receivers.</td>
</tr>
<tr>
<td><strong>Ground vibration peak particle velocity</strong></td>
<td>5 mm/s peak particle velocity for 9 out of 10 consecutive blasts and not greater than 10 mm/second peak particle velocity at any time.</td>
<td>No blasting will occur on Sundays or Public Holidays without notification to sensitive receivers.</td>
</tr>
</tbody>
</table>

Source: after EA EPML00900113.

### 3.7.2 Potential Impacts

#### Operational Noise

**Noise Modelling**

An acoustic model was developed that simulates the Project using noise source information (i.e. sound power levels and locations of equipment) and predicts noise levels at relevant sensitive receivers (i.e. dwellings). The model considers the locations and heights of noise sources and receiver locations; intervening topography; barrier effects and meteorological effects (Appendix H).

Details of the analysis and the day, evening and night meteorological conditions (including adverse [i.e. temperature inversion] conditions likely to lead to elevated noise levels at receivers) are provided in Appendix H.

**Modelling Scenarios**

Potential noise impacts were assessed for the same scenarios modelled for potential air quality impacts; Years 1, 29, 42, 48 and 75 of the Project. These scenarios were selected based on the proximity of mining activities to sensitive receivers, the maximum ROM coal and overburden extraction rates and the number of operating fleet items (Appendix H).

**Noise Modelling Results**

With the implementation of general mitigation measures as described in Section 3.7.3, the Project is predicted to meet the daytime, evening and night-time noise objectives at nearby privately-owned receivers that do not have an agreement in place with Syntech Resources under neutral/calm meteorological conditions (Appendix H).

Under conservative adverse weather conditions at night, a number of privately-owned receivers that do not currently have an agreement in place with Syntech Resources are predicted to experience exceedances of the noise objectives, in the absence of proactive/reactive mitigation measures (Appendix H).

However, with the continued implementation of the existing real-time noise management system (as described in Section 3.7.1), the predicted exceedances would be avoided in practice. The Noise and Vibration Assessment demonstrated this by modelling an example mitigation scenario, consistent with current operational practices, which reduced predicted levels in Year 29 below the noise objectives (Appendix H).

Exceedances of the adopted low frequency noise objectives are predicted at some privately-owned receivers (that do not have agreements in place with Syntech Resources) in the absence of proactive/reactive noise mitigation measures. However, noise controls designed to address the night-time noise level goals presented in Table 3.16 (e.g. the continued implementation of the existing real-time noise management system and associated proactive/reactive mitigation measures) would also address compliance with the low frequency noise objectives (Appendix H).

**Blasting**

The blasting assessment in Appendix H has predicted overpressure and vibration levels at sensitive receivers based on a maximum instantaneous charge (MIC) of 1,120 kilograms (kg). Based on the adopted MIC, the blasting overpressure and vibration levels are predicted to exceed the relevant objectives at one privately-owned receiver that does not have an agreement in place with Syntech Resources.

The blast MIC would be reduced when blasting at the nearest point to this receiver in order to maintain compliance with the EA EPML00900113 blast limits.
3.7.3 Mitigation Measures, Management and Monitoring

Syntech Resources would continue to implement the near-neighbour engagement strategy (including seeking compensation or purchase agreements) to manage and/or mitigate the impacts of the mine on surrounding sensitive receivers.

In addition, Syntech Resources would continue to implement the existing noise management system for the Project, including:

- general noise mitigation measures (e.g. using a less exposed haul route at night regardless of recorded noise levels or weather conditions); and
- the use of real-time directional noise loggers and associated proactive/reactive mitigation measures as described in Section 3.7.1.

The noise monitoring system would be periodically reviewed as the mine progresses, and the noise loggers may be relocated to reflect changes to mining operations.

In the event of a noise-related complaint, noise monitoring would be conducted at the relevant sensitive receiver (if requested by the DES) to inform the implementation of additional noise mitigation measures, if required, where objectives are exceeded. In this instance, noise mitigation measures would be investigated in consultation with the landholder and could include modification of Project operations or at-receiver mitigation measures.

Blasting

Blasting associated with Project open cut operations would be managed (e.g. by reducing the MIC of blasts [Section 3.7.2]) to minimise the potential for overpressure and vibration impacts on privately-owned receivers.

Syntech Resources would monitor blast overpressure and vibration at an appropriate location representative of the closest sensitive receivers to maintain compliance with the EA EPML00900113 blasting limits.

3.8 ABORIGINAL CULTURAL HERITAGE

3.8.1 Environmental Values

An environmental value relevant to cultural heritage is listed in the DES Guideline Application requirements for activities with impacts to land) (DES, 2018b):

The cultural and spiritual values of the land.

CHMPs have been formed with the Barunggam Endorsed Parties and the Western Wakka Wakka Aboriginal Parties. The CHMPs apply to the full extent of the Project ML and MLA areas and clearly define management measures to avoid or minimise harm to Aboriginal cultural heritage.

3.8.2 Potential Impacts

Ground disturbance associated with the Project would result in disturbance of cultural heritage sites where avoidance is not practicable or reasonable.

The potential impacts on Aboriginal cultural heritage sites would be managed in accordance with the CHMPs (Section 3.8.3).

Syntech Resources has consulted with the Barunggam Endorsed Parties and the Western Wakka Wakka Aboriginal Parties regarding the Project (Section 1.4.2).

3.8.3 Mitigation Measures, Management and Monitoring

Syntech Resources would conduct Aboriginal cultural heritage surveys of the Project area with the Barunggam Endorsed Parties and the Western Wakka Wakka Aboriginal Parties.

The surveys would be conducted ahead of any disturbance in the Project area in accordance with the CHMPs.

Any Aboriginal cultural heritage sites identified during the surveys would be managed in accordance with the CHMPs. The management measures would be developed in consultation with the Barunggam and the Western Wakka Wakka Aboriginal parties.
REHABILITATION AND BIODIVERSITY OFFSET STRATEGY

4.1 REHABILITATION AT THE CAMEBY DOWNS MINE

The Plan of Operations and Rehabilitation Management Plan describe the strategy for progressing towards the rehabilitation outcomes required under EA EPML00900113.

A summary of the current rehabilitation strategy for the Cameby Downs Mine is provided below.

4.1.1 Rehabilitation Objective

Schedule H of EA EPML00900113 outlines rehabilitation requirements for the Cameby Downs Mine.

Condition H1 of EA EPML00900113 provides the overall rehabilitation objective for the Cameby Downs Mine:

All areas significantly disturbed by mining activities must be rehabilitated to a stable landform with a self-sustaining vegetation cover in accordance with the Rehabilitation Management Plan.

4.1.2 Post-Mining Land Use

The approved final land use at the Cameby Downs Mine is light intensity grazing (Syntech Resources, 2018).

Native vegetation will be incorporated to provide wildlife corridors, shelter belts for stock (from sun and wind) and visual enhancement (Syntech Resources, 2018).

4.1.3 Final Landform

The Cameby Downs Mine final landform will consist of the following:

- an out-of-pit waste rock emplacement;
- in-pit waste rock emplacements (backfilled voids);
- a final void;
- an out-of-pit coal rejects emplacement; and
- rehabilitated infrastructure areas (including water management areas).

Out-of-Pit Waste Rock Emplacement

An out-of-pit waste rock emplacement (Figure 1.2) was required during the excavation of the box cut.

The out-of-pit waste rock emplacement will be contoured to form an extension of the in-pit waste rock emplacements and drain away from the backfilled open cut, where practicable (Syntech Resources, 2018).

The outer slope of the out-of-pit waste rock emplacement will be re-contoured to a slope of approximately 1V:10H or up to 1V:3.5H where rock mulch or other stabilisation controls are used. A slope of 1V:10H has been achieved for the majority of the existing out-of-pit waste rock emplacement (Syntech Resources, 2018).

The landform will then be topsoiled (up to 0.2 m layer) and seeded with grass and shrub species (Syntech Resources, 2018).

In-Pit Waste Rock Emplacements

Waste rock is used to backfill the mine voids behind the advancing open cut operations. Waste rock will be placed either by a dozer pushing directly into the void and/or by truck emplacement.

Final landform levels and topography of the backfilled mine landforms will generally aim to approximate the pre-mining topography within the open cut areas, with some variations.

The landform will then be topsoiled (up to 0.2 m layer) and seeded with grass and shrub species (Syntech Resources, 2018).

Out-of-Pit Coal Rejects Emplacement

Fine rejects generated at the Cameby Downs Mine are disposed of in the out-of-pit coal Rejects emplacement located within the rail loop (Figure 1.2).

The outer slope of the out-of-pit coal rejects emplacement will be re-contoured to a slope of approximately 1V:10H (Syntech Resources, 2018).

Once ready for rehabilitation, the out-of-pit coal rejects emplacement surface will be covered with a 0.5 m layer of competent rock followed by a 0.5 m layer of compacted non-sodic clay creating a stable landform ready for final profiling, topsoiling (0.1 to 0.2 m layer) and revegetation (seeded with grass and shrub species) (Syntech Resources, 2018).
Final Void

A final void is approved as part of the existing Cameby Downs Mine.

The final void will be rehabilitated in accordance with outcomes outlined in Condition H5 of EA EPML00900113:

Residual void outcome

Residual voids must comply with the following outcomes;
- residual voids must not cause any serious environmental harm to land, surface waters or any recognised groundwater aquifer, other than the environmental harm constituted by the existence of the residual void itself and subject to any other condition within this environmental authority;
- residual voids must comply with the basic criteria in Table H1; and
- a certified design plan must be submitted for each void in advance of operations, that shows the maximum heights between berms and the width of berms, that are required at various levels to provide for safe operations and a final void that is stable for the foreseeable future.

Table H1 – Residual Void Design

<table>
<thead>
<tr>
<th>Void Identification</th>
<th>Void wall – competent rock max slope (deg)</th>
<th>Void wall – incompetent rock max slope (deg)</th>
<th>Void maximum surface area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Void</td>
<td>65</td>
<td>45</td>
<td>15.2 ha</td>
</tr>
</tbody>
</table>

Infrastructure Areas

Infrastructure areas will be rehabilitated in accordance with outcomes outlined in Condition H4 of EA EPML00900113:

Infrastructure

All infrastructure, constructed by or for the environmental authority holder during the mining activities including water storage structures, must be removed from the site prior to mining lease surrender, except where agreed in writing by the post mining land owner / holder and approved by the relevant state regulating authority for the environmentally relevant activity.

Cameby Downs Mine infrastructure (e.g. CHPP, buildings) will be removed and the sites ripped, re-profiled, topsoiled (up to 0.2 m layer) and seeded as required. Some infrastructure may be retained for alternate post-mining uses (subject to the agreement of the landholder and DES).

As described in Section 2.8.2, the development of the approved Cameby Downs Mine includes the diversion of Drainage Line 1 around the open cut extent within ML 50233.

4.1.4 Existing Rehabilitation Management and Monitoring

Rehabilitation management and monitoring at the Cameby Downs Mine is undertaken in accordance with the Rehabilitation Management Plan. The Rehabilitation Management Plan includes (Syntech Resources, 2018):

- final landform design criteria and land use;
- rehabilitation methods;
- rehabilitation planning and implementation;
- rehabilitation success criteria;
- risks to rehabilitation;
- rehabilitation monitoring; and
- management and reporting.

4.1.5 Rehabilitation Status

In accordance with Condition H2 of EA EPML00900113, rehabilitation at the Cameby Downs Mine must be undertaken progressively.

Rehabilitation works on approximately 220 ha have commenced at the Cameby Downs Mine. These works have focussed on the out-of-pit waste rock emplacement areas (Syntech Resources, 2017). Rehabilitation monitoring of the areas of the out-of-pit waste rock emplacement indicated that additional management measures are required to improve the rehabilitation performance. Syntech Resources is implementing these management measures.

4.2 REHABILITATION OF THE PROJECT

As a component of Project planning, Syntech Resources has reviewed the current rehabilitation objectives, rehabilitation practices proposed for the Project, and the opportunity for integration of mine rehabilitation areas with the proposed Project offset strategy.

The review has made use of Syntech Resources’ operational rehabilitation experience and considered leading guidelines and standards including:

- Mined Land Rehabilitation Policy (DES, 2018f);
- Rehabilitation requirements for mining resource activities (DEHP, 2014d);
- Application requirements for activities with impacts to land (DES, 2018b);
- Planning for Integrated Mine Closure: Toolkit (International Council on Mining and Metals, 2008);
- Strategic Framework for Mine Closure (Australian and New Zealand Minerals and Energy Council and Minerals Council of Australia, 2000); and

The objective of the Mined Land Rehabilitation Policy (DES, 2018f) is for land disturbed by mining activities to be rehabilitated to a safe and stable landform that does not cause environmental harm and is able to sustain a post-mining land use which has been approved through a ‘Progressive Rehabilitation and Closure Plan’ (PRC Plan).

Further, it states that voids situated wholly or partially in a floodplain are to be rehabilitated to a safe and stable landform that is able to sustain an approved post-mining land use that does not cause environmental harm.

It is noted that, at the time of preparation of this EVA, a PRC Plan is not a requirement of the EP Act or the Mineral Resources Act 1989. It is understood that it is proposed to be introduced as part of the Mineral and Energy Resources (Financial Provisioning) Bill 2018. This Bill is not expected to be legislated until late 2018. Similarly, key terms (e.g. ‘post-mining land use’, ‘floodplain’) used in the Mined Land Rehabilitation Policy (DES, 2018f) have not yet been defined.

Notwithstanding, Syntech Resources has developed the Project in consideration of the Mined Land Rehabilitation Policy (DES, 2018f). In particular, the Project has been designed to:

- Be rehabilitated to a safe and stable landform:
  - Waste rock emplacements have been designed with shallow slopes (approximately 1V:10H or up to 1V:3.5H where rock mulch or other stabilisation controls are used) (Section 4.2.4).
  - Final void highwalls would be treated (e.g. benched or blasted) so that they are geotechnically stable (Section 4.2.4).
- Final void highwalls would be bunded and or fenced to limit access and be located at least 10 m beyond the area potentially affected by any instability of the open cut pit edge (Section 4.2.4).
- Not cause environmental harm:
  - The final landform would isolate final voids from all flood events, up to and including a PMF event (Section 3.2.2).
  - The two final voids are located beyond the Queensland Floodplain Assessment Overlay extents (Section 3.2.2).
  - Final voids would act as long-term groundwater sinks post-mining, preventing the migration of potentially saline final void water into adjacent aquifers and surface water features (Section 3.3.2).
  - Final void water bodies would equilibrate well below the point at which they would spill to the surrounding environment (Section 3.3.1).
- Sustain post-mining land uses:
  - Mine scheduling has maximised opportunities for progressive backfilling of open cut pits to improve final land use outcomes. Significant volumes of overburden material are proposed to be hauled large distances to completely backfill the majority of the open cut pits (Sections 2.4.4 and 4.2.2).
  - The areas proposed to be disturbed by the Project would be rehabilitated to sustain light intensity grazing with areas of native vegetation. The final voids would provide habitat for native fauna (Section 4.2.3).

As described above, it is acknowledged that the Mineral and Energy Resources (Financial Provisioning) Bill 2018 proposes a requirement for the development of a PRC Plan for mining operations operating under site-specific Environmental Authorities.

The Mineral and Energy Resources (Financial Provisioning) Bill 2018 describes that the purpose of the PRC Plan is to:

- plan for how and where environmentally relevant activities will be carried out on land in a way that maximises the progressive rehabilitation of the land to a stable condition; and
- provide for the condition to which the holder must rehabilitate the land before the authority may be surrendered.
The Project rehabilitation strategy has been prepared in consideration of this purpose, however, the final legislation and, importantly, the associated guidance material, was not available during preparation of this EVA to inform the preparation of a PRC Plan. Notwithstanding, Syntech Resources will comply with the legislation upon enactment, and if required, prepare a PRC Plan for the Project.

4.2.1 Rehabilitation Objective

The rehabilitation objective at the Cameby Downs Mine (Section 4.1.1) would remain unchanged for the Project:

> All areas significantly disturbed by mining activities must be rehabilitated to a stable landform with a self-sustaining vegetation cover in accordance with the Rehabilitation Management Plan.

The rehabilitation strategy for the Project has been developed with consideration of the relevant residual risk matters in the EP Act. The Project would be rehabilitated to minimise the risk of environmental harm and to be safe, stable and non-polluting and able to support and maintain the proposed post-mining land use (Section 4.2.3).

4.2.2 Conceptual Final Landform

Figure 4.1 illustrates the conceptual final rehabilitated landform. Key features of the Project conceptual final landform include:

- eight out-of-pit waste rock emplacements;
- in-pit waste rock emplacements (backfilled voids) including in-pit disposal of coal rejects;
- two out-of-pit coal rejects emplacement;
- two final voids; and
- rehabilitated infrastructure areas (including water management areas).

Further detail on the final landform is provided in Section 4.2.4. Figures 2.2 to 2.7 show the progressive development and rehabilitation of the Project over the Project life. A schedule of progressive development and rehabilitation areas over the Project life is provided in Table 4.1.

**Conceptual Final Landform Justification**

The conceptual final landform is an outcome of the mining operations that have been developed in consideration of mine planning constraints. Mine planning is a structured process that takes into account the range of key variables that may influence a potential mining operation and its viability.

Aspects considered in the mine planning process include safety, resource recovery, geotechnical constraints, management of potential environmental impacts (e.g. noise, air quality, water and coal rejects), community issues, risks to the operation, mining methods and rates, equipment requirements, infrastructure capacity, development timeframes and economics (i.e. capital and operating costs).

**Waste Rock Emplacement and Final Voids**

As described in Section 2.4.4, open cut mining would initially continue in a southern direction inside ML 50233 before progressing to the eastern and then the western open cut pits (Figures 2.2 to 2.7).

Mining would commence generally in the north-eastern extent of each of the open cut pits as the target coal is closer to the surface compared to the southern extent as the coal measures dip to the south-west in the Project area (Section 2.1).

Waste rock would be dozer pushed into in-pit waste rock emplacements and/or loaded into haul trucks for hauling to in-pit waste rock emplacements.

### Table 4.1

<table>
<thead>
<tr>
<th>Project Year</th>
<th>Disturbed (ha)</th>
<th>Rehabilitation Commenced (ha)</th>
<th>Rehabilitation Completed (ha)</th>
<th>Undisturbed (ha)</th>
<th>Total Project Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>741</td>
<td>2761</td>
<td>0</td>
<td>4,605</td>
<td>5,622</td>
</tr>
<tr>
<td>Year 24</td>
<td>694</td>
<td>539</td>
<td>718</td>
<td>3,671</td>
<td>5,622</td>
</tr>
<tr>
<td>Year 29</td>
<td>1,300</td>
<td>766</td>
<td>718</td>
<td>2,838</td>
<td>5,622</td>
</tr>
<tr>
<td>Year 42</td>
<td>1,699</td>
<td>541</td>
<td>1,626</td>
<td>1,756</td>
<td>5,622</td>
</tr>
<tr>
<td>Year 48</td>
<td>2,103</td>
<td>133</td>
<td>2,039</td>
<td>1,347</td>
<td>5,622</td>
</tr>
<tr>
<td>Year 75</td>
<td>1,330</td>
<td>758</td>
<td>3,534</td>
<td>0</td>
<td>5,622</td>
</tr>
</tbody>
</table>

1 Rehabilitation commenced as part of the existing Cameby Downs Mine.
Waste rock would be placed in out-of-pit emplacements during the development of the box cuts for each of the open cut pits. Once sufficient space is available behind the active face (considering working room and safety requirements), waste rock material would be placed in-pit behind the active workings to minimise surface disturbance associated with out-of-pit waste rock emplacements and the size of the final voids.

Waste rock removed during the mining of the western side of the Eastern Pit (Pit 2) would be used to backfill the void on the eastern side of the Eastern Pit (Pit 2) reducing the number of final voids required for the Project (Figures 2.6 and 2.7).

Waste rock would also be placed in out-of-pit waste emplacements in selected areas around the final voids (Figure 4.1) so that the rehabilitated final landform provides flood immunity for the final voids up to the PMF (Section 2.8.2).

Disposal of coal rejects in-pit would also be undertaken where feasible to further minimise the size of the final voids (Section 2.7).

Notwithstanding the above, the nature of open cut mining results in the formation of final voids when the coal resource is fully extracted. The Project mining schedule would result in the creation of two final voids upon completion of the Project (Figure 2.7).

Syntech Resources has considered options of altering mining sequences and/or material handling to further minimise the size of the final voids, including:

- Backfilling of the Central Pit (Pit 1) void with waste rock from the Eastern Pit (Pit 2) box cut.
- Commencing mining operations in the south of the eastern and western open cut pits so that the final voids would be located in the northern extent of the open cut away from Drainage Line 1 and its tributaries.
- Re-handling of waste rock and backfilling the final voids at the end of mining.

These alternatives are discussed below.

**Backfilling Central Pit (Pit 1) Void with Waste Rock from the Eastern Pit (Pit 2) Box Cut**

Waste rock from the Eastern Pit (Pit 2) box cut could alternatively be loaded into haul trucks for hauling to the Central Pit (Pit 1) Void rather than the adjacent out-of-pit waste rock emplacements (Figure 2.4).

However, preliminary investigations by Syntech Resources suggest this would add significantly to operating costs due the significant increase in haul distance. For example, the disposal of approximately 28 million cubic metres ($\text{Mm}^3$) of waste rock from the Eastern Pit (Pit 2) box cut to the Central Pit (Pit 1) Void (Figure 2.4) would require an approximate 12 km round haul trip compared to approximately 2 km. The operating costs associated with this additional haulage would be prohibitive, and were not considered to be feasible or reasonable by Syntech Resources.

Such significant haulage distances of waste rock to the void would also require additional fleet to meet target production rates, and therefore would result in increased potential noise and air quality impacts, as well as increased water use for dust suppression.

As concluded by the supporting assessments, given the poor quality of the existing groundwater resource (and therefore limited opportunities for beneficial use) and that the final voids would act as groundwater sinks, the proposed final voids would have relatively limited environmental implications (e.g. final voids would not result in environmental harm to the surrounding environment in the long-term).

**Commencing Mining in the South**

Mining operations in the Eastern (Pit 2) and Western (Pit 3) Pits could alternatively commence in the south so that the Central and Western Final Voids would be located in the northern extent of the open cut away from Drainage Line 1 and its tributaries. Waste rock from the Eastern and Western Pit (Pit 3) box cuts could then be used to backfill the adjacent Central Void.

Syntech Resources considered the feasibility of this alternative mine sequencing and found that it would significantly impact the economic value of the Project. Mining operations would have to commence in the highest strip ratio areas of these open cut pits rather than the lowest strip ratio areas in the north resulting in the following implications for Project economic value:

- Increased operational costs associated with the larger box cuts that would be required to reach the target coal seams.
- Delayed revenue associated with the additional time required to develop the larger box cuts to reach the target coal seams.

These costs were considered by Syntech Resources to be prohibitive.
Other consequences of commencing mining in the south and associated higher strip ratios up front would require:

- Additional out-of-pit waste rock emplacement disturbance footprint considering a number of factors\(^5\) (and therefore much larger final void volumes and footprints in the north, albeit shallower).
- Additional water management infrastructure for the storage of groundwater that would need to be dewatered from the box cut and up-dip areas (as mining would commence in the deepest/highest groundwater inflow areas first).
- Additional mining fleet to meet target production rates, which would result in increased potential noise and air quality impacts.

Due to existing land constraints, the additional disturbance footprints and infrastructure would also require the purchase of additional private landholdings.

**Backfilling Final Voids at the End of Mining**

The final voids could alternatively be completely backfilled with re-handled waste rock from the out-of-pit emplacements at the end of mining. This would involve the re-excavation and loading of haul trucks with waste rock for haulage to the final voids (i.e. double handling). Approximately 114 Mm\(^3\) of waste rock would be required to backfill all two final voids.

Syntech Resources has considered this option and concluded that the cost would be significant and would delay the rehabilitation of the Project site. In addition to this cost, allowances would also be needed for final rehabilitation (i.e. topsoil spreading, water management and revegetation).

These costs were considered by Syntech Resources to be prohibitive.

As concluded by the supporting assessments, given the poor quality of the existing groundwater resource (and therefore limited opportunities for beneficial use) and that the final voids would act as groundwater sinks, the proposed final voids would have relatively limited environmental implications (e.g. final voids would not result in environmental harm to the surrounding environment in the long-term).

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\(^5\) Including overburden swell factor, in-pit geotechnical constraints and safe working room requirements.

**Out-of-Pit Coal Reject Emplacements**

Fine rejects would either continue to be pumped to the out-of-pit coal rejects emplacement within the rail loop (Rejects Dam 1), or placed in a new out-of-pit coal reject emplacement (Rejects Dam 2), placed in in-pit coal rejects emplacements (IWL cells) or placed in the Central Void.

The Central Void (once available) would contain the majority of the fine rejects produced. Until then, Rejects Dam 2 and four in-pit IWL cells would be constructed over the Project life.

Rejects Dam 2 is required as part of the rejects management strategy as the Central Void and suitable areas for in-pit IWL cells would not be available during Years 20 to 33.

Further details are provided in the Reject Management Concept Design Report (Appendix K).

**4.2.3 Post-Mining Land Use**

Syntech Resources has assessed potential post-mining land uses (e.g. agriculture) taking into account land use in the vicinity of the Project and the potential benefits of the post-mining land use to the environment, future landholders and the community.

Based on this assessment, Syntech Resources proposes the post-mining land use to continue to be light intensity grazing with areas of native vegetation. The native vegetation would be incorporated to provide wildlife corridors, shelter belts for stock (from sun and wind) and visual enhancement. The final voids would also provide habitat for native fauna.

The conceptual final land uses on the rehabilitated Project site are shown on Figure 4.2.

**4.2.4 Rehabilitation Domains and Conceptual Domain Objectives**

Conceptual broad scale rehabilitation domains for planning purposes are shown on Figure 4.3. The conceptual broad scale domains are as follows:

- out-of-pit waste rock emplacements;
- in-pit waste rock emplacements (backfilled voids);
- out-of-pit coal rejects emplacement;
- final voids; and
- infrastructure.
Key features within these broad domains and the domain objectives are described below.

The progressive refinement of these domains into sub-domains and the development of associated sub-domain objectives would be presented in the Rehabilitation Management Plan and Plan of Operations.

An indicative rehabilitation schedule for the Project domains is provided in Table 4.2.

**Out-of-pit Waste Rock Emplacements**

As described in Section 2.4.4, waste rock would be loaded into haul trucks for hauling to out-of-pit waste rock emplacements during the excavation of the box cuts consistent with current mining methods at the Cameby Downs Mine.

Once sufficient space is available behind the active face, waste rock material would be placed in-pit behind the active workings to minimise surface disturbance associated with out-of-pit waste rock emplacements.

Waste rock would also be placed in out-of-pit waste emplacements in selected areas around the final voids (Figure 4.1) so that the rehabilitated final landform provides flood immunity for the final voids up to the PMF (Section 2.8.2). The conceptual designs for the final landforms are shown on Figure 2.12.

The out-of-pit emplacements domain would be approximately 622 ha and would consist of eight sub-domains (Figure 4.3).

The final elevations of the out-of-pit waste rock emplacements associated with the box cuts would range from approximately 35 m to 45 m above natural ground level (Figure 4.1).

The out-of-pit waste rock emplacement would be contoured to form an extension of the in-pit waste rock emplacements and be free-draining away from the backfilled open cut, where practicable.

Consistent with current rehabilitation activities at the Cameby Downs Mine, the outer slope of the out-of-pit waste rock emplacement will be re-contoured to a slope of approximately 1V:10H or up to 1V:3.5H where rock mulch or other stabilisation controls are used.

The toe of the out-of-pit waste rock emplacements adjacent Drainage Line 1 would be treated with an erosion resistant material to maintain its stability in the event of 1,000-year ARI and PMF floodwater interaction (Figure 2.12).

The landform will then be topsoiled and seeded with grass and shrub species. A discussion of the native plant species for revegetation is provided in Section 4.3.4.

A quantification and characterisation of the waste rock that would be produced as part of the Project is provided in Section 2.4.4.

**In-pit Waste Rock Emplacements (Backfilled Voids)**

As described in Section 2.4.4, once sufficient space is available behind the active face, waste rock material would be placed in-pit behind the active workings to minimise surface disturbance associated with out-of-pit waste rock emplacements and the size of the final voids.

Coal rejects would also be disposed in the in-pit waste rock emplacements (Section 2.7). The in-pit coal rejects emplacements (IWL cells) containing fine rejects would be located a minimum of 10m below the final landform surface elevation to allow for sufficient depth for capping and rehabilitation, however may be located at deeper elevations within the overburden material (Appendix K).

In addition, the Central Void (once available) would contain the majority of the fine rejects produced. The fine rejects within the void would reach approximately 301 m AHD. The void would then be infilled and rehabilitated to a final surface level of approximately 330 m AHD. Rehabilitation of the void would then be undertaken consistent with other in-pit waste rock emplacements.

Additional detail on the design, operation and rehabilitation of the IWL cells is provided in the Reject Management Concept Study (Appendix K).

The in-pit emplacements domain would be approximately 3,315 ha and would consist of three sub-domains (Figure 4.3).

The final elevations of the in-pit waste rock emplacements would range from approximately 320 m AHD in the south-east to approximately 365 m AHD in the north-west (Figure 4.1).

The in-pit waste rock emplacements would be progressively rehabilitated once they are available for rehabilitation.
## Table 4.2
Rehabilitation Domain Summary

<table>
<thead>
<tr>
<th>Domain</th>
<th>Sub-domain</th>
<th>Area (ha)</th>
<th>Key Rehabilitation Activities</th>
<th>Indicative Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Commencement</td>
</tr>
<tr>
<td>1 Out-of-pit Waste Rock Emplacements</td>
<td>A</td>
<td>86</td>
<td>Re-contour slopes to a gradient of approximately 1V:10H or up to 1V:3.5H where rock mulch or other stabilisation controls are used.</td>
<td>Year 1</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>223</td>
<td>Establish water management structures (e.g. sediment dams).</td>
<td>Year 55</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>56</td>
<td>Place topsoil (up to 0.2 m) on re-contoured landform.</td>
<td>Year 55</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>65</td>
<td>Seed with grass and shrub species suitable for final land use (light intensity grazing).</td>
<td>Year 55</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>54</td>
<td>Undertake rehabilitation monitoring and maintenance (as required).</td>
<td>Year 75</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>105</td>
<td></td>
<td>Year 75</td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>16</td>
<td></td>
<td>Year 75</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>17</td>
<td></td>
<td>Year 75</td>
</tr>
<tr>
<td>3 In-pit Waste Rock Emplacements (Backfilled Voids)</td>
<td>A</td>
<td>1,081</td>
<td>Re-contour slopes to be a free-draining landform.</td>
<td>Year 1</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>874</td>
<td>Place a 2 m layer of competent rock over any in-pit coal reject emplacements.</td>
<td>Year 29</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>1,360</td>
<td>Establish water management structures (e.g. sediment dams).</td>
<td>Year 55</td>
</tr>
<tr>
<td>4 Out-of-pit Coal Reject Emplacement</td>
<td>A</td>
<td>63</td>
<td>Form outer slopes with a gradient of approximately 1V:10H.</td>
<td>Year 4</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>60</td>
<td>Place a 0.5 m layer of competent rock followed by a 0.5 m layer of compacted non-sodic clay.</td>
<td>Year 34</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Establish water management structures (e.g. sediment dams).</td>
<td>Year 55</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Place topsoil (0.1 to 0.2 m) on re-contoured landform.</td>
<td>Year 55</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Seed with grass and shrub species suitable for final land use (light intensity grazing).</td>
<td>Year 75</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Undertake rehabilitation monitoring and maintenance (as required).</td>
<td>Year 75</td>
</tr>
<tr>
<td>5 Final Voids</td>
<td>A</td>
<td>73</td>
<td>Construct a safety bund wall of competent rock and/or fencing to limit human and livestock/animal access.</td>
<td>Year 75</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>165</td>
<td>Establish water management structures (e.g. sediment dams).</td>
<td>Year 75</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Undertake rehabilitation monitoring and maintenance (as required).</td>
<td>Year 75</td>
</tr>
<tr>
<td>6 Infrastructure</td>
<td></td>
<td>1,324</td>
<td>Remove infrastructure.</td>
<td>Year 75</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Remove potential contaminants (e.g. hydrocarbons, explosives, chemicals and liquid and non-liquid wastes) and undertake land contamination investigation and remediate as required.</td>
<td>Year 75</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Rip and re-contour to be a free-draining landform and place topsoil (up to 0.2 m) on re-contoured landform.</td>
<td>Year 75</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Establish water management structures (e.g. sediment dams).</td>
<td>Year 75</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Seed with grass and shrub species suitable for final land use (light intensity grazing with areas of native vegetation).</td>
<td>Year 75</td>
</tr>
</tbody>
</table>
The landform will then be topsoiled and seeded with grass and shrub species. A discussion of the native plant species for revegetation is provided in Section 4.3.4.

The toe of the out-of-pit waste rock emplacements adjacent Drainage Line 1 would be treated with an erosion resistant material to maintain its stability in the event of a 1,000-year ARI and PMF floodwater interaction (Figure 2.12).

A quantification and characterisation of the waste rock that would be produced as part of the Project is provided in Section 2.4.4.

**Out-of-pit Coal Rejects Emplacements**

As described in Section 2.7, fine rejects would either be pumped to out-of-pit coal rejects emplacement (Rejects Dams 1 and 2), placed in in-pit coal rejects emplacements or placed in the Central Void.

The existing Rejects Dam 1 would be used during Years 1 to 3 and the new out-of-pit coal rejects emplacement (Rejects Dam 2) would be constructed for use during Years 20 to 33 (Section 2.7).

The out-of-pit coal reject emplacement domain would be approximately 60 ha and would consist of two sub-domains (Figure 4.3).

The rehabilitated outer slope of the out-of-pit coal rejects emplacement would have a slope of approximately 1V:10H consistent with the current Cameby Downs Mine rehabilitation objectives.

Once ready for rehabilitation, the out-of-pit coal rejects emplacement would be covered with a 0.5 m layer of competent rock followed by a 0.5 m layer of compacted non-sodic clay creating a stable landform ready for final profiling, topsoiling (0.1 to 0.2 m layer) and revegetation (seeded with grass and shrub species).

Additional detail on the design and rehabilitation of the out-of-pit coal reject emplacements is provided in the Reject Management Concept Study (Appendix K).

A discussion of the native plant species for revegetation is provided in Section 4.3.4.

**Final Voids**

At the completion of mining, the Project final landform would include two final voids (Figures 4.1 to 4.3).

The size of the final voids would be minimised by disposing waste rock and coal rejects in-pit. In addition, waste rock removed during the mining of the western side of the Eastern Pit (Pit 2) would be used to backfill the void on the eastern side of the Eastern Pit (Pit 2) reducing the number of final voids required for the Project (Figures 2.6 and 2.7).

The dimensions of the two final voids are provided in Table 4.3.

<table>
<thead>
<tr>
<th>Approximate Dimension</th>
<th>Final Void Sub-domain A</th>
<th>Final Void Sub-domain B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth (m)</td>
<td>70</td>
<td>87</td>
</tr>
<tr>
<td>Length (m)</td>
<td>1,460</td>
<td>3,770</td>
</tr>
<tr>
<td>Width (m)</td>
<td>540</td>
<td>495</td>
</tr>
<tr>
<td>Area(^1) (ha)</td>
<td>75</td>
<td>165</td>
</tr>
<tr>
<td>Volume (Mm(^3))</td>
<td>28</td>
<td>86</td>
</tr>
</tbody>
</table>

\(^1\) The area of the final void at the post-mining surface.

The final voids would be rehabilitated in accordance with outcomes outlined in Condition H5 of EA EPML00900113 (Section 4.1.3). Final void highwalls would be treated (e.g. benched or blasted) so that they are geotechnically stable.

The final voids are expected to provide habitat for native fauna.

A safety bund wall consisting of competent rock and/or fencing would be constructed to limit human and livestock/animal access. The bund wall would have a minimum height of 2 m, with a minimum base width of 4 m and be located at least 10 m beyond the area potentially affected by any instability of the open cut pit edge.

The final landform design plans and sections for the two final voids post-mining which provide flood immunity for the post-mining final voids are shown on Figures 2.13 and 2.14.

The conceptual designs for the final landforms (including erosion protection) are shown on Figure 2.12.

The flood modelling demonstrates that the final voids are beyond the predicted 1,000-year ARI flood and probable maximum flood event extents for the local drainages (Appendix B).
Once mining operations cease, groundwater inflows to the final voids would no longer be collected and pumped out, and as a result, the final voids would gradually begin to fill with water. Water in other on-site operational storages may also be transferred to the final voids to facilitate decommissioning and rehabilitation.

Inflows into the final voids would comprise incident rainfall, runoff within the final void catchment area and groundwater.

The catchment area of the final voids would be defined by the surrounding landform including safety bunds.

Final void water recovery analyses have been conducted as part of the Surface Water Assessment (Appendix A). The assessment is based on predicted groundwater inflows developed as part of the Groundwater Assessment (Appendix C). The final void water recovery analyses include simulations of the long-term salinity of the final void waterbodies (Appendix A).

The final void waterbodies are not predicted to spill under any of the simulated climatic sequences (Appendix A).

The salinity of the final void waterbodies is predicted to slowly increase over time (Appendix A).

**Infrastructure**

This domain is dominated by the infrastructure associated with the existing mine infrastructure area. The infrastructure domain would include, but is not limited to:

- CHPP;
- ROM coal and product stockpiles;
- train loadout and rail loop;
- workshops, stores, administration buildings, toilet complexes, vehicle wash bays, control room and coal testing laboratory, diesel fuel storage area;
- access roads and haul roads;
- electrical supply infrastructure; and
- water management features including water storages, sediment control structures, diversions and operational flood levees.

The infrastructure domain would be approximately 1,324 ha.

The majority of the infrastructure domain would be rehabilitated at the end of the Project life as the infrastructure areas would typically remain active for the Project life.

The infrastructure area would be rehabilitated in accordance with outcomes outlined in Condition H4 of EA EPML00900113:

**Infrastructure**

All infrastructure, constructed by or for the environmental authority holder during the mining activities including water storage structures, must be removed from the site prior to mining lease surrender, except where agreed in writing by the post mining land owner / holder and approved by the relevant state regulating authority for the environmentally relevant activity.

Syntech Resources would remove all infrastructure unless otherwise agreed with post-mining land holder and the DES.

Infrastructure (e.g. CHPP, buildings) would be removed and the sites ripped, re-profiled and seeded with grass and shrub species. A discussion of the native plant species for revegetation is provided in Section 4.3.4.

Hydrocarbons (petrol, diesel, oils, greases, degreasers and kerosene), explosives, chemicals and liquid and non-liquid wastes unused at the completion of mining would be returned to the supplier in accordance with relevant safety and handling procedures.

Investigations would be undertaken at mine closure and prior to rehabilitation to identify and remediate any contaminated soil materials that may exist in accordance with the requirements under Part 8 of Chapter 7 of the EP Act or equivalent statutory provision in force at the time.

**Water Management Features**

Water storages and sediment control structures would either be retained as water sources for future land uses or decommissioned and rehabilitated.

Temporary and permanent up-catchment diversion structures would be constructed over the life of the Project to divert runoff from undisturbed areas around the open cut pits and waste rock emplacements.

The proposed drainage feature diversion for Drainage Line 1 has been designed and assessed using the ACARP stream diversion design criteria (Project C8030 – Maintenance of Geomorphic Processes in Bowen Basin River Diversions).
An objective of the proposed diversion of Drainage Line 1 is to provide a self-sustaining landform at the end of the mine life so that the diversion channel functions like a natural drainage similar to the hydraulic and geomorphic characteristics of the existing Drainage Line 1 channel within the Project area.

Additional details on the conceptual design of the Drainage Line 1 diversion is provided in Appendix A.

At the completion of mining the operational flood levees in the south and south-east would be removed or be integrated with the final landforms where required to provide flood immunity up to the PMF.

### 4.2.5 Rehabilitation Goals, Objectives, Indicators and Completion Criteria

The Rehabilitation Management Plan outlines rehabilitation goals, objectives, indicators and completion criteria for the existing Cameby Downs Mine. It is proposed that these generally be adopted for the Project. The strategic Project rehabilitation goals, objectives, indicators and completion criteria for the Project are described in Table 4.4.

It is appropriate that the Project rehabilitation goals, objectives, indicators and completion criteria remain at the strategic level for this EVA. The Rehabilitation Management Plan would describe the rehabilitation performance measures and completion criteria including more detailed and quantified criteria where applicable.

#### Table 4.4

<table>
<thead>
<tr>
<th>Rehabilitation Domain</th>
<th>Rehabilitation Goal</th>
<th>Rehabilitation Objectives</th>
<th>Rehabilitation Indicators</th>
<th>Completion Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure</td>
<td>Site safe for humans and wildlife</td>
<td>Hazardous materials adequately managed.</td>
<td>Contaminated land assessment.</td>
<td>Hydrocarbon, heavy metal or other contamination levels are within relevant DES limits.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Very low probability of rock fails with serious consequences.</td>
<td></td>
<td>Site added to the Environmental Management Register if required.</td>
</tr>
<tr>
<td>Non-polluting site</td>
<td>Polluted water contained on site or treated.</td>
<td>Surface and ground water quality (e.g. sediment load, pH, heavy metal content, etc) meet EA EPML00900113 conditions.</td>
<td>Receiving water and end of pipe water quality monitoring results comply with EA EPML009000113, for a period of at least two years post-mining.</td>
<td></td>
</tr>
<tr>
<td>Stable site</td>
<td>Very low probability of subsidence or rock fails with serious consequences.</td>
<td>Slope angle, length and profile.</td>
<td>Landform recontoured to be sympathetic to the adjacent landforms.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Very low probability of slope slippage with serious consequences.</td>
<td>Erosion rates and gully formation.</td>
<td>Slopes less than 1V:10H.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Landform design achieves appropriate erosion rates.</td>
<td>Vegetation type, density and cover.</td>
<td>Limited erosion (presence of sheets, rills and gullies) similar to vegetation reference sites, for a period of five years post-mining.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adequate vegetation cover established to minimise erosion.</td>
<td></td>
<td>Site is stable when comparing photographs from successive monitoring events, for a period of five years post-mining.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Erosion maintenance requirements are comparable to designated reference sites, for a period of at least five years post-mining.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Groundcover density achieves and maintains at least 70% of vegetation reference sites at land suitability classes 3 to 4 and at least 50% at land suitability class 5.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Litter density comparable to vegetation reference sites.</td>
<td></td>
</tr>
<tr>
<td>Rehabilitation Domain (cont.)</td>
<td>Rehabilitation Goal</td>
<td>Rehabilitation Objectives</td>
<td>Rehabilitation Indicators</td>
<td>Completion Criteria</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------------</td>
<td>--------------------------</td>
<td>---------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>• Suitable site</td>
<td>• Soil properties that support and will continue to support the desired final land use.</td>
<td>• Ecosystem functionality, such as vegetation dynamics, habitat complexity and habitat quality.</td>
<td>• Stocking rates in rehabilitated pasture areas are comparable to designated reference sites.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Establish self sustaining pasture and natural vegetation areas.</td>
<td>• Landscape function, such as rate of soil loss, erosion features, soil physical parameters, organic matter and nutrient content and cycling.</td>
<td>• Vegetation consistent with pasture grass species suitable for grazing and native vegetation comparable to designated reference sites.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Establish land use with comparable management requirements to similarly used non-mining land.</td>
<td>• Rehabilitation progress and success rate.</td>
<td>• Groundcover density achieves and maintains at least 70% of vegetation reference sites at land suitability classes 3 to 4 and at least 50% at land suitability class 5.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Achievement of sustainable agreed final land use.</td>
<td>• Species in rehabilitated areas show evidence of flowering, viable seed setting, germination and emergence.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Evidence of generational succession of trees and shrubs is apparent in rehabilitated areas.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Litter density comparable to vegetation reference sites.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Salinity levels of less than 0.6 deci-Siemens per metre (dS/m) in soil root zone or less than 110% of comparable natural reference sites.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Cation exchange capacity levels are greater than 8 to 10 in soil root zone or less than 110% of comparable natural reference sites.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Evidence of weed management being successful by weed diversity being less than 110% of baseline survey results and abundance being comparable to vegetation reference sites.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Pests do not occur in substantial numbers or visibly affect the development of native plant species.</td>
</tr>
</tbody>
</table>
### Table 4.4 (Continued)
**Strategic Rehabilitation Goals, Objectives, Indicators and Completion Criteria**

<table>
<thead>
<tr>
<th>Rehabilitation Domain</th>
<th>Rehabilitation Goal</th>
<th>Rehabilitation Objectives</th>
<th>Rehabilitation Indicators</th>
<th>Completion Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Voids</td>
<td>• Site safe for humans and wildlife</td>
<td>• Very low probability of rock fails with serious consequences.</td>
<td>• Safety assessment of final voids.</td>
<td>• Safety assessment conducted.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Hazardous materials adequately managed.</td>
<td>• Slope angle, length and profile.</td>
<td>• Geotechnical stability of the final void walls has been achieved and geotechnical investigations demonstrating this have been undertaken and reported.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Polluted water contained on site or treated.</td>
<td>• Installation of safety barriers and human/wildlife exclusion fencing of final void if required following safety assessment.</td>
<td>• Access is prohibited to final voids by bund wall with a minimum height of 2 m, a minimum base width of 4 m and be located at least 10 m beyond the area potentially affected by any instability of the pit edge or a fence.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Residual water bodies have a low risk of environmental harm.</td>
<td>• Contaminated land assessment.</td>
<td>• Hydrocarbon, heavy metal or other contamination levels are within allowable departmental limits.</td>
</tr>
<tr>
<td></td>
<td>• Non-polluting site</td>
<td>• Polluted water contained on site or treated.</td>
<td>• Surface and ground water quality (e.g. sediment load, pH, heavy metal content, etc) meet EA EPML00900113 conditions.</td>
<td>• Final void walls drain internally to the final void.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Residual water bodies have a low risk of environmental harm.</td>
<td></td>
<td>• Receiving water and end of pipe water quality monitoring results comply with EA EPML00900113, for a period of at least two years post-mining.</td>
</tr>
<tr>
<td></td>
<td>• Stable site</td>
<td>• Very low probability of rock fails with serious consequences.</td>
<td>• Safety assessment of final voids.</td>
<td>• As for “safe to human and wildlife” and “non-polluting” rehabilitation goals.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Very low probability of slope slippage with serious consequences.</td>
<td>• Slope angle, length and profile.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Landform design achieves appropriate erosion rates.</td>
<td>• Erosion rates and gully formation.</td>
<td></td>
</tr>
<tr>
<td>Rehabilitation Domain</td>
<td>Rehabilitation Goal</td>
<td>Rehabilitation Objectives</td>
<td>Rehabilitation Indicators</td>
<td>Completion Criteria</td>
</tr>
<tr>
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</tr>
<tr>
<td>In-pit Waste Rock Emplacements (Backfilled Voids) and Out-of-pit Emplacements</td>
<td>Site safe for humans and wildlife</td>
<td>Hazardous materials adequately managed. Very low probability of rock fails with serious consequences.</td>
<td>Slope angle, length and profile. Contaminated land assessment.</td>
<td>Landform recontoured to be sympathetic to the adjacent landforms. Out-of-pit waste rock emplacements – approximately 1V:10H or up to 1V:3.5H where rock mulch or other stabilisation controls are used. Other slopes – less than 1V:10H. Hydrocarbon, heavy metal or other contamination levels are within relevant DES limits. Site added to the Environmental Management Register if required.</td>
</tr>
<tr>
<td></td>
<td>Polluted water contained on site or treated. Residual water bodies have a low risk of environmental harm.</td>
<td>Surface and ground water quality (e.g. sediment load, pH, heavy metal content, etc) meet EA EPML00900113 conditions.</td>
<td>Receiving water and end of pipe water quality monitoring results comply with EA EPML00900113, for a period of at least two years post-mining.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stable site</td>
<td>Very low probability of subsidence or rock fails with serious consequences. Very low probability of slope slippage with serious consequences. Landform design achieves appropriate erosion rates. Adequate vegetation cover established to minimise erosion.</td>
<td>Slope angle, length and profile. Erosion rates and gully formation. Vegetation type, density and cover.</td>
<td>Landform recontoured to be sympathetic to the adjacent landforms. Out-of-pit waste rock emplacements – approximately 1V:10H or up to 1V:3.5H where rock mulch or other stabilisation controls are used. Other slopes – less than 1V:10H. Limited erosion (presence of sheets, rills and gullies) similar to vegetation reference sites, for a period of five years post-mining. Site is stable when comparing photographs from successive monitoring events, for a period of five years post-mining. Erosion maintenance requirements are comparable to designated reference sites, for a period of at least five years post-mining. Groundcover density achieves and maintains at least 70% of vegetation reference sites at land suitability classes 3 to 4 and at least 50% at land suitability class 5. Litter density comparable to vegetation reference sites.</td>
</tr>
</tbody>
</table>
### Table 4.4 (Continued)
**Strategic Rehabilitation Goals, Objectives, Indicators and Completion Criteria**

<table>
<thead>
<tr>
<th>Rehabilitation Domain</th>
<th>Rehabilitation Goal</th>
<th>Rehabilitation Objectives</th>
<th>Rehabilitation Indicators</th>
<th>Completion Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-pit Waste Rock Emplacements (Backfilled Voids) and Out-of-pit Emplacements (cont.)</td>
<td>• Suitable site</td>
<td>• Soil properties that support and will continue to support the desired final land use.</td>
<td>• Ecosystem functionality, such as vegetation dynamics, habitat complexity and habitat quality.</td>
<td>• Stocking rates in rehabilitated pasture areas are comparable to designated reference sites.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Establish self sustaining pasture and natural vegetation areas.</td>
<td>• Landscape function, such as rate of soil loss, erosion features, soil physical parameters, organic matter and nutrient content and cycling.</td>
<td>• Vegetation consistent with pasture grass species suitable for grazing and native vegetation comparable to designated reference sites.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Establish land use with comparable management requirements to similarly used non-mining land.</td>
<td>• Rehabilitation progress and success rate.</td>
<td>• Groundcover density achieves and maintains at least 70% of vegetation reference sites at land suitability classes 3 to 4 and at least 50% at land suitability class 5.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Achievement of sustainable agreed final land use.</td>
<td>• Species in rehabilitated areas show evidence of flowering, viable seed setting, germination and emergence.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Evidence of generational succession of trees and shrubs is apparent in rehabilitated areas.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Litter density comparable to vegetation reference sites.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Salinity levels of less than 0.6 dS/m in soil root zone or less than 110% of comparable natural reference sites.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Cation exchange capacity levels are greater than 8 to 10 in soil root zone or less than 110% of comparable natural reference sites.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Evidence of weed management being successful by weed diversity being less than 110% of baseline survey results and abundance being comparable to vegetation reference sites.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Pests do not occur in substantial numbers or visibly affect the development of native plant species.</td>
</tr>
<tr>
<td>Rehabilitation Domain</td>
<td>Rehabilitation Goal</td>
<td>Rehabilitation Objectives</td>
<td>Rehabilitation Indicators</td>
<td>Completion Criteria</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>----------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Out-of-pit Coal Reject Emplacements</td>
<td>• Site safe for humans and wildlife</td>
<td>• Hazardous materials adequately managed.</td>
<td>• Slope angle, length and profile.</td>
<td>• Landform recontoured to be sympathetic to the adjacent landforms.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Very low probability of rock fails with serious consequences.</td>
<td>• Contaminated land assessment.</td>
<td>• Approximately 1V:10H or up to 1V:3.5H where rock mulch or other stabilisation controls are used.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Other slopes – less than 1V:10H.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Hydrocarbon, heavy metal or other contamination levels are within relevant DES limits.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Site added to the Environmental Management Register if required.</td>
</tr>
<tr>
<td></td>
<td>• Non-polluting site</td>
<td>• Polluted water contained on site or treated.</td>
<td>• Surface and ground water quality (e.g. sediment load, pH, heavy metal content, etc) meet EA EPML00900113 conditions.</td>
<td>• Receiving water and end of pipe water quality monitoring results comply with EA EPML00900113, for a period of at least two years post-mining.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Residual water bodies have a low risk of environmental harm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Stable site</td>
<td>• Very low probability of subsidence or rock fails with serious consequences.</td>
<td>• Slope angle, length and profile.</td>
<td>• Landform recontoured to be sympathetic to the adjacent landforms.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Very low probability of slope slippage with serious consequences.</td>
<td>• Erosion rates and gully formation.</td>
<td>• Out-of-pit waste rock emplacements – approximately 1V:10H or up to 1V:3.5H where rock mulch or other stabilisation controls are used.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Landform design achieves appropriate erosion rates.</td>
<td>• Vegetation type, density and cover.</td>
<td>• Other slopes – less than 1V:10H.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Adequate vegetation cover established to minimise erosion.</td>
<td></td>
<td>• Limited erosion (presence of sheets, rills and gullies) similar to vegetation reference sites, for a period of five years post-mining.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Site is stable when comparing photographs from successive monitoring events, for a period of five years post-mining.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Erosion maintenance requirements are comparable to designated reference sites, for a period of at least five years post-mining.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Groundcover density achieves and maintains at least 70% of vegetation reference sites at land suitability classes 3 to 4 and at least 50% at land suitability class 5.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Litter density comparable to vegetation reference sites.</td>
</tr>
</tbody>
</table>
### Table 4.4 (Continued)
Strategic Rehabilitation Goals, Objectives, Indicators and Completion Criteria

<table>
<thead>
<tr>
<th>Rehabilitation Domain</th>
<th>Rehabilitation Goal</th>
<th>Rehabilitation Objectives</th>
<th>Rehabilitation Indicators</th>
<th>Completion Criteria</th>
</tr>
</thead>
</table>
| Out-of-pit Coal Reject Emplacements (cont.) | Suitable site | - Soil properties that support and will continue to support the desired final land use.<br>- Establish self sustaining pasture and natural vegetation areas.<br>- Establish land use with comparable management requirements to similarly used non-mining land.<br>- Ecosystem functionality, such as vegetation dynamics, habitat complexity and habitat quality.<br>- Landscape function, such as rate of soil loss, erosion features, soil physical parameters, organic matter and nutrient content and cycling.<br>- Rehabilitation progress and success rat.<br>- Achievement of sustainable agreed final land use. | - Stocking rates in rehabilitated pasture areas are comparable to designated reference sites.<br>- Vegetation consistent with pasture grass species suitable for grazing and native vegetation comparable to designated reference sites.<br>- Groundcover density achieves and maintains at least 70% of vegetation reference sites at land suitability classes 3 to 4 and at least 50% at land suitability class 5.<br>- Species in rehabilitated areas show evidence of flowering, viable seed setting, germination and emergence.<br>- Evidence of generational succession of trees and shrubs is apparent in rehabilitated areas.<br>- Litter density comparable to vegetation reference sites.<br>- Salinity levels of less than 0.6 dS/m in soil root zone or less than 110% of comparable natural reference sites.<br>- Cation exchange capacity levels are greater than 8 to 10 in soil root zone or less than 110% of comparable natural reference sites.<br>- Evidence of weed management being successful by weed diversity being less than 110% of baseline survey results and abundance being comparable to vegetation reference sites.<br>- Pests do not occur in substantial numbers or visibly affect the development of native plant species. | Source: after Syntech Resources (2017).
Over the life of the Project, rehabilitation goals, objectives, indicators and completion criteria would periodically be updated and refined in consultation with relevant regulatory stakeholders to reflect evolving site rehabilitation practices and standards.

Rehabilitated lands would be considered suitable for surrender when the completion criteria have been met. Syntech Resources would prepare a Final Rehabilitation Report (including a residual risk assessment) as part of an application to surrender EA EPML00900113 in accordance with section 62 of the EP Act.

4.3 GENERAL REHABILITATION PRACTICES AND MEASURES

General rehabilitation practices and measures that would be implemented for the Project are described in the following sub-sections.

Rehabilitation progress and rehabilitation activities would regularly be re-evaluated and the results would inform future rehabilitation initiatives, and refinement or amendment to the practices and measures described below.

4.3.1 Vegetation Clearance Procedures

Clearance of vegetation would be conducted in accordance with the Plan of Operations. Clearing would be conducted progressively, with the area of vegetation cleared at any particular time generally being no greater than that required to accommodate projected development activities for the next 12 months.

Further detail on management of potential impacts on biodiversity during vegetation clearance activities is provided in Section 3.4 and Appendix D.

4.3.2 Topsoil Management

General topsoil management practices would include the stripping and stockpiling of soil resources for use in rehabilitation. The objectives of soil resource management for the Project site would be to:

- identify and quantify potential topsoil resources for rehabilitation;
- optimise the recovery of usable topsoil reserves during soil stripping operations;
- preferentially replace stripped topsoil directly on completed sections of the final landform;
- manage topsoil reserves so as not to degrade the resource when stockpiled; and
- establish effective topsoil amelioration procedures to maximise the availability and suitability of soil reserves for future rehabilitation works.

Additional soil management details are provided in Section 3.1.3.

The Plan of Operations would describe the topsoil resource management measures that would be used during the Project life.

Soil Reserves

LRS Environmental (2018) has completed a preliminary material inventory to determine the quantity of soil available for rehabilitation (Appendix I). The results of these calculations are summarised in Table 4.5 and indicate that there would be sufficient topsoil available to meet the requirements of the rehabilitation concepts.

<table>
<thead>
<tr>
<th>Topsoil Resource</th>
<th>Approximate Volume Available (m³)</th>
<th>Approximate Volume Required (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stockpiled</td>
<td>530,000</td>
<td>-</td>
</tr>
<tr>
<td>Binkey and Braemar Soil Units</td>
<td>8,700,000</td>
<td>8,500,000</td>
</tr>
<tr>
<td>Tara Soil Unit</td>
<td>2,000,000</td>
<td>1,800,000</td>
</tr>
</tbody>
</table>

Source: Appendix I. m³ = cubic metres.

Details of available topsoil resources, stripping and application schedules, and topsoil stockpile inventories would be included in the Plan of Operations.

4.3.3 Erosion and Sediment Control

Erosion and sediment control plans would be progressively developed as part of the Site Water Management Plan. Sediment and erosion controls would be periodically updated and regularly reviewed.

Operational sediment and erosion control works would be maintained during the establishment of revegetation. However, once self-sustaining stable final landforms have been achieved within an area, key elements of the operational sediment control structures would either be left as passive water control storages or would be removed and the area would become free-draining.
4.3.5 Revegetation Program

Native species to be planted in revegetation areas would be selected on a site by site basis depending on soil types, aspect and site conditions.

Rehabilitated light intensity grazing areas would be seeded with pasture grasses and legumes known to suit the local area (e.g. Buffel Grass, Many-headed Wire Grass) (Syntech Resources, 2018). Light intensity grazing areas are shown on Figure 4.2.

Native vegetation will be incorporated to provide wildlife corridors, shelter belts for stock (from sun and wind) and visual enhancement (Syntech Resources, 2018). Native vegetation tree and shrub species selected would also be known to suit the local area (e.g. Eucalyptus tereticornis and Casuarina cunninghamiana along drainage lines and Eucalyptus crebra, Eucalyptus fibrosa ssp. nubila and Callitris glaucophylla on other rehabilitation areas). Native vegetation areas are shown on Figure 4.2.

The list of suitable plant species to be used in the revegetation of disturbance areas would be documented in the Rehabilitation Management Plan.

4.3.6 Land Contamination Management

Investigations would be undertaken at mine closure to identify and remediate any contaminated soil materials that may exist in accordance with the requirements under Part 8 of Chapter 7 of the EP Act or equivalent statutory provision in force at the time.

4.3.7 Rehabilitation Management

Maintenance of rehabilitated areas may include the following (Syntech Resources, 2018):

- fertiliser application;
- gypsum application;
- mulch application;
- repairing eroded areas; and
- invasive plant and animal control.

Rehabilitation will be monitored and actions taken as required.

4.3.8 Invasive Plant and Animal Management

Project invasive plant and animal control measures are described in Section 3.4.4.

4.3.9 Bushfire Management

Bushfire management measures for the Project are described in Section 3.4.4.

4.3.10 Post-closure Maintenance

The management and maintenance of rehabilitation areas post-closure would be outlined in the Plan of Operations.

4.4 REHABILITATION MONITORING

Rehabilitation monitoring would continue to be conducted in accordance with the Rehabilitation Management Plan.

4.5 BIODIVERSITY OFFSET STRATEGY

4.5.1 Summary of Offset Requirements

A summary of the residual impacts on MSES is provided in Table 4.6. An environmental offset is required for the Project to address significant residual impacts on MSES (i.e. Regulated Vegetation, Connectivity Areas and Protected Wildlife Habitat [habitat for the Yakka Skink, Grey Snake and Koala]) as determined by the Queensland Environmental Offsets Policy — Significant Residual Impacts Guideline (DEHP, 2014e).

4.5.2 Offset Strategy

An offset strategy for the Project is described below in relation to MSES, and is offered in support of the Project’s application for a major amendment to the existing EA (EPML00900113).

An environmental offset would be provided for residual significant impacts on each MSES in Table 4.6 following approval of the Project, and subject to the timing in EA EPML00900113. The environmental offset for MSES would be provided in accordance with the Environmental Offsets Act, 2014 and Queensland Environmental Offsets Policy – Version 1.4 (DEHP, 2017c). The environmental offset would be:

- staged over time (consistent with the four indicative stages of the Project shown on Figures 3.12a and 3.12b) whereby the initial offsets will be secured for Stage 1 (Figure 4.4) with the balance of offsets in subsequent stages; and
Stage 1 Disturbance

**REFERENCE**

- Mining Lease
- Mining Lease Application
- Indicative Extent of Additional Surface Development
- Existing/Approved Extent of Operations
- Stage 1

**Regulated Vegetation (Data Source - Ecosure 2018)**

- 11.3.4 *
- 11.4.3
- 11.4.10
- Regional Ecosystems
- Vegetation Management Watercourse
- Connectivity Areas
- Yakka Skink Habitat
- Grey Snake Habitat
- Koala Habitat

* This RE is only present in a mixed polygon.
Table 4.6
Residual Significant Impacts on Matters of State Environmental Significance

<table>
<thead>
<tr>
<th>Matters of State Environmental Significance</th>
<th>Residual Impacts</th>
<th>Significant Residual Impacts Likely?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stage 1&lt;sup&gt;A&lt;/sup&gt; (ha)</td>
<td>Stage 2 (ha)</td>
</tr>
<tr>
<td>Regulated Vegetation</td>
<td>RE 11.4.3&lt;sup&gt;B&lt;/sup&gt;</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>RE 11.4.10</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>RE 11.3.2</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Regional ecosystems within the defined distance of a vegetation management watercourse</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Connectivity Areas</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>Protected Wildlife Habitat&lt;sup&gt;*&lt;/sup&gt;</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>Yakka Skink&lt;sup&gt;C&lt;/sup&gt;</td>
<td>54.2</td>
</tr>
<tr>
<td></td>
<td>Grey Snake</td>
<td>20.5</td>
</tr>
</tbody>
</table>

<sup>A</sup> Refer Figure 4.4.
<sup>B</sup> RE 11.4.3 equates to the Brigalow TEC listed under the EPBC Act.
<sup>C</sup> The Yakka Skink and Koala are also listed under the EPBC Act.
<sup>*</sup> The REs and species habitats overlap (i.e. the REs and habitats are not mutually exclusive).
<sup>A</sup> The vegetation patch is 0.4 ha in size comprising 50% RE11.3.25 and 50% RE11.3.4. As such, 0.2 ha has been assigned to each of RE11.3.25 and RE11.3.4 (Ecosure, 2018a).
<sup>D</sup> Number has been rounded.
• a land-based proponent-driven offset site(s), direct-benefit offset and/or a financial settlement offset.

If the offset is to be satisfied through a land-based proponent-driven offset site, the offset would be as follows (DEHP, 2017c):

• For Regulated Vegetation:
  - the offset site will contain vegetation of the same broad vegetation group as the impacted regional ecosystem.
  - the offset site will contain vegetation of the same regional ecosystem status.
  - the offset site will be located within the same bioregion.

• For Connectivity Areas:
  - the offset site will contain an equivalent area of non-remnant ecosystem that will be revegetated to remnant status.
  - the offset site will be located within the same subregion.

• For Protected Wildlife Habitat (Yakka Skink, Grey Snake and Koala):
  - the offset site will contain or be capable of containing a self-sustaining population of the same impacted species.

It is likely that land-based offsets meeting these requirements would be able to be located for the matters requiring offsetting (Table 4.6). The MSES proposed to be impacted by the Project (Table 4.6) occur more widely in the surrounding locality, including on land held by Syntech Resources.

Syntech Resources would investigate the potential for these properties to be used as offsets for the impacts associated with the Project.

In accordance with the Queensland Environmental Offsets Policy (DEHP, 2017c), a notice of election for Stage 1 would be provided to DES no less than 3 months before residual significant impacts on a relevant MSES. The notice of election would include a description of the:

• offset delivery approach (a land-based proponent-driven offset site(s), direct-benefit offset and/or a financial settlement offset); and

• proposed staging details.
SUMMARY OF ENVIRONMENTAL MANAGEMENT COMMITMENTS

This section provides a consolidated summary of proposed environmental management commitments, including mitigation, monitoring and reporting for the Project.

The existing environmental management systems at the Cameby Downs Mine include environmental management plans and programs that have been developed and implemented since operations commenced.

Syntech Resources would continue to implement the existing plans and programs and where necessary, review, revise and build on them. A summary of these measures and the associated reporting is provided in Table 5.1.

Table 5.1
Summary of Management, Monitoring and Reporting Commitments

<table>
<thead>
<tr>
<th>Proposed Management, Monitoring and Reporting</th>
<th>EVA Section Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land</strong></td>
<td></td>
</tr>
<tr>
<td>• Continued implementation of agricultural land resource management measures.</td>
<td>Section 3.1.3</td>
</tr>
<tr>
<td>• Continued implementation of soil resource management measures in accordance with the Plan of Operations to maximise soil resources available for rehabilitation.</td>
<td>Sections 3.1.3 and 4.3.2.</td>
</tr>
<tr>
<td>• Implementation of management measures at the five properties where evidence of contamination of historical contaminating activities has been identified.</td>
<td>Section 3.1.3</td>
</tr>
<tr>
<td>• On-site consumable storage areas would be designed with appropriate bunding and would be operated, where applicable, in compliance with the requirements of AS 1940-2017 The Storage and Handling of Flammable and Combustible Liquids and AS 2187.1 Explosives – Storage, Transport and Use – Storage.</td>
<td>Section 3.1.3</td>
</tr>
<tr>
<td>• All external lighting would be operated in accordance with AS 4282 (IN):1997 Control of Obtrusive Effects of Outdoor Lighting.</td>
<td>Section 3.1.3</td>
</tr>
<tr>
<td><strong>Surface Water</strong></td>
<td></td>
</tr>
<tr>
<td>• Site water management and monitoring would be conducted in accordance with the Site Water Management Plan.</td>
<td>Section 2.8.2</td>
</tr>
<tr>
<td>• Continuation of surface water level (flow) and quality monitoring within and surrounding the mine site in accordance with EA EPML00900113.</td>
<td>Section 3.2.3</td>
</tr>
<tr>
<td>• The new water storages would be designed by a suitably qualified and experienced person in accordance with good engineering practice and the requirements of the relevant version of the Manual for assessing consequence categories and hydraulic performance of structures (DEHP, 2016a) and Structures which are dams or levees constructed as part of environmentally relevant activities (DEHP, 2017a).</td>
<td>Section 2.8.2</td>
</tr>
<tr>
<td>• A consequence category assessment of the new water storages would be conducted in accordance with the Manual for assessing consequence categories and hydraulic performance of structures (DEHP, 2016a) following completion of the detailed design.</td>
<td>Section 2.8.2</td>
</tr>
<tr>
<td>• The operational flood levees would be designed in accordance with the Manual for assessing consequence categories and hydraulic performance of structures (DEHP, 2016a) and Structures which are dams or levees constructed as part of environmentally relevant activities (DEHP, 2017a).</td>
<td>Section 2.8.2</td>
</tr>
<tr>
<td>• Operational flood levees and waste rock emplacements would be designed and constructed to provide 1:1,000 AEP flood protection to open cut voids and 1:100 AEP protection to operational mine infrastructure.</td>
<td>Section 2.8.2</td>
</tr>
<tr>
<td><strong>Groundwater</strong></td>
<td></td>
</tr>
<tr>
<td>• Continuation of groundwater level and quality monitoring within and surrounding the mine site in accordance with EA EPML00900113.</td>
<td>Section 3.3.3</td>
</tr>
<tr>
<td>• Expansion of existing groundwater level and quality monitoring program to include additional bores (MB1 to MB5) outside of the current mine area to target groundwater associated with the upper Macalister Horizon (MA1) down to the lower Wambo Horizon (WM3).</td>
<td></td>
</tr>
<tr>
<td>• Preparation of an annual monitoring report that would include records of groundwater levels and quality in the monitoring bores and details of any review undertaken of the groundwater model since the previous annual monitoring report (NB: A review of the groundwater model should be undertaken within three years of commencement of the Cameby Downs Continued Operations Project by a suitably qualified hydrogeologist).</td>
<td></td>
</tr>
<tr>
<td>• An associated water licence for the Project would be obtained under the Water Act separately.</td>
<td></td>
</tr>
</tbody>
</table>
Table 5.1 (Continued)  
Summary of Management, Monitoring and Reporting Commitments

<table>
<thead>
<tr>
<th>Proposed Management, Monitoring and Reporting</th>
<th>EVA Section Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biodiversity</strong></td>
<td></td>
</tr>
<tr>
<td>• Implementation of a vegetation clearance protocol (including pre-clearance surveys).</td>
<td>Section 3.4.4</td>
</tr>
<tr>
<td>• Implementation of a Species Management Program under section 332 of the Nature Conservation [Wildlife Management] Regulation 2006 as required.</td>
<td>Section 3.4.4</td>
</tr>
<tr>
<td>• Implementation of weed and feral animal control measures.</td>
<td>Section 3.4.5</td>
</tr>
<tr>
<td>• Implementation of a biodiversity offset strategy.</td>
<td>Section 3.5.4</td>
</tr>
<tr>
<td>• Where practicable, land clearance associated with waterways would occur during the dry season.</td>
<td>Section 3.5.4</td>
</tr>
<tr>
<td>• Construction of waterway crossings with consideration of the Queensland Fisheries Guidelines for Design of Stream Crossings (Cotterell, 1998, under revision).</td>
<td>Section 3.5.4</td>
</tr>
<tr>
<td><strong>Air Quality</strong></td>
<td></td>
</tr>
<tr>
<td>• Continued implementation of the near-neighbour engagement strategy (including seeking compensation or purchase agreements).</td>
<td>Section 3.6.3</td>
</tr>
<tr>
<td>• Continued implementation of general dust mitigation measures such as watering haul roads, water sprays on stockpiles and progressive rehabilitation.</td>
<td></td>
</tr>
<tr>
<td>• Continued implementation of the existing air quality management system, including the use of a real-time Beta Attenuation Monitor (located near receivers to the south-west) and associated proactive/reactive mitigation measures. The air quality monitoring network would be expanded with an additional real-time monitor near sensitive receivers to the north-west once operations expand to the north-west (e.g. Year 42).</td>
<td></td>
</tr>
<tr>
<td><strong>Noise and Vibration</strong></td>
<td></td>
</tr>
<tr>
<td>• Continued implementation of the near-neighbour engagement strategy (including seeking compensation or purchase agreements).</td>
<td>Section 3.7.3</td>
</tr>
<tr>
<td>• Continued implementation of the existing noise management system, including the use of general mitigation measures (implemented regardless of recorded noise levels or weather conditions) and real-time directional noise loggers and associated proactive/reactive mitigation measures.</td>
<td></td>
</tr>
<tr>
<td>• The blast MIC would be reduced when blasting at the nearest point to sensitive receivers. Blast monitoring would be conducted at a representative location in order to maintain compliance with the EA EPML00900113 blast limits.</td>
<td></td>
</tr>
<tr>
<td><strong>Aboriginal Cultural Heritage</strong></td>
<td></td>
</tr>
<tr>
<td>• Conduct Aboriginal cultural heritage surveys of the Project area with the Barunggam Endorsed Parties and the Western Wakka Wakka Aboriginal Parties.</td>
<td>Section 3.8.3</td>
</tr>
<tr>
<td>• Any Aboriginal cultural heritage sites identified during the surveys would be managed in accordance with the CHMPs and in consultation with the Barunggam and the Western Wakka Wakka Aboriginal parties.</td>
<td></td>
</tr>
<tr>
<td><strong>Rehabilitation</strong></td>
<td></td>
</tr>
<tr>
<td>• Undertake rehabilitation of the Project on a progressive basis in accordance with the Plan of Operations and Rehabilitation Management Plan.</td>
<td>Section 4.2</td>
</tr>
<tr>
<td>• Rehabilitate the Project to be safe, stable and non-polluting and able to support and sustain the proposed post-mining land use.</td>
<td>Section 4.2.1</td>
</tr>
<tr>
<td>• The post-mining land use would be light intensity grazing with areas of native vegetation.</td>
<td>Section 4.2.3</td>
</tr>
<tr>
<td><strong>Community</strong></td>
<td></td>
</tr>
<tr>
<td>• Continuation of consultation with Project stakeholders during the assessment of the Project by the Queensland State Government.</td>
<td>Section 1.4</td>
</tr>
<tr>
<td>• Continuation of support for the local and regional community through sponsorships and donations.</td>
<td>Section 2.13</td>
</tr>
<tr>
<td>• Continuation of sourcing goods and services from local businesses were practicable.</td>
<td></td>
</tr>
</tbody>
</table>
REFERENCES


Department of Environment and Heritage Protection (2014d) Rehabilitation requirements for mining resource activities.


Department of Environment and Heritage Protection (2017a) Structures which are dams or levees constructed as part of environmentally relevant activities. (ESR/2016/1934). Version 8.00.


Department of Environment and Science (2018f) Mined Land Rehabilitation Policy.


WRM Water & Environment (2018c) Response to DES Information Request for the CDCOP – Concept designs of final landforms around the final voids.

Cameby Downs
Continued Operations Project
Environmental Values Assessment

ATTACHMENT 1

Department of Environment and Science
Information Request – Reference Summary
The Department of Environment and Science (DES) issued an Information Request on 12 January 2017 to request additional information from Syntech Resources Pty Ltd for an amendment application for an Environmental Authority for the Cameby Downs Continued Operations Project.

The information request is attached and Table A1 provides a summary of the requested information and the section it is addressed in the Environmental Values Assessment (EVA).

**Table A1**

**DES Information Request – Reference Summary**

<table>
<thead>
<tr>
<th>Information Request</th>
<th>EVA Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Land</strong></td>
<td></td>
</tr>
</tbody>
</table>
| a) Further to the statements on page 48 of the ‘consideration report’ submitted with the application, provide an assessment of potential impacts on land that:  
  (i) considers the requirements in the Departmental Guideline Application requirements for activities with impacts to land (ESR/2015/1839);  
  (ii) demonstrates how the Project will be managed to minimise the extent and severity of land disturbance and impact to existing land uses; and  
  (iii) describes how the Project will be rehabilitated to ensure that following completion of mining activities, the site will be safe, stable and non-polluting and able to support and sustain the proposed post-mining land use. | Sections 3.1 and 4               |
| b) Further to the information provided on page 21 of the ‘consideration report’, provide detail of:  
  (i) stabilisation controls for final voids;  
  (ii) utilisation and maximisation of in-pit dumping to minimise the size of final voids; and  
  (iii) the final area and volume of the proposed final voids for each individual pit. | Sections 2.4.4, 2.7 and 4.2.4 Section 4.2.4 |
| c) Further to information detailed on page 60 of the ‘consideration report’, provide details of all onsite contamination including:  
  (i) exact location and area of extent of any contaminated land;  
  (ii) proposed remediation methods prior to disturbance; and  
  (iii) any proposed ongoing management strategies of the contaminated land. | Appendix J Section 3.1.3 and Appendix J |
| d) Further to information provided on page 30 of the ‘consideration report’, provide:  
  (i) the rehabilitation goals and objectives, indicators and completion criteria for each Project domain, in accordance with Departmental Guideline Rehabilitation requirements for mining resource activities (EM1112);  
  (ii) A schedule of rehabilitation works for the existing Cameby Downs Mine and the extension project that includes:  
    a. The total area of disturbance for each identified disturbance domain and all rehabilitation activities required to be completed for the Cameby Downs Project area ML50233, ML50258, ML50259, ML50260, ML50269 i.e. progressive rehabilitation to be undertaken for the life of the project;  
    b. Timeframes associated with the rehabilitation activities as they relate to each identified disturbance domain.  
  (iii) A description of the topsoil requirements for the Cameby Downs Mine and details of any topsoil deficit for rehabilitation purposes. | Section 4.2.5 Section 4.2.4 Section 4.2.4 Section 4.3.2 and Appendix I |
### Table A1 (Continued)
**DES Information Request – Reference Summary**

<table>
<thead>
<tr>
<th>Information Request</th>
<th>EVA Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2. Surface Water</strong></td>
<td></td>
</tr>
<tr>
<td>a) Further to your statements on page 50 of the ‘consideration report’ submitted with the application, provide an assessment of potential impacts to surface water that includes:</td>
<td></td>
</tr>
<tr>
<td>(i) consideration of the requirements in the Departmental Guideline: Application requirements for activities with impacts to water (ESR/2015/1837);</td>
<td>Section 2.8.2 and Appendices A and B</td>
</tr>
<tr>
<td>(ii) a description of the Project surface water management system including clean and dirty water management and any proposed releases to the receiving environment.</td>
<td>Appendix A</td>
</tr>
<tr>
<td>(iii) revision for the existing site water balance model to include the proposed expansion.</td>
<td>Appendix A</td>
</tr>
<tr>
<td>(iv) an assessment of potential impacts of any releases to the receiving environment.</td>
<td>Section 2.2.2 and Appendix A</td>
</tr>
<tr>
<td>(v) an assessment of potential flooding impacts, including consideration of an 1:1,000 AEP flood event.</td>
<td>Section 2.2.2 and Appendix A</td>
</tr>
<tr>
<td>(vi) conceptual design of any proposed drainage feature diversions.</td>
<td>Appendix A</td>
</tr>
<tr>
<td>b) Further to information provided on page 51 of the ‘consideration report’, provide details of:</td>
<td></td>
</tr>
<tr>
<td>(i) location of all proposed release points (latitude and longitude in decimal degrees, GDA94) including a map detailing the locations;</td>
<td>Appendix A</td>
</tr>
<tr>
<td>(ii) description of the receiving environment at any proposed release points;</td>
<td>Section 2.1.1 and Appendix A</td>
</tr>
<tr>
<td>(iii) the source, quality and quantity of all proposed releases;</td>
<td>Appendix A</td>
</tr>
<tr>
<td>(iv) the source, quality and quantity of all mine affected water;</td>
<td>Appendix A</td>
</tr>
<tr>
<td>(v) an assessment of the potential impacts to environment values from the additional releases;</td>
<td>Section 2.2.2 and Appendix A</td>
</tr>
<tr>
<td>(vi) an assessment of whether the additional release(s) will achieve the existing Cameby Downs Mine environmental authority water release conditions.</td>
<td>Section 2.2.2 and Appendix A</td>
</tr>
<tr>
<td>(vii) the proposed containment, management and disposal systems for all mine affected water.</td>
<td>Sections 2.8.2 and 3.2.3, and Appendix A</td>
</tr>
<tr>
<td>c) Further to information stated on page 50 of the ‘consideration report’, provide a Receiving Environment Monitoring Program (REMP) for the proposed Project expansion in accordance with the Departmental Guideline Receiving Environment Monitoring Program guideline (EM1260) and Schedule F – Water in the Departmental Guideline Model Mining Conditions (ESR/2016/1936).</td>
<td>Attachment 3</td>
</tr>
<tr>
<td>d) Further to information stated on page 51 of the ‘consideration report’, provide a revised Water Management Plan for the site that includes the proposed expansion in accordance with Condition F27 in Departmental Guideline Model Mining Conditions ESR/2016/1936).</td>
<td>Attachment 2</td>
</tr>
<tr>
<td><strong>3. Groundwater</strong></td>
<td></td>
</tr>
<tr>
<td>a) Further to your statements on pages 49 - 51 of the ‘consideration report’ submitted with the application, provide an assessment of potential impacts to groundwater that includes:</td>
<td></td>
</tr>
<tr>
<td>(i) consideration of the requirements in the Departmental Guideline EM963: Application requirements for activities with impacts to water;</td>
<td>Section 3.3 and Appendix C</td>
</tr>
<tr>
<td>(ii) identification of the chemical and physical properties of hydrogeological systems potentially affected by the Project;</td>
<td>Section 3.3.3 and Appendix C</td>
</tr>
<tr>
<td>(iii) identification of the groundwater users of all aquifers potentially affected by the Project and the water quality characteristics of those aquifers;</td>
<td>Appendix C</td>
</tr>
<tr>
<td>(iv) a numerical groundwater model;</td>
<td>Appendix C</td>
</tr>
<tr>
<td>(v) predicted potential impacts to groundwater levels and quality, groundwater users and associated impacts to surface water resources; and</td>
<td>Section 3.3.2 and Appendix C</td>
</tr>
<tr>
<td>(vi) proposed groundwater trigger values for aquifers potentially impacted by the Project.</td>
<td>Appendix C</td>
</tr>
<tr>
<td>Information Request</td>
<td>EVA Reference</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------</td>
</tr>
<tr>
<td><strong>4. Biodiversity</strong></td>
<td></td>
</tr>
<tr>
<td>a) Further to your statements on page 51 of the 'consideration report', provide an assessment regarding the potential impacts to terrestrial and aquatic biodiversity, and how the Project will be managed to protect the identified biodiversity values. This report must consider:</td>
<td>Section 3.1.1 and Appendices D and E</td>
</tr>
<tr>
<td>(i) the requirements in the Departmental Guideline Application requirements for activities with impacts to land (ESR/2015/1839);</td>
<td>Sections 3.4.2 and 3.5.2 and Appendices D and E</td>
</tr>
<tr>
<td>(ii) Matters of State Environmental Significance (MSES);</td>
<td>Section 3.4.2 and Appendix D</td>
</tr>
<tr>
<td>(iii) Regional Ecosystem description database and mapping;</td>
<td>Section 3.4.2 and Appendices D and E</td>
</tr>
<tr>
<td>(iv) flora and fauna species within the Project area, particularly threatened species listed under the Nature Conservation Act 1992 and Environmental Protection and Biodiversity Conservation Act 1999;</td>
<td>Section 3.4.2 and Appendix D</td>
</tr>
<tr>
<td>(v) Environmentally Sensitive Areas (ESA’s);</td>
<td>Section 3.4.2 and Appendix D</td>
</tr>
<tr>
<td>(vi) wetlands (mapped and field validated);</td>
<td>Section 3.4.2 and Appendix F</td>
</tr>
<tr>
<td>(vii) groundwater dependent ecosystems;</td>
<td>Section 3.4.2 and Appendix D</td>
</tr>
<tr>
<td>(viii) Matters of National Environmental Significance (MNES);</td>
<td>Section 3.4 and Appendices D, E and F</td>
</tr>
<tr>
<td>(ix) Any relevant biodiversity offset requirements including:</td>
<td>Section 4.5</td>
</tr>
<tr>
<td>a. details of whether suitable offsets exist for impacts to prescribed environmental matters;</td>
<td>Section 4.5.2</td>
</tr>
<tr>
<td>b. if already determined, the proposed offset delivery mechanism, i.e. land-based, financial payment or a combination of both for impacts to prescribed environmental matters. Where financial payment is proposed, the values to which the financial payment relates and the quality (as determined by the offset financial calculator). Where land-based offsets are proposed, provide an assessment of ‘habitat quality’ of the impact area and offset area;</td>
<td>Section 4.5.2</td>
</tr>
<tr>
<td>c. details of whether the proposed impacts / offsets will be undertaken in full prior to the impacts occurring, or whether they will be staged over the life of the project. If staged impacts / offsets are proposed, identify what those stages are, which impacts are proposed for each stage and the anticipated timeframe for each stage.</td>
<td>Section 4.5.2</td>
</tr>
<tr>
<td>b) Provide detail of how mapped and/or field validated Regional Ecosystem 11.4.3 will be avoided, the proposed mitigation measure and/or any buffers to be implemented.</td>
<td>Sections 3.4.1, 3.4.2 and 3.4.3</td>
</tr>
<tr>
<td>c) Provide proposed Regional Ecosystem mapping changes including datasheets, photos and GIS shapefiles.</td>
<td>Section 3.4.2 and Appendix D</td>
</tr>
<tr>
<td>d) Further to statements made on page 15 of the 'consideration report', provide field validation assessments to demonstrate that &quot;all the mapped lacustrine wetlands&quot; are &quot;stock watering dams and dammed watercourses&quot;.</td>
<td>Section 3.5 and Appendix F</td>
</tr>
<tr>
<td>e) Provide relevant field survey data and methodologies used to identify the presence or absence of threatened flora and fauna.</td>
<td>Sections 3.4 and 3.5 and Appendices D, E and F</td>
</tr>
<tr>
<td>f) Demonstrate how the Environmental Offsets Act 2014, regulation, and policy has been applied to the project or provide an offset strategy which addresses, at a minimum:</td>
<td>Section 4.5</td>
</tr>
<tr>
<td>(i) how the activity has avoided or minimised impacts on values subject to the Environmental Offsets Act 2014.</td>
<td>Sections 3.4.3 and 3.5.3 and Appendices D, E and F</td>
</tr>
</tbody>
</table>
### Table A1 (Continued)
#### DES Information Request – Reference Summary

<table>
<thead>
<tr>
<th>Information Request</th>
<th>EVA Reference</th>
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</thead>
<tbody>
<tr>
<td><strong>5. Air Quality</strong></td>
<td></td>
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</tbody>
</table>
| a) As indicated on page 53 of the ‘consideration report’ submitted with the application, undertake an air quality assessment that assesses the potential impacts of the Project on the air environment, including:  
  (i) consideration of the values and objectives in the Environmental Protection (Air) Policy 2008;  
  (ii) consideration of the requirements in the Departmental Guideline Application requirements for activities with impacts to air (ES/2015/1840);  
  (iii) air dispersion modelling to predict potential impacts from the Project;  
  (iv) proposed mitigation measures for minimising impacts; | Sections 3.6.1 and 3.6.2 and Appendix G |
| b) Management of dust from exposed areas including roads should be specifically addressed with consideration of the Project’s predicted water deficit. | Sections 2.8.3 and 3.6 and Appendices A and G |
| **6. Noise and Vibration** | |
| a) Further to the information stated on page 53 of the ‘consideration report’ submitted with the application, provide a noise and vibration assessment that assess the potential impacts of the proposed Project expansion, including:  
  (i) consideration of the values and objectives in the Environmental Protection (Noise) Policy 2008;  
  (ii) consideration of the requirements in the Departmental Guideline Application requirements for activities with noise impacts (ESR/2015/1838);  
  (iii) noise modelling to predict potential impacts from the Project;  
  (iv) a description of the environmental values of the acoustic environment in and surrounding the Project areas including sensitive receptors, site topography and built environment, and background noise levels;  
  (v) identification of the potential impacts of the Project including noise sources and levels for the life of the Project; and  
  (vi) proposed mitigation measures for minimising noise impacts. | Sections 3.7.1 and 3.7.2 and Appendix H |
| **7. Waste Management** | |
| a) Provide details of waste rock, rejects and tailings management including the following:  
  (i) Consideration of the requirements in the Departmental Guideline Application requirements for activities with waste impacts (EM964);  
  (ii) Quantity of waste rock, rejects and tailings generated for the life of the project;  
  (iii) Geochemical characteristics of the waste rock, rejects and tailings including dispersivity and acid-forming potential;  
  (iv) Proposed management method for waste rock, rejects and tailings including any environmental values likely to be impacted, a description of the impacts and the risk of the impacts, and mitigation measures for reducing the likelihood of the risks and potential impacts.  
  (v) The specific management method for waste identified as being highly dispersive or potentially acid-forming material.  
  (vi) The design of any waste encapsulation facility with consideration of the characteristics of the waste to be emplaced.  
  (vii) The ongoing management, maintenance and monitoring methods to be employed to ensure the integrity of any waste encapsulation facilities including consideration of leaching. | Sections 2.12, 2.4.4, 2.7, 3.1, 3.2 and 3.3 |

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Cameby Downs Mine
MANAGED BY THE TANZANIA AUSTRALIA GROUP
<table>
<thead>
<tr>
<th>Information Request</th>
<th>EVA Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>b) Waste Management (continued)</strong></td>
<td></td>
</tr>
<tr>
<td>(i) Quantity and quality of sewage generated on site as a total and from each source; and</td>
<td>Section 2.12</td>
</tr>
<tr>
<td>(ii) Proposed management method for sewage including any environmental values likely to be impacted, a description of the impacts and the risk of the impacts, and mitigation measures for reducing the likelihood of the risks and potential impacts.</td>
<td>Sections 2.12 and 3.2</td>
</tr>
<tr>
<td><strong>c) Further to the information stated on page 57 of the ‘consideration report’ submitted with the application, provide details of the additional benign, non-putrescible waste proposed to be disposed of in pit, including:</strong></td>
<td></td>
</tr>
<tr>
<td>(i) Types of waste to be disposed and identification of any regulated wastes;</td>
<td>Section 2.12</td>
</tr>
<tr>
<td>(ii) Locations of where the waste is proposed to be disposed;</td>
<td>Section 2.12</td>
</tr>
<tr>
<td>(iii) Quantity and quality of the waste to be disposed;</td>
<td>Section 2.12</td>
</tr>
<tr>
<td>(iv) Disposal methods for such waste;</td>
<td>Section 2.12</td>
</tr>
<tr>
<td>(v) An assessment of the potential for leachate to occur and whether this may impact on groundwater or surface water environmental values;</td>
<td>Sections 2.12, 3.2 and 3.3</td>
</tr>
<tr>
<td>(vi) Management strategies for odour, leachate and vermin; and</td>
<td>Section 2.12</td>
</tr>
<tr>
<td>(vii) Rehabilitation strategies for these pits to ensure that the rehabilitation goals for safe, stable and, non-polluting are achieved and the rehabilitation area is able to support the proposed post-mining land use.</td>
<td>Sections 4.2 and 4.3</td>
</tr>
</tbody>
</table>
Notice

Environmental Protection Act 1994

Information request for an amendment application for an environmental authority

This notice is issued by the administering authority¹ pursuant to sections 140 and 232 of the Environmental Protection Act 1994 to request further information needed to assess an amendment application for an environmental authority.

To: Syntech Resources Pty Ltd T/A Cameby Downs Mine
   Cl: Yancoal Australia Pty Ltd
   Level 26, 363 George Street
   SYDNEY NSW 2000
   Attention: Mark Jacobs
   Email: Mark.Jacobs@yancoal.com.au

Cc: The Mining Registrar
    Coal Assessment Hub
    Department of Natural Resources and Mines
    Email: CoalHub@dnrm.qld.gov.au

Your reference: EPML00900113 Cameby Downs Coal Mine
Our reference: 315050

Further information needed to decide an amendment application for an environmental authority

1. Application details

   The amendment application for an environmental authority, made by Syntech Resources Pty Ltd T/A Cameby Downs Mine was received by the administering authority on 21 November 2016.

   The application reference number is: EPML00900113.

   Land description: ML50233; ML50258; ML50259; ML50260; ML50269.

2. Information request

   The administering authority is unable to make a decision on your application as insufficient information has been provided. In order to make a decision, the administering authority requires the information set out in Appendix A.

3. Actions

   As per section 146(1) of the Environmental Protection Act 1994, to respond to this information request, you must take one of the following actions:

   a) give the administering authority all of the information requested;

   b) give the administering authority part of the information requested together with a written notice asking the administering authority to proceed with the assessment of the application;

   c) give the administering authority a written notice:

      i. stating that none of the information requested is intended to be supplied, and

      ii. asking that the administering authority proceed with the assessment of the application.

A response to the information requested must be provided by 31 January 2018.

¹ The Director-General of the Department of Environment and Heritage Protection is the administering authority under the Environmental Protection Act 1994.
Information request for an amendment application for an environmental authority

As per section 147 of the Environmental Protection Act 1994, if you do not provide a response, your application will lapse unless the information response period is extended. A request to extend the information response period must be made at least 10 business days before the date the response is due to be provided.

The response to this information request or a request to extend the information response period can be submitted to the administering authority using the enquiries details below.

If the information provided in response to this information request is still not adequate for the administering authority to make a decision, your application may be refused as per section 176 of the Environmental Protection Act 1994, where the administering authority must have regard to any response given for an information request.

Ben Byrd  
Department of Environment and Heritage Protection  
Delegate of the administering authority  
Environmental Protection Act 1994

Enquiries:  
Business Centre (Coal)  
Department of Environment and Heritage Protection  
PO Box 3028  
EMERALD QLD 4720  
Phone: (07) 4987 9320  
Email: CRMining@ehp.qld.gov.au

Signature  
12 January 2017  
Date
Appendix A

1. Land

a) Further to the statements on page 48 of the 'consideration report' submitted with the application, provide an assessment of potential impacts to land that:

(i) considers the requirements in the Departmental Guideline *Application requirements for activities with impacts to land (ESR/2015/1839)*;

(ii) demonstrates how the Project will be managed to minimise the extent and severity of land disturbance and impact to existing land uses; and

(iii) describes how the Project will be rehabilitated to ensure that following completion of mining activities, the site will be safe, stable and non-polluting and able to support and sustain the proposed post-mining land use.

b) Further to the information provided on page 21 of the 'consideration report', provide detail of:

(i) stabilisation controls for final voids;

(ii) utilisation and maximisation of in-pit dumping to minimise the size of final voids; and

(iii) the final area and volume of the proposed final voids for each individual pit.

c) Further to information detailed on page 60 of the 'consideration report', provide details of all onsite contamination including:

(i) exact location and area of extent of any contaminated land;

(ii) proposed remediation methods prior to disturbance; and

(iii) any proposed ongoing management strategies of the contaminated land.

d) Further to information provided on page 30 of the 'consideration report', provide:

(i) the rehabilitation goals and objectives, indicators and completion criteria for each Project domain, in accordance with Departmental Guideline *Rehabilitation requirements for mining resource activities (EM1112)*;

(ii) A schedule of rehabilitation works for the existing Cameby Downs Mine and the extension project that includes:

a. The total area of disturbance for each identified disturbance domain and all rehabilitation activities required to be completed for the Cameby Downs Project area ML50233, ML50258, ML50259, ML50260 and ML50269 i.e. progressive rehabilitation to be undertaken for the life of the project;

b. Timeframes associated with the rehabilitation activities as they relate to each identified disturbance domain.

(iii) A description of the topsoil requirements for the Cameby Downs Mine and details of any topsoil deficit for rehabilitation purposes.

2. Surface Water

a) Further to your statements on page 50 of the 'consideration report' submitted with the application, provide an assessment of potential impacts to surface water that includes:

(i) consideration of the requirements in the Departmental Guideline: *Application requirements for activities with impacts to water (ESR/2015/1837)*;
(ii) a description of the Project surface water management system including clean and dirty water management and any proposed releases to the receiving environment.

(iii) revision of the existing site water balance model to include the proposed expansion.

(iv) an assessment of potential impacts of any releases to the receiving environment.

(v) an assessment of potential flooding impacts, including consideration of an 1:1,000 AEP flood event.

(vi) conceptual design of any proposed drainage feature diversions.

b) Further to information provided on page 51 of the ‘consideration report’, provide details of:

(i) location of all proposed release points (latitude and longitude in decimal degrees, GDA94) including a map detailing the locations;

(ii) description of the receiving environment at any proposed release points;

(iii) the source, quality and quantity of all proposed releases;

(iv) the source, quality and quantity of all mine affected water;

(v) an assessment of the potential impacts to environmental values from the additional releases;

(vi) an assessment of whether the additional release(s) will achieve the existing Cameby Downs Mine environmental authority water release conditions.

(vii) the proposed containment, management and disposal systems for all mine affected water.

c) Further to information stated on page 50 of the ‘consideration report’, provide a Receiving Environment Monitoring Program (REMP) for the proposed Project expansion in accordance with the Departmental Guideline Receiving Environment Monitoring Program guideline (EM1260) and Schedule F – Water in the Departmental Guideline Model Mining Conditions (ESR/2016/1936).

d) Further to information stated on page 51 of the ‘consideration report’, provide a revised Water Management Plan for the site that includes the proposed expansion in accordance with Condition F27 in Departmental Guideline Model Mining Conditions (ESR/2016/1936).

3. Groundwater

a) Further to your statements on pages 49 - 51 of the ‘consideration report’ submitted with the application, provide an assessment of potential impacts to groundwater that includes:

(i) consideration of the requirements in the Departmental Guideline EM963: Application requirements for activities with impacts to water;

(ii) identification of the chemical and physical properties of hydrogeological systems potentially affected by the Project;

(iii) identification of the groundwater users of all aquifers potentially affected by the Project and the water quality characteristics of those aquifers;

(iv) a numerical groundwater model;

(v) predicted potential impacts to groundwater levels and quality, groundwater users and associated impacts to surface water resources; and

(vi) proposed groundwater trigger values for aquifers potentially impacted by the Project.
4. Biodiversity

a) Further to your statements on page 51 of the ‘consideration report’, provide an assessment regarding the potential impacts to terrestrial and aquatic biodiversity, and how the Project will be managed to protect the identified biodiversity values. This report must consider:

(i) the requirements in the Departmental Guideline *Application requirements for activities with impacts to land (ESR/2015/1839)*;

(ii) Matters of State Environmental Significance (MSES);

(iii) Regional Ecosystem description database and mapping;

(iv) flora and fauna species within the Project area, particularly threatened species listed under the Nature Conservation Act 1992 and Environmental Protection and Biodiversity Conservation Act 1999;

(v) Environmentally Sensitive Areas (ESA’s);

(vi) wetlands (mapped and field validated);

(vii) groundwater dependent ecosystems;

(viii) Matters of National Environmental Significance (MNES);

(ix) Any relevant biodiversity offset requirements including:

a. details of whether suitable offsets exist for impacts to prescribed environmental matters;

b. if already determined, the proposed offset delivery mechanism, i.e. land-based, financial payment or a combination of both for impacts to prescribed environmental matters. Where financial payment is proposed, the values to which the financial payment relates and the quantity (as determined by the offset financial calculator). Where land-based offsets are proposed, provide an assessment of ‘habitat quality’ of the impact area and offset area;

c. details of whether the proposed impacts / offsets will be undertaken in full prior to the impacts occurring, or whether they will be staged over the life of the project. If staged impacts / offsets are proposed, identify what those stages are, which impacts are proposed for each stage and the anticipated timeframe for each stage.

b) Provide detail of how mapped and/or field validated Regional Ecosystem 11.4.3 will be avoided, the proposed mitigation measures and/or any buffers to be implemented.

c) Provide proposed Regional Ecosystem mapping changes including datasheets, photos and GIS shapefiles.

d) Further to statements made on page 15 of the ‘consideration report’, provide field validation assessments to demonstrate that “all of the mapped lacustrine wetlands” are “stock watering dams and dammed watercourses”.

e) Provide relevant field survey data and methodologies used to identify the presence or absence of threatened flora and fauna.

f) Demonstrate how the *Environmental Offsets Act 2014*, regulation, and policy has been applied to the project or provide an offset strategy which addresses, at a minimum:

(i) how the activity has avoided or minimised impacts on values subject to the *Environmental Offsets Act 2014*. 
5. Air Quality
   a) As indicated on page 53 of the ‘consideration report’ submitted with the application, undertake an air quality assessment that assesses the potential impacts of the Project on the air environment, including:
      (i) consideration of the values and objectives in the Environmental Protection (Air) Policy 2008;
      (ii) consideration of the requirements in the Departmental Guideline Application requirements for activities with impacts to air (ESR/2015/1840);
      (iii) air dispersion modelling to predict potential impacts from the Project;
      (iv) proposed mitigation measures for minimising impacts;
   b) Management of dust from exposed areas including roads should be specifically addressed with consideration of the Project’s predicted water deficit.

6. Noise and Vibration
   a) Further to the information stated on page 53 of the ‘consideration report’ submitted with the application, provide a noise and vibration assessment that assess the potential impacts of the proposed Project expansion, including:
      (i) consideration of the values and objectives in the Environmental Protection (Noise) Policy 2008;
      (ii) consideration of the requirements in the Departmental Guideline Application requirements for activities with noise impacts (ESR/2015/1838);
      (iii) noise modelling to predict potential impacts from the Project;
      (iv) a description of the environmental values of the acoustic environment in and surrounding the Project areas including sensitive receptors, site topography and built environment, and background noise levels;
      (v) identification of the potential impacts of the Project including noise sources and levels for the life of the Project; and
      (vi) proposed mitigation measures for minimising noise impacts.

7. Waste Management
   a) Provide details of waste rock, rejects and tailings management including the following:
      (i) Consideration of the requirements in the Departmental Guideline Application requirements for activities with waste impacts (EM964);
      (ii) Quantity of waste rock, rejects and tailings generated for the life of the project;
      (iii) Geochemical characteristics of the waste rock, rejects and tailings including dispersivity and acid-forming potential;
      (iv) Proposed management method for waste rock, rejects and tailings including any environmental values likely to be impacted, a description of the impacts and the risk of the impacts, and mitigation measures for reducing the likelihood of the risks and potential impacts.
      (v) The specific management method for waste identified as being highly dispersive or potentially acid-forming material.
      (vi) The design of any waste encapsulation facility with consideration of the characteristics of the waste to be emplaced.
(vii) The ongoing management, maintenance and monitoring methods to be employed to ensure the integrity of any waste encapsulation facilities including consideration of leaching.

b) Provide details for sewage management across the entire proposed project area including the following:
   (i) Quantity and quality of sewage generated on site as a total and from each source; and
   (ii) Proposed management method for sewage including any environmental values likely to be impacted, a description of the impacts and the risk of the impacts, and mitigation measures for reducing the likelihood of the risks and potential impacts.

c) Further to the information stated on page 57 of the 'consideration report' submitted with the application, provide details of the additional benign, non-putrescible waste proposed to be disposed of in pit, including:
   (i) Types of waste to be disposed and identification of any regulated wastes;
   (ii) Locations of where the waste is proposed to be disposed;
   (iii) Quantity and quality of the waste to be disposed;
   (iv) Disposal methods for such waste;
   (v) An assessment of the potential for leachate to occur and whether this may impact on groundwater or surface water environmental values;
   (vi) Management strategies for odour, leachate and vermin; and
   (vii) Rehabilitation strategies for these pits to ensure that the rehabilitation goals of safe, stable and, non-polluting are achieved and the rehabilitated area is able to support the proposed post-mining land use.
Cameby Downs
Continued Operations Project
Environmental Values Assessment

ATTACHMENT 2
Site Water Management Plan
Report Title  
Cameby Downs Mine Water Management Plan

Client  
Syntech Resources Pty Ltd  
Cameby Downs Mine Site  
Ryalls Road  
Miles Qld 4415

Report Number  
0928-08-C8

<table>
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<tr>
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<th>Report Date</th>
<th>Report Author</th>
<th>Reviewer</th>
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<td>0</td>
<td>11/09/2018</td>
<td>HM</td>
<td>JO</td>
</tr>
</tbody>
</table>

For and on behalf of WRM Water & Environment Pty Ltd  
Level 9, 135 Wickham Tce, Spring Hill  
PO Box 10703 Brisbane Adelaide St Qld 4000  
Tel 07 3225 0200  

WRM Water & Environment Pty Ltd

Julian Orth  
Associate

NOTE: This report has been prepared on the assumption that all information, data and reports provided to us by our client, on behalf of our client, or by third parties (e.g. government agencies) is complete and accurate and on the basis that such other assumptions we have identified (whether or not those assumptions have been identified in this advice) are correct. You must inform us if any of the assumptions are not complete or accurate. We retain ownership of all copyright in this report. Except where you obtain our prior written consent, this report may only be used by our client for the purpose for which it has been provided by us.
FORM OF CERTIFICATION

Name of Registered Professional Engineer providing certification:
Julian Orth RPEQ No 15706
Employed by WRM Water & Environment Pty Ltd

Address of Registered Professional Engineer providing certification:
WRM Water & Environment
Level 9, 135 Wickham Terrace, Spring Hill
PO Box 10703
Adelaide St Brisbane QLD 4000

Statement of Relevant Experience:
I hereby state that I am a Registered Professional Engineer of Queensland and meet the requirements of the definition of ‘suitably qualified and experienced person’.

Statement of Certification:
All relevant material relied upon by me, including subsidiary certifications of specialist components, where required by the environmental authority, is provided in the attached report ‘Cameby Downs Mine - Water Management Plan’, dated 15 December 2017.

I hereby certify that the Water Management Plan prepared for Cameby Downs Mine:

• Has been prepared in accordance with the engineering practice consistent with the standards required for this assessment, and in accordance with the requirements of Environmental Authority EPML00900113.

I, Julian Orth, declare that the information provided as part of this certification is true to the best of my knowledge. I acknowledge that it is an offence under Section 480 of the Environmental Protection Act 1994 to give the administering authority a document containing information that I know is false, misleading or incomplete in a material particular.

Signed: Julian Orth
Date: 11 September 2018
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1 Introduction

1.1 BACKGROUND

Cameby Downs Mine (CDM), which is owned by Syntech Resources Pty LTD (Syntech) and managed by Yancoal, is located approximately 280 kilometres (km) west-northwest of Brisbane in the Western Downs Regional Council (WDRC) local government area (see Figure 1.1). The CDM has been operating for seven years, with excavation of overburden commencing in July 2010 and the first coal excavated in August of that year. The coal handling and preparation plant (CHPP) was commissioned in November 2010 with the first railing of coal occurring in December 2010.

The Water Management Plan (WMP) has been prepared to ensure compliance of the water management system (WMS) with both the existing operation and the Cameby Downs Continued Operations Project (CDCOP). The CDCOP involves the extension of operations within Mining Lease (ML) 50233 and into Mining Lease Applications (MLAs) 50258, 50259, 50260 and 50269. The run-of-mine (ROM) coal mining rate will increase from the from 2.8 million tonnes per annum (Mtpa) to 3.5 Mtpa.

Figure 1.2 shows the current mine footprint and the mine plan disturbance for the three years from 2018 to 2020. Figure 1.3 shows the mine footprint in the last year of operations (year 2029).

1.2 PURPOSE AND SCOPE

This WMP has been prepared to meet the requirements of Condition F32 of the Environmental Authority EPML00900113 for CDM. The WMP has been prepared in accordance with the Department of Environment and Heritage Protection (DEHP) guideline Preparation of Water Management Plans for Mining Activities (DEHP, 2012a) and the CDM EA conditions.

The WMP examines and addresses all issues relevant to the importation, generation, use, and management of water on a mining project in order to minimise the quantity of water that is contaminated and released by and from the project.

The actual and potential risks of environmental harm to natural water flows posed by mining activities have been identified and management actions that will effectively minimise these risks have been presented.

1.3 RELATED DOCUMENTS

This WMP should be read in conjunction with the following CDM plans:

- Receiving Environment Monitoring Plan (REMP); and
- Erosion and Sediment Control Plan (ESCP).

1.4 REPORT STRUCTURE

The report is structured as follows:

- Section 2 describes the local and regional catchments and drainage characteristics at the CDM;
- Section 3 describes the environmental values of the regional and local drainage receiving waters;
- Section 4 presents the site operating activities including an assessment of the potential for generating contaminants on the site;
- Section 5 presents the surface water management system including the management objectives and principles;
• Section 6 provides a description of the site water balance model and identifies the performance criteria of the site water balance;
• Section 7 provides an overview of the surface water monitoring program;
• Section 8 provides a summary of the emergency and contingency planning information related to water management; and
• Section 9 gives a list of references.
Figure 1.1 - Locality plan and regional drainage characteristics, Cameby Downs Mine
Figure 1.2 - Current Mine footprint, disturbance plan (years 2018 to 2020) and water management system
Figure 1.3 – Footprint at the last year of mining operations (year 2092)
2 Catchment and drainage characteristics

2.1 OVERVIEW

The CDM is located in the Surat Basin, approximately 280 km west-northwest of Brisbane and near the township of Columboola, between Miles and Chinchilla. The CDM mine lease area covers approximately 69.5 km² and comprises several mining tenements including the existing Cameby Downs Coal Mine mining lease (ML) 50233 and additional mining lease applications (MLA) 50258, MLA 50259, MLA 50260 and MLA 50269. The CDM surface development limit within these ML and MLA’s is approximately 69.5 km² in area. Figure 2.1 and Figure 2.2 show the local and regional drainage features respectively in the vicinity of CDM.

The existing land use within the catchment is primarily grassland (grazing) with some sparse areas of remnant vegetation and current Cameby Downs infrastructure and pit operation areas.

2.2 REGIONAL CATCHMENT CHARACTERISTICS

The CDM site is located within the Columboola Creek and Punch-bowl Creek catchments. These creeks are tributaries of Dogwood Creek, which is a major tributary of the Condamine River (see Figure 2.2). The Condamine River drains in a southwesterly direction to the south of Chinchilla and Miles and becomes the Balonne River, a major tributary of the Murray-Darling Basin, approximately 20 km upstream of its confluence with Dogwood Creek.

Brief descriptions of these regional catchments are given below.

- The Condamine-Balonne River system is predominantly located in Southern Queensland, but also extends about 100 km into northwest New South Wales. This system has a catchment area of 136,642 km², representing around 13% of the total catchment area of the Murray-Darling Basin. The catchment of the Condamine River to its confluence with Dogwood Creek is 37,000 km². The flow conditions in the Condamine river are shown in Figure 2.3 and Figure 2.4, which indicate that The Condamine River flows less than 70% of the year.

- Dogwood Creek is an ephemeral creek that flows southwest to the west of the mining lease and drains to the Condamine River. Its confluence with Columboola Creek and the Condamine River are approximately 19 km and 85 km southwest of the CDM area respectively. The catchment area of Dogwood Creek to its confluence with the Condamine River is some 6,630 km². The flow conditions in Dogwood Creek are shown in Figure 2.5 and Figure 2.6, which indicate that Dogwood Creek is ephemeral and flows less than 40% of the year.

- Columboola Creek commences to the south of the CDM area and drains in a westerly direction to Dogwood Creek. It has a catchment area of approximately 432 km² to Dogwood Creek. The majority of the CDM area drains into Columboola Creek via three drainage features, named in this report as Drainage Line 1, Drainage Line 2, and Drainage Line 3. Another drainage feature, called Drainage Line 4, drains into Columboola Creek to the south of the CDM area (see Figure 2.1).

- Punch-bowl Creek drains in a westerly direction about 5 km to the north of the CDM and has a catchment area of 124.2 km² to its confluence with Dogwood Creek. The northern portion of the CDM area drains into Punch-bowl Creek via three headwater
drainage features, named in this report as Drainage Line 5, Drainage Line 6 and Drainage Line 7 (see Figure 2.1).

2.3 LOCAL DRAINAGE CHARACTERISTICS

Figure 2.1 shows the local drainage features that cross the CDM area. The Queensland Department of Natural Resources and Mines (DNRM) have advised that the main drainage feature (Drainage Line 1) is not a watercourse as defined by the Water Act (2000). Therefore, it has been assumed that the smaller drainage features, which have similar characteristics, are also not watercourses. Description of these drainage features are as follows:

- Drainage Line 1 drains in an easterly and then in a southerly direction across the CDM to Columboola Creek. Its catchment includes a number of other minor drainage features, which combine with Drainage Line 1 and captures the majority of the CDM site. The upper headwaters of the catchment commence upstream to the west of the CDM site.

- Drainage Line 2 drains through the southwestern portion of the CDM to the southern mining lease boundary. It then continues in a southeasterly direction and discharges into Drainage Line 1 just upstream of the Western Railway and Warrego Highway. It has been diverted around the existing rail loop on the CDM.

- Drainage Line 3 drains through the southeastern portion of the CDM before discharging through the Warrego Highway and the Western Railway embankments (via bridges and culverts) and joins Drainage Line 1 about 1 km downstream of the CDM site.

- Drainage Line 4 drains in a southwest direction to the south of the CDM, the Western Railway and the Warrego Highway, where it joins Drainage Line 3. The catchment area of Drainage Line 4 is approximately 114.1 km².

- Drainage Lines 5, 6 and 7 drain the northern sections of the CDM to Punch-bowl Creek.

The upper reaches of the drainage features consist of scattered forest areas whereas the lower reaches have been cleared for grazing.

Table 2.1 summarises the catchment areas and the potential areas occupied by the CDM surface development limit within each of the catchments described above.

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<tr>
<td>Condamine/Balonne River</td>
<td>37,000</td>
<td>78.4</td>
<td>0.2</td>
</tr>
<tr>
<td>Dogwood Creek to its confluence with Columboola Creek</td>
<td>6,630</td>
<td>74</td>
<td>1.2</td>
</tr>
<tr>
<td>Columboola Creek</td>
<td>432</td>
<td>61.3</td>
<td>14</td>
</tr>
<tr>
<td>Drainage Line 1</td>
<td>46.8</td>
<td>39.8</td>
<td>85</td>
</tr>
<tr>
<td>Drainage Line 2</td>
<td>12.5</td>
<td>2.8</td>
<td>22</td>
</tr>
<tr>
<td>Drainage Line 3</td>
<td>59.7</td>
<td>16.3</td>
<td>27</td>
</tr>
<tr>
<td>Punch-bowl Creek</td>
<td>124.2</td>
<td>12.7</td>
<td>10.2</td>
</tr>
<tr>
<td>Drainage Line 5</td>
<td>30.3</td>
<td>3.1</td>
<td>10.2</td>
</tr>
<tr>
<td>Drainage Line 6</td>
<td>19.1</td>
<td>7.1</td>
<td>37.2</td>
</tr>
<tr>
<td>Drainage Line 7</td>
<td>37.0</td>
<td>2.4</td>
<td>6.4</td>
</tr>
</tbody>
</table>
Stream flows are recorded in both Drainage Line 1 and Drainage Line 2 at the locations shown in Figure 2.1.

Figure 2.7 shows the flow duration relationship in Drainage Line 1 at WS1 and in Drainage Line 2 at WS3 for the period of 2014 to 2016. At WS1, flows were recorded or pooled water was present on approximately 60% of the days and has a 10th percentile flow rate of approximately 4.4 ML/day. At WS3, flows were recorded or pooled water was present on approximately 44% of the days and has a 10th percentile flow rate of approximately 4.7 ML/day.
Figure 2.1 - Cameby Downs Mine local drainage features
Figure 2.2 - Regional drainage features
Figure 2.3 - Condamine River at Cotswold (No. 422325A) historical flow volumes (ML) (Source: DNRM)

Figure 2.4 - Condamine River at Cotswold (No. 422325A) daily flow duration curve (Source: DNRM)
Figure 2.5 - Dogwood Creek at Gilweir (No. 422202A) historical flow volumes (Source: DNRM)

Figure 2.6 - Dogwood Creek at Gilweir (No. 422202A) daily flow duration curve (Source: DNRM)
Figure 2.7 - Daily flow duration curves for Drainage Line 1 and Drainage Line 2 between 2014 and 2016
2.4 GEOLOGY AND SOILS

2.4.1 Geology

According to Australasian Groundwater and Environmental Consultants Pty Ltd (AGE), although the geological mapping for the region indicates that much of the CDM area is overlain by alluvial sediments, the exploration drilling program did not identify any alluvial sediments (AGE, 2017). The soil profile consists of essentially very thin soil, then white to orange sandy clay or claystone and occasional thin hard bands of calcrete / silcrete. This whole profile may be up to 30m thick before reaching the coal measures which are grey siltstones, mudstones, fine sandstones and coal (AGE, 2017).

The CDM is located in the Surat Basin and the coal deposits mined at CDM occur in the upper coal horizon of the Walloon Coal Measures, known as the Juandah Coal Measures, that dip gently to the south and south-west. The CDM mines coal in the Kogan, Macalister and Wambo horizons. Within these horizons 13 individual seams have been recognised with any continuity across the deposit and are named KGU, KG, KGLU, KGLL, MA1, MA2T, MA2B, MA2L, MA3, MA4, WM1, WM2 and WM3.

All of the coal seams are thin and split to varying degrees away from their individual centres of deposition. They contain thin beds, or laminae, of clastic sediments although the MA2B Seam is characterised by the notable absence of clastic material. The variations in the thickness and abundance of non-coal materials gives rise to the significant variation in the raw ash of any nominated seam.

2.4.2 Topography

Areas of softer rocks (mudstone, shale and siltstone) have been eroded to form gently undulating inclined residual and depositional clay plains, leaving harder (quartzose sandstone) rocks as low hills and rises. Continued erosion associated with sheet flooding has resulted in a thick depositional cover over parts of the lower clay plains, with infilling of the shallow valley floors (LRS, 2017).

Much of the topography in the mining lease consists of low sandstone hills and rises in the northern part with mainly gently undulating and inclined plains (overall slopes less than 1 to 2%). Areas surrounding the waterways consist of alluvial plains, with clay and sandy plains occurring towards the centre of the mining lease area. The hills average only 20 to 30 m above the surrounding plains and are not obvious on the horizon (LRS, 2017).

The CDM Pit 1 is located on hills to the north of the ephemeral Drainage Line 1 and will progress across the Drainage Line 1 flood plain in a southerly direction. Drainage Line 1 flows in a southeasterly direction through the centre of the CDM ML.

2.4.3 Soil landscape

The mining tenure is predominantly classified as either Blinkey (Brown Sodosol), Braemar (Brown Sodosol) or Tara (Grey Vertosol) (LRS, 2017), described as follows (see Figure 2.8):

- **Blinkey (Brown Sodosol)** - Confined primarily to the low sand stone hills within the CDM area, this management unit consists of a predominantly duplex soil interspersed with minor occurrences of shallow soils of limited pedological development. The more dominant of these soil types was characterised by a fine brown sandy loam surface soil followed by a layer of conspicuous bleaching before an abrupt change to a heavier clay subsoil. Chemical analysis revealed a soil with low levels of key plant nutrients and high levels of sodicity, particularly in the subsoil horizons. The soil is moderately acidic throughout the profile;

- **Braemar (Brown Sodosol)** - Confined primarily to the sandstone derived gently undulating plain within the project area, this management unit consists of a duplex soil characterised by a thin hard setting sandy loam surface before an abrupt textural change to heavier more structured clay subsoil. This soil is considered moderately acidic throughout the profile, tending towards a neutral pH at depth.
This soil is sodic to very strongly sodic below the upper horizon and has generally low levels of key plant nutrients; and

- **Tara (Grey Vertosol)** - Confined to the gently undulating alluvial plains, this soil management unit consists of a deep, cracking grey clay with moderately deep Gilgai development. Both the surface and subsoils are uniformly but strongly structured. Chemical analysis indicates a soil of neutral pH with low to moderate levels of plant nutrients. Surface soils are considered strongly sodic further increasing with depth. Levels of exchangeable sodium indicate the potential for dispersion and the soil is considered slightly to moderately saline in areas, increasing with depth.

Figure 2.8 - Distribution of soil management units (Source: LRS, 2017)
3 Environmental values, water quality objectives, regional and local water quality

3.1 OVERVIEW

The Environmental Protection Act 1994 seeks to protect Queensland’s water resources while allowing ecologically sustainable development through the Environmental Protection (Water) Policy 2009 (EPP Water). The EPP Water achieves this within a framework that includes:

- Identifying environmental values (EVs) for aquatic ecosystems and for human uses; and
- Determining water quality guidelines (WQGs) and water quality objectives (WQOs) to enhance or protect the EVs.

3.2 ENVIRONMENTAL VALUES

Environmental values are the qualities of receiving waters to be protected from activities in the catchment. Protecting environmental values aims to ensure healthy aquatic ecosystems and receiving waters that are safe and suitable for community use. Environmental values reflect the ecological, social and economic values and uses of the receiving waters (Such as stock water, swimming, fishing and agriculture).

The processes to identify EVs and determine WQGs and WQOs are based on the National Water Quality Management Strategy: Implementation Guidelines (NWQMS, 1998) and further outlined in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ, 2000).

EVs and WQOs for the Maranoa-Balonne (and Lower Condamine) Sub-basin are currently being developed by the Queensland Department of Environment and Heritage Protection (DEHP). DEHP have been developing the EV’s and WQO’s in collaboration with the Queensland Murray Darling Committee (QMDC). DEHP have republished a draft report by QMDC entitled Healthy Waters Management Plan Draft Environmental Values and Community Consultation Report (DEHP, 2017). Although this document is only in draft form, it is likely to be used to inform the subsequent development of EV’s, WQO’s and future water quality guidelines under the EPP Water.

Based on DEHP (2017), the receiving surface waters downstream of the CDM are located in the Dogwood Creek zone. The surface water EVs nominated for protection for this zone are:

- Aquatic ecosystems
- Irrigation
- Farm supply/use
- Stock water
- Human consumer
- Primary recreation
- Visual recreation
- Drinking water
- Cultural and spiritual values
3.3 DEFAULT TRIGGER VALUES

The indicators and water quality guidelines relevant to the above Surface Water EVs are listed in the Queensland WQGs and ANZECC & ARMCANZ (2000). The conditions of receiving waters located in the vicinity of the CDM are classified as Level 2: slightly to moderately disturbed ecosystems under the Queensland WQGs (DEHP, 2009). CDM have adopted the Model Mine Conditions release limits and receiving waters trigger levels (shown in Section 3.4), which are based on the values for aquatic ecosystem protection shown in Table 3.1.

The receiving waters of CDM enter Dogwood Creek, downstream of the gauging station at Gilweir. Dogwood Creek Combines with the Condamine River and becomes the Balone River. The following factors were considered when defining local water quality objectives:

- Gilweir is a man-made weir and samples collected behind this weir may be impacted by the weir depending on where the sample is taken; and
- The Condamine River has similar characteristics to the CDM receiving water which consists mainly of agricultural land.

Comparison of the water quality triggers for the ANZECC default triggers level and the local receiving waters indicates:

- The 80th percentile pH ranges in the receiving waters are in a similar range to the ANZECC trigger values.
- The 80th percentile EC in the receiving waters indicates:
  - Dogwood Creek value is 130 μS/cm. This is lower than the ANZECC trigger value; and
  - Condamine River values varies from 245 μS/cm (event flow) to 523 μS/cm (base flow). The event flows are lower than the ANZECC trigger value, while the base flows are higher.
- The turbidity in the receiving waters indicates:
  - Dogwood Creek value is 190 NTU, this is higher than the ANZEC trigger value;
  - Condamine River value is 150 NTU (base flow) and 835 NTU (event flow). These values are higher than the ANZEC trigger value.
- The TSS in the receiving waters indicate:
  - There are no default TSS trigger levels;
  - The Dogwood Creek value is 70 mg/l; an
  - The Condamine River values range between 90 mg/l (base flow) and 940 mg/l (event flow).
- The Nutrient concentrations (Total Nitrogen and Total Phosphorus) in the receiving waters are significantly higher than the ANZECC default triggers.

CDM will adopt the Model Mine Conditions receiving waters trigger levels for metals (shown in Table 3.3), which are based on the values for ANZECC aquatic ecosystem protection shown in Table 3.1. There are no water quality guidelines for metals in the DSITIA (2017) draft report.

It is noted that updated draft documentation has been released by the DES in 2018 and is currently the subject of final consultation under the Environmental Protection (Water) Policy 2009 on the environmental values (EVs), aquatic ecosystem protection mapping and water quality objectives (WQOs) for all surface water and groundwater of the Queensland Murray-Darling Basin (QMDB). It is also understood that some ANZECC default trigger values for ecosystem protection are expected to be revised in a planned (yet to be released) update to the ANZECC & ARMCANZ (2000). As these draft EVs, mapping and WQOs are yet to be finalised, no further consideration is made in this report.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>ANZECC Trigger Level</th>
<th>Dogwood Creek 80th percentile</th>
<th>Lower Condamine Base Flow 80th percentile</th>
<th>Lower Condamine Event Flow 80th percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>pH units</td>
<td>lower 6.0</td>
<td>lower 6.5</td>
<td>lower 7.5</td>
<td>lower 7.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>upper 7.5</td>
<td>upper 7.4</td>
<td>upper 8</td>
<td>upper 7.4</td>
</tr>
<tr>
<td>Conductivity</td>
<td>μS/cm</td>
<td>350</td>
<td>130</td>
<td>523</td>
<td>245</td>
</tr>
<tr>
<td>Turbidity</td>
<td>NTU</td>
<td>25</td>
<td>190</td>
<td>150</td>
<td>835</td>
</tr>
<tr>
<td>Total Suspended Solids</td>
<td>mg/L</td>
<td>ID</td>
<td>70</td>
<td>95</td>
<td>940</td>
</tr>
<tr>
<td>Total Nitrogen</td>
<td>mg/L</td>
<td>0.25</td>
<td>1.83</td>
<td>1.3</td>
<td>ID</td>
</tr>
<tr>
<td>Nitrite + Nitrate</td>
<td>mg/L</td>
<td>0.015</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Phosphorous</td>
<td>mg/L</td>
<td>0.02</td>
<td>0.44</td>
<td>0.425</td>
<td>0.95</td>
</tr>
<tr>
<td>Metals (dissolved)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aluminium (pH&gt;6.5)</td>
<td>mg/L</td>
<td>0.055</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aluminium (pH&lt;6.5)</td>
<td>mg/L</td>
<td>ID</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arsenic (As III)</td>
<td>mg/L</td>
<td>0.024</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arsenic (As V)</td>
<td>mg/L</td>
<td>0.013</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boron</td>
<td>mg/L</td>
<td>0.37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cadmium</td>
<td>mg/L</td>
<td>0.0002</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chromium (Cr VI)</td>
<td>mg/L</td>
<td>0.001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td>mg/L</td>
<td>0.0014</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead</td>
<td>mg/L</td>
<td>0.0034</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manganese</td>
<td>mg/L</td>
<td>1.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mercury (inorganic)</td>
<td>mg/L</td>
<td>0.0006</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nickel</td>
<td>mg/L</td>
<td>0.0011</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selenium</td>
<td>mg/L</td>
<td>0.0011</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silver</td>
<td>mg/L</td>
<td>0.00005</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td>mg/L</td>
<td>0.008</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: ANZECC & ARMCANZ (2000) Trigger Values for ‘Upland Streams’ (above 150 mAHD) in South-east Australia for protection of 95% of species. ID - Insufficient data.
3.4 WATER QUALITY OBJECTIVES

Water quality monitoring of the water management system would prioritise sampling of water storages that are able to release water during wet periods. Available water quality for Sediment Dam 1 and the MIA Dam (See Figure 3.1 for locations) indicate these are the only storages that can be regularly released from. These storages should be monitored frequently for pH and EC during wet periods (October to March) to ensure water quality is within release limits. This sampling will enable CDM to establish a release strategy during wet periods.

CDM should regularly monitor runoff from surface water catchments to ensure that water quality is below release limits. Identifying areas with affected runoff water quality will limit the risk of exceedances in release conditions and allow areas with unsuitable runoff water quality to be segregated from the ‘surface’ water system to prevent contamination of sediment dams.

3.4.1 Release limits

Table 3.2 and Table 3.3 show the Table F2 and Table F3 of CDM EA mine affected water release limits and release contaminants trigger investigation levels, based on the Model Mine Conditions (MMC) and locally derived trigger levels. Under Table F2 conditions, water cannot be released from the mine water storages to the receiving waters when the water quality in the storages exceeds the specified release limits. The release limits for the CDM for Table F2 (and Table F4) of the MMC are shown in Table 3.2. Flow rate criteria for the release limits are yet to be determined.

<table>
<thead>
<tr>
<th>Flow Criteria</th>
<th>Receiving Water flow rate (m³/s)</th>
<th>Maximum release rate (m³/s)</th>
<th>Release Limit - EC (μS/cm) / Sulphate (mg/L)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Flow</td>
<td>&lt;0.2</td>
<td>&lt;0.2</td>
<td>&lt;350/250</td>
<td>DAILY DURING RELEASE (WITHIN 2 HOURS OF COMMENCEMENT)</td>
</tr>
<tr>
<td>Medium Flow</td>
<td>&gt;0.2</td>
<td>&lt;0.2</td>
<td>&lt;1,500/500</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;0.5</td>
<td>&lt;0.1</td>
<td>&lt;3,500/1,200</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;0.9</td>
<td>&lt;0.8</td>
<td>&lt;1,500/500</td>
<td></td>
</tr>
<tr>
<td>High Flow</td>
<td>&gt;1.0</td>
<td>&lt;0.2</td>
<td>&lt;3,500/1,200</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;1.7</td>
<td>&lt;1.5</td>
<td>&lt;1500/500</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;2.5</td>
<td>&lt;0.6</td>
<td>&lt;3,500/1,200</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;4</td>
<td>&lt;0.2</td>
<td>&lt;10,000/3,400</td>
<td></td>
</tr>
<tr>
<td>pH (pH Unit)</td>
<td></td>
<td></td>
<td></td>
<td>6.5 - 9</td>
</tr>
<tr>
<td>Turbidity (NTU)</td>
<td></td>
<td></td>
<td></td>
<td>TBA</td>
</tr>
</tbody>
</table>

3.4.2 Release contaminants trigger investigation levels

Under Table F3 conditions, when a trigger level is exceeded in the release water, CDM is required to compare the results with water quality in the receiving waters (both downstream and background sites) in accordance with Condition F6 of the EA. The water quality characteristics in Table F3 will therefore be monitored in the following locations during each release event:

- The release point at the end-of-pipe/spillway;
- At the downstream receiving water monitoring point; and
- At the upstream background receiving water monitoring point.

Table 3.3 shows the Table F3 release contaminant trigger investigation levels, potential contaminants and monitoring frequencies. The table includes locally derived trigger levels for TSS.
Figure 3.1 - CDM water management system and monitoring locations
Table 3.3 - Release contaminant trigger investigation levels, potential contaminants for Table F3 of the Model Mine Conditions and monitoring frequencies

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Trigger Level</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al</td>
<td>(μg/L)</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>As</td>
<td>(μg/L)</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Cd</td>
<td>(μg/L)</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Cr</td>
<td>(μg/L)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Cu</td>
<td>(μg/L)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Fe</td>
<td>(μg/L)</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>Pb</td>
<td>(μg/L)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Hg</td>
<td>(μg/L)</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Ni</td>
<td>(μg/L)</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Zn</td>
<td>(μg/L)</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>(μg/L)</td>
<td>370</td>
<td></td>
</tr>
<tr>
<td>Co</td>
<td>(μg/L)</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>Mn</td>
<td>(μg/L)</td>
<td>1,900</td>
<td></td>
</tr>
<tr>
<td>Mo</td>
<td>(μg/L)</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Se</td>
<td>(μg/L)</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Ag</td>
<td>(μg/L)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>(μg/L)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Va</td>
<td>(μg/L)</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Ammonia</td>
<td>(μg/L)</td>
<td>900</td>
<td></td>
</tr>
<tr>
<td>Nitrate</td>
<td>(μg/L)</td>
<td>1,100</td>
<td></td>
</tr>
<tr>
<td>C9 - C9</td>
<td>(μg/L)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>C9 - C36</td>
<td>(μg/L)</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Fluoride</td>
<td>(μg/L)</td>
<td>2,000</td>
<td></td>
</tr>
<tr>
<td>TSS</td>
<td>(mg/L)</td>
<td>The higher value of 216(^a) or +20% of background value</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) 80\(^{th}\) percentile locally derived value

**3.4.3 Receiving waters contaminant trigger levels**

Table 3.4 shows Table F5 of the CDM EA receiving waters contaminant trigger levels. CDM will monitor the parameters at the frequency shown in Table 3.4 in the receiving waters at the downstream sites and the upstream background sites during release events.

Table 3.4 - Receiving waters contaminant trigger investigation levels for Table F5 of the MMC

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Trigger Level</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>pH Unit</td>
<td>6.5 - 9</td>
<td></td>
</tr>
<tr>
<td>EC no flow</td>
<td>µS/cm</td>
<td>350(^a)</td>
<td>Daily during the release</td>
</tr>
<tr>
<td>EC low to High Flow</td>
<td>µS/cm</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>TSS</td>
<td>(mg/L)</td>
<td>The higher value of 216 of +20% of background</td>
<td></td>
</tr>
<tr>
<td>Sulphate</td>
<td>(mg/L)</td>
<td>250</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) Source: ANZECC & ARMCANZ (2000)
3.5 REGIONAL AND LOCAL WATER QUALITY

3.5.1 Overview

Table 3.5 shows the locations for which regional (Condamine River and Dogwood Creek) and local (Drainage Line 1 and Drainage Line 2) receiving water quality data is available. The Water Quality of the regional and local receiving waters is detailed below.

Table 3.5 - Summary of available receiving water quality data

<table>
<thead>
<tr>
<th>Data Source</th>
<th>Site</th>
<th>Receiving Waters</th>
<th>Location</th>
<th>Period of Record</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDM</td>
<td>Upstream Monitoring Points</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>D/S of Ryalls Road crossing</td>
<td>Feb.'11 - Mar '17</td>
<td></td>
</tr>
<tr>
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<td>Drainage Line 2</td>
<td>D/S of Ryalls Road crossing</td>
<td>Jun.'11 - Oct '17</td>
<td></td>
</tr>
<tr>
<td>WS5</td>
<td>Drainage Line 2</td>
<td>D/S of Ryalls Road crossing</td>
<td>Dec.'10 - Mar '17</td>
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<tr>
<td></td>
<td>Downstream Monitoring Points</td>
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<td></td>
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<tr>
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<td>U/S of Boort Koi Road crossing</td>
<td>Feb.'11 - Mar '17</td>
<td></td>
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<tr>
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<tr>
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<td>Condamine River</td>
<td>28 km U/S of Dogwood Creek confluence</td>
<td>Varies</td>
<td></td>
</tr>
<tr>
<td>422325A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>422202B</td>
<td>Dogwood Creek</td>
<td>2km U/S of Columboola Creek confluence</td>
<td>Varies</td>
<td></td>
</tr>
</tbody>
</table>

3.5.2 Condamine River

Water quality in the Condamine River has been monitored at the DNRM stream gauge Cotswold (No. 422325A), which is located 28 km upstream of the Dogwood Creek confluence. Percentile water quality data for the Lower Condamine River base flow and event flow is shown in Appendix A (Table A.1 and Table A.2).

The Lower Condamine River water quality percentiles and a comparison against Table F5 of the Model Mine Conditions (MMC) trigger levels (guideline and locally derived levels) for receiving waters (see Table 3.4) and the default trigger levels for Environmental Values (ANZECC) (see Table 3.1) shows the following:

- **pH**
  - Median values are 7.8 and 7.3 for base and events flows respectively; and
  - 20th and 80th percentile values are 7.5 and 8.1 for base flows and 7.1 and 7.5 for event flows.

- **EC**
  - Median values are 376 and 243 μs/cm for base and events flows respectively; and
  - 80th percentile values are 650 and 262 μs/cm for base and event flows respectively.

- **TSS**
  - Median values are 51 and 675 mg/L for base and events flows respectively; and
  - 80th percentile values are 139 to 1130 for base and event flows respectively.

- **Turbidity**
  - Median values are 57 and 490 NTU for base and events flows respectively; and
80th percentile values are 208 to 1058 for base and event flows respectively.

- Sulphate
  - 80th percentile values are 11 and 6 mg/L for base and flow events respectively.

The above water quality percentiles indicate that the background Lower Condamine River water quality is poorer than the default and MMC trigger levels. The water quality percentiles show:

- Base flows
  - 20th percentile pH values are above the default upper trigger level and all values are within the MMC trigger level range;
  - Median EC values are higher than the default trigger levels, but lower than the MMC trigger levels;
  - 80th percentile TSS values are lower than the MMC trigger levels;
  - Median Turbidity values are higher than the default trigger levels; and
  - 80th percentile sulphate values are below MMC and default trigger levels.

- Event Flow
  - pH values are within the default and MMC trigger level range;
  - 80th percentile EC values are within the default and MMC trigger level range;
  - Median TSS values are higher than the MMC trigger levels;
  - Median Turbidity values are higher than the default trigger levels; and
  - 80th percentile sulphate values are below the MMC trigger levels.

3.5.3 Dogwood Creek

Water quality in Dogwood Creek has been monitored at the DNRM stream gauge Gilweir (No. 422202B), which is located 2 km upstream of the Dogwood Creek confluence with Columboola Creek. Percentile water quality data for the Dogwood Creek base flow and event flow is shown in Appendix B (Table A.3 and Table A.4).

The Dogwood Creek water quality data and a comparison against Table F5 of the Model Mine conditions (MMC) trigger levels for receiving waters (see Table 3.4) and the default trigger levels for Environmental Values (ANZECC) (see Table 3.1) shows the following:

- pH
  - Median values are 7 and 6.8 for base and events flows respectively; and
  - 20th and 80th percentile values are 6.5 and 7.6 for base flows and 6.4 and 7.4 for event flows.

- EC
  - Median values are 113 and 100 μs/cm for base and events flows respectively; and
  - 80th percentile values are 145 and 121 μs/cm for base and event flows respectively.

- TSS
  - Median values are 48 and 70 mg/L for base and events flows respectively; and
  - 80th percentile values are 105 and 130 for base and event flows respectively.

- Turbidity
  - Median values are 145 and 195 NTU for base and events flows respectively; and
80th percentile values are 270 and 410 for base and event flows respectively.

- Sulphate
  - 80th percentile values are 5 and 8.9 mg/L for base and flow events respectively, below the MMC trigger levels.

The above water quality percentiles indicate that the background Dogwood Creek water quality is poorer than the default and MMC trigger levels. The water quality percentiles show:

- Base flows
  - 80th percentile pH values for base flows are higher than the default upper trigger level, but within the MMC trigger levels;
  - 80th percentile EC values are within the default and MMC trigger levels;
  - 80th percentile TSS values are within the MMC trigger levels; and
  - Median Turbidity values are higher than the default trigger levels.

- Event Flow
  - 20th percentile pH values are lower than the MMC lower trigger levels, but within the default trigger levels;
  - 80th percentile EC values are within the default and MMC trigger levels;
  - 80th percentile TSS values are within the MMC trigger levels;
  - Median Turbidity values are higher than the default trigger levels; and
  - 80th percentile Sulphate values are within the MMC trigger levels.

### 3.5.4 Drainage Line 1/Drainage Line 2

The CDM has carried out a water quality monitoring program since 2010 in accordance with the CDM EA conditions. The monitoring program has included regular surface water quality sampling from drainage lines in the vicinity of the mine including Drainage Line 1 and Drainage Line 2. Surface water is currently sampled and tested at five locations (see Figure 3.1 for locations) for a range of physical and chemical parameters.

CDM has monitored water quality at stream gauging stations from December 2010 to October 2017. Background water quality has been monitored upstream of the CDM boundary in Drainage Line 1 (WS2) and Drainage Line 2 and its tributary (WS4 and WS5). Receiving water quality has been monitored in Drainage Line 1 (WS1) and Drainage Line 2 (WS3) downstream of CDM site. A summary of the water quality data for the background receiving water sites is provided in Appendix A, Table A.5 to Table A.7.

A comparison of the Drainage Line 1 and Drainage Line 2 background site recorded water quality data and the combined data for both drainage lines are given below. The percentile values are compared against Table F5 of the MMC Receiving Waters Contaminant trigger levels (see Table 3.3) and the default trigger values (ANZECC) (Table 3.1) shows the following:

- pH
  - Drainage Line 1 80th and 20th percentile pH values of 6.5 and 6.9 respectively compared with Drainage Line 2 pH values of 6.4 and 6.9 respectively. Drainage Line 2 20th percentile pH is lower than the MMC lower trigger levels.
  - The combined data 80th and 20th percentile pH values are 6.4 and 6.9 which are within both the default and MMC trigger levels.

- EC
Drainage Line 1 80th percentile EC value is 80 µS /cm and this compares to a value of 67 µS /cm in Drainage Line 2. The 80th percentile values for both drainage lines are within the default and the MMC trigger levels; and

The combined data 80th percentile EC value is 67 µS /cm, which is within the default and MMC trigger levels.

- **TSS**
  - Drainage Line 1 80th percentile TSS value is 211 mg/L, compared to Drainage Line 2 TSS value of 222 mg/L; and
  - The combined data 80th percentile TSS value is 216 mg/L which is the proposed locally derived trigger level, for MMC.

- **Turbidity**
  - Drainage Line 1 80th percentile Turbidity value is 453 NTU, compared to Drainage Line 2 value of 632 NTU; and
  - The combined data 80th percentile Turbidity value is 571 NTU.

- **Sulphate** sampling has not been conducted to date in the receiving waters.

- **Metals** have been sampled in the receiving waters for total concentrations. The MMC and default trigger levels are based on dissolved concentrations. Analyses of total metals at CDM has identified that 4 metals (Chromium, Copper, Lead and Zinc) are elevated in the background receiving water sites. Further water quality monitoring at CDM receiving waters will be required to derive local trigger levels for Table F5 of the model mine conditions.

Water quality monitoring of the background sites in the receiving waters of Drainage Line 1 and Drainage Line 2 has shown that the local water quality is poorer than the default and MMC trigger levels.
4 Contaminant source study

4.1 OVERVIEW

Sources/activities at CDM which may potentially impact on the receiving environment by the introduction of contaminants have been identified as follows:

- Runoff from disturbed land generating suspended sediment (e.g. from stockpiles, overburden and open pit);
- Potential saline or acidic leachate from overburden dumps;
- Groundwater inflows to the pits;
- Coal washing/processing in the CHPP;
- Runoff from chemical or fuel/oil spills; and
- External Water.

Comments on the available water quality data of relevance to the above contaminant sources/activities are given in the following sections.

4.2 RUNOFF FROM DISTURBED LAND

Disturbed land on the mining lease consists of roads, pits, overburden dumps, coal stockpiles, rejects facilities and the coal processing area. Runoff from these areas may contain lubricants, detergents, dissolved salts and sediment.

Sediment deposition into receiving waters may result in bed degradation, potentially altering flow parameters and increasing erosion potential within the receiving waters. The greatest risk of disturbed land impacts however, is in respect of particulate matter. Further to this, important consideration must also be given to associated impacts such as nutrients, heavy metals, acidity, alkalinity, sodicity, EC, chemical and other impacts.

Runoff from disturbed land at CDM is collected in the various site storages and Pit 1. CDM has been monitoring water quality in the site storages and pits since 2010, at the locations presented in Figure 1.2. Appendix B shows the statistics of available mine site storage water quality data. Sediment managed is detailed in the CDM ESCP.

Monitoring data in comparison to release limits in Table F2 of the EA indicates the following:

- **pH** (field samples)
  - Sediment Dam 1 10th and 90th percentile values are 6.4 and 8.6 respectively. The 10th percentile value is below the lower release limit.
  - MIA Dam 10th and 90th percentile values are 7.3 and 8.7 respectively and they are within the release limits.
  - The 10th and 90th percentile values of the Mine Water Dam, Raw Water Dam and Return Water Dam are generally within release limits.

- **Electrical Conductivity (EC)** (field samples)
  - 90th percentile value for Sediment Dam 1 is below the proposed release limit for low flow conditions of 500 us/cm.
  - Values for Raw Water Dam 1, Mine Water Dam 1 and MIA Dam, regularly exceed the release limits for medium flows (3,500 µs/cm) and high flows (10,000 µs/cm).

- **Total Suspended Solids (TSS)**
Median TSS in MIA Dam and Sediment Dam 1 is 80 mg/l and 700 mg/L respectively, which indicate that there is a high risk of TSS exceedance from Sediment Dam 1. This highlights the importance of implementing adequate ESC measures outlined in the CDM ESCP to manage TSS.

4.3 SALINE / ACIDIC LEACHATE FROM OVERBURDEN DUMPS

A waste characterisation report produced by SRK Consulting (SRK, 2012) for CDM concluded that the majority of overburden could be managed as non-acid forming material. However, there is potential for existing salinity to be washed from the overburden in response to rainfall events. SRK noted, however that appropriate management strategies would be required for the carbonaceous units as variable proportions of this unit may have a capacity to generate acid.

The available Sediment Dam 1 water monitoring results indicate the following:

- 10th and 90th percentile pH values are 6.4 and 8.6 respectively (median value is 7.3);
- TSS ranges from 59 to 3,140 mg/L (median value is 700 mg/L); and
- EC (laboratory) ranges from 180 to 640 µS/cm (median value is 324 µS/cm).

On the basis of the recorded Sediment Dam 1 water monitoring results, runoff from overburden dumps in the past appear to have been generally neutral pH.

4.4 GROUNDWATER INFLOWS

A groundwater assessment at CDM was undertaken by AGE (2018). Groundwater at the CDM site is generally brackish to saline. AGE conducted a search of the DNRM groundwater database and found that nearby groundwater bores at similar depths to the Juandah Coal Measures (30 m - 125 m deep) were also typically brackish to saline.

AGE (2018) noted that the CDM site also overlies deeper, freshwater aquifers (which form part of the Great Artesian Basin) known as the Precipice Sandstone and Hutton Sandstone aquifers. However, they are hydraulically isolated from the Walloon Coal Measures by large thicknesses of low permeability strata, and that the sub crop/recharge area is well distant from the CDM site.

According to AGE (2018):

- The coal seam aquifers in the area of the mine form poor aquifers due to highly brackish to saline water quality and low yields;
- Monitoring of the coal seams found that groundwater in the coal seam aquifers have electrical conductivity ranging from about 700 µS/cm to 35,000 µS/cm; and
- The shallow alluvium aquifers in the area of the mine are highly variable in salinity ranging from brackish to potable. Generally silty to clayey sediments are associated with poor quality water, whereas clean sands and gravels are likely to yield better quality water.

The predicted groundwater inflows for the CDM were provided by AGE (2018). A variable groundwater inflow rate is predicted over the life of the mine. The daily inflow rates over the simulation period are:

- 0.32 ML/day during 2018;
- 0.33 ML/day during 2019; and
- 0.38 ML/day during 2020.

A proportion of the predicted groundwater inflows may be lost from the water balance as moisture in coal extracted from the seam (entrained water) and evaporation from exposed coal seams. AGE (2018) state that such losses are considered negligible in the context of the modelled annually averaged groundwater inflow rates provided. Hence, the potential groundwater losses from the exposed coal seam have been assumed negligible for the purposes of the site water balance and surface water assessments given that:
• possible evaporation losses from exposed coal seams would be many orders of magnitude lower than evaporation losses from mine water storages; and
• entrained water has been accounted in the site water balance as moisture in the ROM coal.

The available groundwater monitoring results indicate the following:
• pH (field) ranges from 5.5 to 8.0; and
• EC ranges from 700 to 35,000 \( \mu s/cm \).

### 4.5 COAL WASHING/PROCESSING

The fine rejects from the CHPP will be disposed via a pipeline into either the rejects dams, integrated waste landforms or in a final void (Pit 1). Rejects are in the form of a wet slurry composed of fine silt, clay, water and coal material. Coarse rejects are disposed of in-pit in backfilled spoil.

The available monitoring results in Rejects Dam Cell 1 when active indicate the following:
• pH (field samples) ranges from 4.5 to 8.5; and
• EC (field samples) ranges from 1,870 to 3,890 \( \mu s/cm \).

Seepage water quality from Rejects Dam Cell 1 is more concentrated and of poorer quality than the water stored in the dam and available monitoring data indicate the following:
• pH (field samples) ranges from 4.5 to 8.9; and
• EC (field samples) ranges from 6,540 to 29,700 \( \mu s/cm \).

### 4.6 CHEMICAL STORAGE

Diesel and other hydrocarbon fuels are consumed by the haul trucks and other mobile equipment. Fuel storage facilities are located in designated areas.

Reagents are used in the coal preparation process and blasting process and are stored in bulk. Lubricants and solvents are also used on the mine. Waste lubricants and solvents are contained and transported off site for recycling or reuse.

Fuel storages areas at the mining workshop have been constructed and bunded in accordance with the relevant specification of AS1940 – Storage and Handling of Flammable and Combustible Liquids (AS1940). Fuel storage areas associated with the operation are inspected regularly and maintenance work completed on as-needs basis. Bunds filled with stormwater are drained (i.e. diesel/oil storage bunding at warehouse drains to oil sump and onto oil separator system) or pumped out by a licensed contractor as soon as practical to maintain the bund volume.

### 4.7 EXTERNAL WATER

CDM source ‘external’ water from Queensland Gas Corporation’s (QGCs) Glen Eden Pond to meet shortfalls for the on-site water demands when they cannot be met by onsite sources. This ‘external’ water is extracted during QGCs coal seam gas operations and supplied to CDM (via a pipeline) and stored in the Raw Water Dam.

The quality of ‘external’ QGC water, which is a blend of raw (untreated) water and water treated by reverse-osmosis, is monitored weekly during transfers to ensure that it is within acceptable water quality limits.

The available water monitoring data indicate the following for ‘external’ QGC water:
• pH ranges from 8.5 to 9.7; and
• TDS ranges from 1,100 to 4,300 mg/L.

Note that water quality is measured at Glen Eden Pond and transfers only occur if water quality is within the acceptable limits.
5 Surface water management

5.1 OVERVIEW

This section of the WMP describes the objectives and principles of the water management system (WMS) including a description of the infrastructure and measures that have been put in place to achieve these objectives and principles.

5.2 SURFACE WATER TYPES

For surface water management purposes, the surface runoff water generated in the CDM area is divided into three types based on water quality:

- **‘Diverted’** - surface runoff water from areas of the CDM where water quality is unaffected by mining operations. ‘diverted’ water includes runoff from undisturbed areas;
- **‘Surface’** - surface runoff water and seepage from the CDM areas that are disturbed by mining operations such as overburden spoil dumps and roads. This runoff may contain silt and sediment but is unlikely to contain contaminant concentrations in excess of the CDM EA release limits for water quality parameters. However, this runoff must be of suitable quality if discharge into receiving waters if required; and
- **‘Worked’** - surface runoff water and seepage from CDM areas affected by mining operations and potentially containing chemicals of various types generated by mining operations. Areas where hazardous waste can potentially be generated include the open pit, service bays, fuel storage areas, and process areas. Runoff from these areas must be managed to avoid discharge of potentially contaminated water into the receiving waters. There are restrictions on the use and release of this water.

The following type of water used at the CDM site is also of relevance to the proposed surface water management system based on its water quality:

- **‘External’** - groundwater that has been extracted as part of the coal seam gas operations from the QGC and supplied to CDM (via Glen Eden Pond). A proportion of this water undergoes reverse osmosis treatment by QGC prior to entering the CDM WMS. There are currently restrictions within the EA on the use of this water.

5.3 MANAGEMENT OBJECTIVES

The key operational objectives of the CDM WMS include the following:

- Protect the integrity of local and regional water resources;
- Maintain separation between ‘diverted’ runoff and water generated from mine impacted areas;
- Operate in accordance with the requirements of this WMP and EA conditions; and
- Provide a reliable source of water for mining and CHPP processing.

To achieve these objective, the following measures are taken:

- Separate ‘diverted’, ‘surface’ and ‘worked’ water runoff as much as possible;
- Minimise the area of surface disturbance, thus limiting the volume of ‘surface’ and/or ‘worked’ runoff and at the same time limit external water supply requirements;
- Manage 'worked' and 'surface' water on site via containment storages or sediment dam's dependant on the quality of water likely to be generated;
• Release ‘surface’ water following sediment removal through a sediment management structure (e.g. sediment dams), provided water quality is within the Cameby Downs EA water quality release limits;
• Segregate, collect and contain all ‘worked’ water runoff as much as possible on site via adequately sized containment storages;
• Provide permanent pumping infrastructure to allow transfer of ‘worked’ water between containment storages as required, to limit the potential for worked water overflows to the receiving environment and build-up of water in active open pits; and
• Limit ‘diverted’ and ‘external’ water consumption and prioritise the reuse of ‘surface’ and ‘worked’ water within the mine site (e.g. for coal washing).

5.4 WATER MANAGEMENT SYSTEM

The layout of the worked water and surface water management systems are shown in Figure 3.1 and shown schematically in Figure 5.1.

5.5 ‘WORKED’ WATER DAMS

5.5.1 General description

Figure 1.2 shows the locations of the ‘worked’ water dams. ‘Worked’ water collected in the open pit and the infrastructure areas will be managed using five existing water storages (Raw Water Dam, Admin Dam, MIA Dam, Mine Water Dam, Return Water Dam). Excess ‘worked’ water will be stored in WMD1 from 2019. Table 5.1 shows the ‘worked’ water dam full storage level volumes, catchment areas and estimated preliminary consequence category for ‘worked’ water storages.

<table>
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<th>Dam ID</th>
<th>Operating Volume (ML)</th>
<th>FSL Volume (ML)</th>
<th>Catchment area (ha)</th>
<th>Preliminary Consequence Category</th>
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<td>90</td>
<td>4</td>
<td>Low</td>
</tr>
<tr>
<td>Admin Dam</td>
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<td>2,250</td>
<td>59</td>
<td>Low(^a)</td>
</tr>
</tbody>
</table>

\(^a\) A consequence category assessment should be undertaken for this storage during detailed design.
Figure 5.1 - Water management system schematic
5.5.2 Raw Water Dam and Admin Dam

Raw Water Dam and Admin Dam are turkey’s nest storages with no external catchment area. These dams are operated as a linked system. ‘External’ water is pumped into these dams from the QGCs Glen Eden Pond at a maximum rate of up to 4 ML/d. MIA Dam will dewater into Raw Water Dam and Admin Dam prior to the wet season (1 November) each year to limit the risk of overflows to Drainage Line 1.

Raw Water Dam and Admin Dam will be the primary source of water for the CHPP water demand and all industrial / Infrastructure water demands. The combined storage capacity of Raw Water Dam and Admin Dam is approximately 180 ML. This will allow for storage of up to approximately 45 days of continuously pumped inflows from the Glen Eden Pond. Potential overflows from RWD1 will be directed into MIA Dam.

5.5.3 MIA Dam

The MIA Dam catchment area consists of the coal stockpiles, CHPP, laydown areas and maintenance areas. The runoff from the MIA dam catchment is considered ‘worked’ water. The MIA dam transfers to the Admin Dam when the stored volume is above its operating capacity or to meet CHPP demands at a rate of up to 8.6 ML/day.

5.5.4 Mine Water Dam 1

MWD1 is a turkey’s nest dam with no external catchment. MWD1 will be used as an open pit water storage and transfer dam. ‘Worked’ water collected in the open pit will be dewatered to MWD1. ‘Worked’ water will also be transferred to the MWD1 from Raw Water Dam and Admin Dam as required for dust suppression. MWD1 will transfer dewatered open pit water to the Raw Water Dam and Admin Dam at a combined rate of up to approximately 8.6 ML/d.

5.5.5 Return Water Dam 1

RWD1 will collect potentially ‘worked’ water that is decanted from RD1. RWD1 is a Turkey’s nest dam with no external catchment area. ‘Worked’ water will be transferred either to meet the CHPP water demand or to the Raw Water Dam and Admin Dam at a combined rate of up to 4.6 ML/d.

5.5.6 Rejects Dam 1

RD1 will collect fine (rejects) rejects from the CHPP during 2018 and 2019. The following is of note with respect to the rejects water management system:

- Rejects slurry water has the potential to contain water that exceeds the contaminant concentration release limit. Hence, this water is considered ‘worked’ and appropriate management measures should be implemented to contain and reuse this water within the CDM mine water system;
- Return water from RD1 will be used for makeup water demand in the CHPP and dust suppression, if required; and
- RD1 will be operated to store its DSA requirement within the dam itself or WMD1 (2019 and 2020 only); and
- RD1 won’t receive fine rejects after 2019. RD1 will remain an active storage with the same operating rules until rehabilitated.

5.5.7 Water Management Dam 1

Additional ‘worked’ water dams may be required to manage excess ‘worked’ water generated at CDM. Excess ‘worked’ water will predominantly be generated by rainfall and runoff into Pit 1 and RD1.

WMD1 will be used as a storage from 2019, if required. WMD1 will require an operational storage capacity of 2,000 ML (90% of FSL).
5.6 REJECTS MANAGEMENT

Coarse rejects will be disposed of in Pit 1 within backfilled spoil in an integrated waste landform. Syntech have advised fine (rejects) rejects disposal will occur in the following locations/structures and years:

- RD1 for years 2018 and 2019; and
- Integrated waste landform within the backfilled Pit 1 from year 2020.

5.7 OPEN PIT WATER MANAGEMENT

Figure 1.2 shows the open pit progression from 2018 to 2020. The open pit mine progression in regards to the WMS is managed as follows:

- the "pre-strip" in the front of mining will be managed under the sites ESCP, not the WMS;
- the open pit catchment area will remain approximately the same as the pit progresses, this is due to spoil backfilling the pit (no out of pit dumping); and
- the in-pit spoil dump will be raised to approximately 340 m RL, which is above natural surface. The in-pit spoil dump will drain northeast towards Sediment Dam 1, increasing the catchment of Sediment Dam 1 by approximately 50 ha per year.

It is proposed to provide DSA requirements for Pit 1 within WMD1 when constructed. When the combined open pit water inventory exceeds 50 ML, water will be pumped to WMD1 at a dewatering rate of 8.6 ML/day. In the unlikely event that WMD1 is full, excess water will be stored in an inactive area of the open pit.

‘Worked’ water collected in the open pits will primarily be used in the water management system for use in the CHPP, industrial/infrastructure water demands and dust suppression.

5.8 PRELIMINARY CONSEQUENCE ASSESSMENT OF ‘WORKED’ WATER STORAGE

5.8.1 General

A preliminary assessment of the consequence category of all ‘worked’ water dams and open pits was undertaken based on the procedures given in DEHP’s ‘Manual for Assessing Consequence Categories and Hydraulic Performance of Structures’ (DEHP, 2016). Figure 5.2 shows the adopted design configuration for significant and high consequence dams. Based on DEHP (2016), the following is of note:

- Mandatory Reporting Level (MRL) volume (Extreme Storm Storage (ESS)) is the minimum volume of freeboard between the spillway and the stored water volume that is allowed in the storage before pumped inflows must cease. No water will be pumped into a storage that exceeds the MRL. The required airspace volume for the ESS has been calculated for significant consequence dams as:
  - 10% AEP (10 year ARI) 72-hour rainfall depth (158 mm) multiplied by the contributing catchment area (assuming no rainfall losses).

- Design Storage Allowance (DSA) volume is the minimum volume of freeboard between the spillway and the stored water volume that must be provided for regulated dams on 1 November each year. The required airspace volume for the DSA volume has been calculated for significant consequence dams as:
  - 5% AEP (20 year ARI) 4-month rainfall depth (595 mm) multiplied by the contributing catchment area plus net inflows into the dam during a 4-month period.

- Full Storage Level (FSL) volume is the capacity of the storage from the base to the spillway of the dam.
• Dam spillway capacities for significant consequence dams will be appropriately sized to convey up to between the 1% AEP (100 year ARI) and 0.1% AEP (1,000 year ARI) discharges plus wave run-up allowance for 10% AEP (10 year ARI) wind.

• The spillway capacity requirement depends on the potential implications of a failure to contain and/or dam break scenario. The appropriate dam spillway size will be determined during detailed design.

![Figure 5.2 - Typical water management dam cross-section for regulated dams](image)

5.8.2 ‘Worked’ water dams

Table 5.1 shows the results of the preliminary consequence assessment for each existing and proposed dam for the CDM.

All proposed ‘worked’ water dams except for the rejects dams and their return water dams have been assigned a preliminary category of low consequence due to the low risk of significant consequence in the event of a failure to contain or dam break. The preliminary ‘low’ category reflects the small pumped transfer rates and dam storage capacities compared with natural flows and low expected total dissolved solid (TDS) concentrations.

RD1 and RWD1 have been assigned at least a significant consequence category due to the potential cost of remediation and water quality impacts caused by the possible release of coal rejects in the event of a failure to contain (overflow) and dam break scenario. As a result, RD1 and RWD1 will likely require a DSA and ESS volume.

Table 5.2 shows the preliminary estimates of DSA and ESS volume requirements for RD1 and RWD1 based on a significant consequence category.

The following is of note:

- The water quality of each ‘worked’ water dam will be monitored to confirm the appropriate consequence category for each dam.
- A failure to contain and dam break assessment will be undertaken at the detailed design stage to confirm the appropriate consequence category for each dam.
- The DSA and ESS preliminary estimates are based on the method of deciles, which assumes there are no losses in the system from evaporation or seepage. Other methods may be adopted if there is sufficient historical recorded water level/volume data for the ‘worked’ water dams.
Table 5.2 - Preliminary DSA/ESS requirements

<table>
<thead>
<tr>
<th>Dam</th>
<th>DSA/ESS (ML)</th>
<th>Operational Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>RD1 and RWD1</td>
<td>400/110</td>
<td>2018 and 2019</td>
</tr>
</tbody>
</table>

5.8.3 Pit 1

Table 5.3 shows the total contributing catchment area and preliminary DSA requirement for Pit 1. The DSA has been calculated based on a significant consequence category using the method of deciles, which assumes that there are no losses in the system from evaporation or seepage. Other methods may be adopted if there is sufficient historical recorded water level/volume data for the open pit.

Table 5.3 - Contributing catchment area and preliminary DSA requirements for Pit 1

<table>
<thead>
<tr>
<th>Pit 1 Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catchment area (ha)</td>
</tr>
<tr>
<td>Preliminary estimate of wet season containment (DSA) requirement (ML)</td>
</tr>
</tbody>
</table>

5.9 CHEMICAL STORAGE

Primary chemical storage areas at CDM are located on the mine infrastructure area at the workshop area. These storage facilities are constructed and bunded in accordance with the relevant specifications of AS1940 - Storage and Handling of Flammable and Combustible Liquids (AS1940). Hazardous Substances SOP are in place at these operations. A register is also maintained on site for all chemicals. Where appropriate, MSDSs will be kept in storage areas or accessed on line, as required.

5.10 FUEL STORAGE

Fuel storage areas are a potential source of hydrocarbons. Primary fuel storage areas at the mine infrastructure area will be constructed and bunded in accordance with the relevant specifications of AS1940 - Storage and Handling of Flammable and Combustible Liquids (AS1940). Fuel storage areas have also been constructed at service and operational points across the mining lease.

Fuel storage areas associated with CDM operations will be inspected regularly, with repair and maintenance work completed on an as-needs basis. Bunds filled with stormwater are drained (i.e. diesel/oil storage bunding at warehouse drains to oil sump and onto oil separator system) or pumped out by a licensed contractor as soon as practicable to maintain the bund volume.

5.11 SEWAGE

Sewage is managed through a package STP which services the workshop, CHPP and admin office block. The treated effluent is irrigated in accordance with Schedule G of the CDM EA. Solids from the STP and sewage from other sources at site will be trucked off site by registered waste transport contractors.

5.12 ‘SURFACE’ RUNOFF MANAGEMENT MEASURES

The ‘surface’ water drains will direct runoff from active in-pit and out-of-pit spoil dumps towards sediment dams. Based on water quality data for Sediment Dam 1, runoff from the existing out-of-pit spoil dump is of a quality that can be released to the receiving waters following removal of sediment as per the ESCP. Note that if runoff and/or seepage from future active spoil areas is found to be ‘worked’ water quality, active management measures and/or additional storage volume would be required to fully contain the ‘worked’ water on site.
It is expected that ‘surface’ water drains and sediment dams located within the project area will be operational (once constructed) until the active spoil dumps in the connected catchment area have been fully rehabilitated and it can be demonstrated (with water quality tests) that runoff from the catchment is of suitable quality to release to the downstream environment without active sediment removal management (i.e. ‘diverted’ runoff). Overflows from sediment dams will be directed into the receiving waters.

‘Surface’ water drains and sediment dams will be designed in accordance with the site ESCP. The design criteria in the ESCP is based on the Best Practice Erosion & Sediment Control’, International Erosion Control Association (IECA, 2008).

5.13 DIVERTED RUNOFF MANAGEMENT MEASURES

5.13.1 Flood protection levees

The flood protection levees will be used to protect key mine infrastructure such as open pits and infrastructure areas from inundation and to direct diverted runoff from undisturbed upstream catchments around potentially disturbed and/or contaminated areas.

Details of the design and assessment of the proposed flood protection levees are documented separately in the flood study report (WRM, 2018a). The following sections provide a summary of the proposed flood protection levees.

5.13.1.1 Flood protection size requirements

Figure 5.3 shows the 100 year ARI flood extent and the alignments of the following proposed flood protection levees:

- Infrastructure levee to protect the mine infrastructure from up to 100 year ARI flood events;
- Pit 1 North Levee to protect Pit 1 from up to 1000 year ARI flood events.

CWD1 is also required for the ‘diverted’ water catchment to the northwest of Pit 1 North Levee. CWD is a ‘diverted’ water drain and needs to be constructed at the same time as the Pit 1 North Levee.

Table 5.4 shows a summary of the design flood depths along the proposed levees and the year by which each of the proposed levees would need to be commissioned. The proposed flood protection levees will include a 0.5 m freeboard above the appropriate design flood level.

<table>
<thead>
<tr>
<th>Levee ID</th>
<th>Length (m)</th>
<th>Average 1000 Year ARI Flood Depth (m)</th>
<th>Maximum 1000 Year ARI Flood Depth (m)</th>
<th>Indicative Commissioning Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pit 1 North</td>
<td>250</td>
<td>0.75</td>
<td>1.40</td>
<td>2019</td>
</tr>
<tr>
<td>Infrastructure Levee a</td>
<td>1,000</td>
<td>0.70</td>
<td>1.60</td>
<td>2019</td>
</tr>
</tbody>
</table>

* - Average and maximum depths are for the 100 Year ARI flood event

5.13.1.2 Flood protection levee design notes

The following is of note with respect to the design of the proposed flood protection levees:

- Infrastructure areas (including process areas, site offices, contaminated water storage spillways, etc.) will be protected from inundation for flood events up to a 1% AEP (100 year ARI) during CDM operations;
• Flood protection levees around open pits will be constructed with a crest level at least above the 0.1% AEP (1000 year ARI) level plus a suitable freeboard in accordance with DEHP (2016);
• Flood protection levees will be designed and constructed to appropriate engineering standards;
• Adequate erosion protection will be provided on the banks of the flood protection levee to withstand erosive forces generated by floodwaters from Drainage Line 1, Drainage Line 3 and local gullies and overland flow paths; and
• Flood protection levees will be constructed at least one year in advance of the open pit progression schedule during the dry season to minimise the potential risk of open pit inundation.

5.13.2 ‘Diverted’ water drains

The proposed ‘diverted’ water drains will be used to direct ‘diverted’ runoff from undisturbed upstream catchments around potentially disturbed and/or contaminated areas. Figure 1.2 shows the location of the CWD1. Catchments that are fully rehabilitated will also be considered ‘diverted’ water catchments and drained off site, not through sediment dams.

A number of other minor drains and bunds would be required to direct upslope ‘diverted’ runoff around areas of disturbance. For example, temporary ‘diverted’ water drainage works will be required to prevent overland flow from entering the Pit from the east from year 2019 (see Figure 5.3). These works could be in the form of a bund and/or drain. These ‘diverted’ runoff works will be constructed in accordance with the site’s ESCP.

‘Diverted’ water drains will be sized and designed in accordance with the site ESCP. The design criteria in the ESCP is based on the Best Practice Erosion & Sediment Control (IECA, 2008).
Figure 5.3 – 100 year ARI flood extent and flood protection infrastructure

Temporary drainage works to divert overland flow from year 2019 mine plan.
6  Mine site water balance

6.1 OVERVIEW

As part of the preparation of this WMP, a water balance model was built to represent the CDM water management system, using the OPSIM software (Water Solutions, 2017). OPSIM is a daily timestep water balance model that dynamically simulates the operation of the site water management system. The model estimates daily catchment runoff using the AWBM model (Boughton, 2003).

The water balance model simulates the operation of the major components of the water management system, including:

- Climatic variability - rainfall and evaporation;
- Catchment runoff and collection;
- Pit dewatering;
- Pump transfers;
- Water storage filling, spilling, evaporation and leakage;
- Process water extraction, usage and return; and
- Regional groundwater inflows.

The water balance model comprises a collection of functional nodes, each representing a specific operational feature of the mine’s water management system. A schematic layout of the existing CDM model is presented in Figure 5.1. Operational guidelines and controls applied to the model are described in Appendix C.

Catchment runoff parameters were based on parameters adopted in a recent CDM study (WRM, 2018b).

The water balance modelling outcomes are dependent on the accuracy of input assumptions. There is inherent uncertainty with respect to some key site characteristics (e.g. catchment yield/rainfall runoff, mining area groundwater inflows). The monitoring requirements detailed in Section 7 should assist with reducing this uncertainty associated with the water balance modelling outcomes.

The modelling is based on long-term historical climatic data and it is assumed that the climatic sequences which have occurred over the past 128 years are representative of future climatic patterns. The potential changes in climate (such as climate change effects) are not modelled.

Detailed information relating to the set-up and calibration of the CDM water balance model is provided in Appendix C.

6.2 ASSESSMENT METHODOLOGY

An assessment of the proposed CDM mine water management system (discussed in Section 5) during the three year (calendar years) period (2018 to 2020) was undertaken using the CDM OPSIM Model. The CHPP demands vary each year based on coal forecasts. All other demands are constant. Assessment of the performance of the water management system was undertaken against the following key performance indicators:

- Mine water storage behaviour;
- External water requirements;
- Uncontrolled off-site discharges; and
• Overall site water balance.
Details of the assessment outcomes are discussed in the following sections.

For this assessment, the model has been run as a “forecast” assessment. A description of the assessment is as follows:

• The model is run as a single 3-year forecast (2018, 2019 and 2020 calendar years) based on the proposed WMS configuration and CHPP throughput. A 3-year forecast has been adopted as it provides an indication of WMS performance for the short to medium term.

• The model is run using 128 years of rainfall data, to produce 126 sets of individual results (or realisations) and the results are then presented as percentiles versus time. That is, the first run uses rainfall data from 1889-1891, the second uses 1890-1892 and so on.

• The forecast assessment results are presented as “percentile traces”, which provide an envelope of the results. Note that a “percentile trace” shows the percentile chance of a particular value on each day, and does not represent continuous results from a single model realisation.

• This type of assessment is most suited to tracking inventory changes over the length of a forecast period.

6.3 PERFORMANCE OF THE CDM WATER MANAGEMENT SYSTEM

6.3.1 Overview
The performance of the proposed water management system was assessed for five climatic conditions: very dry (99% confidence trace), dry (90% confidence trace), median (50% confidence trace), wet (10% confidence trace), and very wet (1% confidence trace) to provide a range of possible storage behaviours based on the 128 sequences of rainfall data modelled for the 3-year period. These confidence traces represent the following:

• The 99% confidence trace represents ‘very dry’ climatic conditions during CDM. There is a 1% chance that conditions will be this dry;

• The 90% confidence trace represents ‘dry’ climatic conditions during CDM. There is a 10% chance that conditions will be this dry;

• The 50% confidence trace represents ‘median’ climatic conditions during CDM and is the most likely scenario;

• The 10% confidence trace represents ‘wet’ climatic conditions during CDM. There is a 10% chance that conditions will be this wet; and

• The 1% confidence trace represents ‘very wet’ climatic conditions. There is a 1% chance that conditions will be this wet.

6.3.2 Open pit storage behaviour
Figure 6.1 shows the predicted variation in Pit 1 storage volumes for very dry (99% confidence trace), dry (90% confidence trace), median (50% confidence trace), wet (10% confidence trace) and very wet (1% confidence trace) climate conditions. Figure 6.2 shows the number of days per year that more than 50 ML would be stored in Pit 1.

The following is of note with respect to these results:

• Under very wet (1% confidence trace) climate conditions, Pit 1 will have an inventory of:
  o up to 704 ML during 2018;
  o up to 532 ML during 2019; and
  o up to 270 ML during 2020.
• Pit 1 inventory is greater than 50 ML under very wet (1% confidence trace) climate conditions due to storage or pumping capacity limitations for:
  o up to 359 days during 2018;
  o up to 215 days during 2019; and
  o up to 287 days during 2020.
• Under wet (10% confidence trace) climate conditions, Pit 1 will have an inventory of
  o up to 246 ML during 2018;
  o up to 240 ML during 2019; and
  o up to 41 ML during 2020.
• Pit 1 inventory is greater than 50 ML under wet (10% confidence trace) climate conditions due to storage or pumping capacity limitations for a maximum of:
  o up to 349 days during 2018;
  o up to 42 days during 2019; and
  o 0 days during 2020.
• Under all other climate conditions considered, Pit 1 does not store water greater than 50 ML.

The above results assume that Pit 1 will be fully dewatered to either the ‘worked’ water system to meet on-site water demands or to a WMD1 to provide minimal disruption to mining operations. If adequate storage capacity is not made available to dewater Pit 1, excess water would have to be held in an inactive part of Pit 1 until spare storage becomes available or released to the receiving waters under the approved EA conditions. If water has to be held in Pit 1 for prolonged periods of time, this may cause interruptions to coal production.

Figure 6.1 – Predicted variation in Pit 1 storage volume
6.3.3 Water Management Dam 1

WMD1 was assumed to be operational from the start of 2019 for modelling purposes. Excess water that can’t be stored in other ‘worked’ water dams will be pumped to WMD1 to prevent pit inundation. WMD1 has a modelled capacity of 2,250 ML. Any excess water that is unable to be stored in the WMD1 will be held in Pit 1.

Figure 6.3 shows the modelled variation in WMD1 volumes for very dry (99% confidence trace), dry (90% confidence trace), median (50% confidence trace), wet (10% confidence trace) and very wet (1% confidence trace) climate conditions.

The following is of note with respect to the results:

- Under very wet (1% confidence trace) climate conditions, WMD1 has a maximum inventory of:
  - Up to 1,390 ML during 2019; and
  - Up to 1,879 ML during 2020.
- Under wet (10% confidence trace) climate conditions, WMD1 has a maximum inventory of:
  - Up to 596 ML during 2019; and
  - Up to 917 ML during 2020.
- Under median (50% confidence trace) climate conditions, WMD1 has a maximum inventory:
  - Up to 152 ML during 2019; and
  - Up to 233 ML during 2020.
- Under dry and very dry (90% to 99% confidence trace) climate conditions, WMD1 does not store water.

The results predict that site may require the WMD1 for median to very wet climate conditions from 2019. WMD1 would not reach its storage capacity under any climate conditions in the 3 year period investigated.
6.3.4 Rejects Dam 1 storage behaviour

Figure 6.1 shows the predicted variation in RD1 storage volumes for very dry (99% confidence trace), dry (90% confidence trace), median (50% confidence trace), wet (10% confidence trace) and very wet (1% confidence trace) climate conditions. The following is of note with respect to these results:

- Under very wet (1% confidence trace) climate conditions, RD1 will have an inventory of:
  - up to 286 ML during 2018;
  - up to 126 ML during 2019; and
  - up to 62 ML during 2020.

- Under all other climate conditions considered, RD1 does not store water greater than 50 ML.

The above results assume that the RD1 will be fully dewatered to either the ‘worked’ water system to meet on-site water demands or to a WMD1 to provide minimal disruption to mining operations. The results indicate that from 2019 when WMD1 is constructed, RD1 will not store any water for a prolonged period. Until WMD1 is commissioned, RD1 will require at least 300 ML of storage capacity. This is less than the DSA specified for RD1 in Table 5.2.
6.3.5 ‘External’ (QGC) water supply requirements

The model results predict that there would be no supply shortages from the ‘external’ QGC supply assuming the maximum available supply is 1460 ML/yr (4 ML/day). The potential site demands are:

• up to 311 ML/yr during 2018;
• up to 564 ML/yr during 2019; and
• up to 475 ML/yr during 2020.

Figure 6.5 shows the predicted annual maximum volume (in ML) of ‘external’ QGC water supply required to meet on-site water demands for the very dry (99% confidence trace), dry (90% confidence trace), median (50% confidence trace), wet (10% confidence trace) and very wet (1% confidence trace) climate conditions.

The following is of note with respect to the model results:

• The predicted total ‘external’ QGC water supply requirement ranges between 0 ML to 830 ML during 3 years of operations;
• There is a 50% probability that less than 91 ML of ‘external’ QGC water will be required during the 3 year period;
• There is a 90% probability that less than 554 ML of ‘external’ QGC water will be required during the 3 year period; and
• There is a 99% probability that less than 829 ML of ‘external’ QGC water will be required during the 3 year period.
6.3.6 ‘Worked’ water dam overflow frequencies and volumes

‘Worked’ water dams have an assumed maximum operating capacity of 80% of FSL volume to minimise the risk of spills. The MIA dam is the only ‘worked’ water dam with an external catchment and a predicted risk of releases (spills) to the receiving waters (Drainage Line 1).

Figure 6.6 shows the predicted annual spill risk and annual spill volume for the MIA dam. Figure 6.7 shows the corresponding spill EC values for the same spill risk. The annual exceedance probability (AEP) spill risk from the MIA Dam is predicted to decrease from 4% AEP in 2018 to 1% AEP in 2020, this is due to the construction of WMD1 which provides additional storage capacity and allows MIA Dam to be de-watered to reduce the risk of spills.

Note that the results for MIA Dam were provided in AEP due to the change in spill risk over the next 3 years.

The following is of note with respect to the results:

- During 2018 the MIA Dam is predicted to have the following AEP spill risk volumes and corresponding ECs:
  - 1% spill volume of up to 120 ML with a maximum EC of 1,290 μs/cm;
  - 2% spill volume of up to 18 ML with a maximum EC of 1,264 μs/cm;
  - 3% spill volume of up to 8 ML with a maximum EC of 1,253 μs/cm; and
  - 4% spill volume of up to 7 ML with a maximum EC of 1,244 μs/cm.

- During 2019 the MIA Dam is predicted to have the following AEP spill risk volumes and corresponding ECs:
  - 1% spill volume of up to 110 ML with a maximum EC of 1,314 μs/cm;
  - 2% spill volume of up to 24 ML with a maximum EC of 1,295 μs/cm;
  - 3% spill volume of up to 5 ML with a maximum EC of 1,265 μs/cm; and
  - 4% spill volume of Zero (0 ML).

- During 2020 the MIA Dam is predicted to have the following AEP spill risk volumes and corresponding ECs:
  - 1% spill volume of up to 3 ML with a maximum EC of 1,251 μs/cm;
2% spill volume of Zero (0 ML).

The results predict the maximum EC of spills is less than 1500 μs/cm, which is below the release limit for “low flow” criteria in the CDM EA release limits (see Table 3.2). The predicted EC in the receiving waters is discussed in Section 6.3.8.

![Figure 6.6 - Predicted variation annual spill risk volumes from MIA Dam during operations](image)

6.3.7 ‘Surface’ water releases from Sediment Dam 1

Sediment Dam 1 is managed under the CDM ESCP and therefore has a higher release (spill) frequency than ‘worked’ water dams. The spill risk was assessed to predict the impact of increasing the catchment area of Sediment Dam 1 as the mine progresses.

Figure 6.8 shows the predicted variation in Sediment Dam 1 spill volumes for very dry (99% confidence trace), dry (90% confidence trace), median (50% confidence trace), wet (10%...
confidence trace) and very wet (1% confidence trace) climate conditions. Figure 6.9 shows the corresponding spill EC values for the same climate (confidence) traces.

The following is of note with respect to the results:

- Under very wet (1% confidence trace) climate conditions, Sediment Dam 1 is predicted to have a yearly spill volume of:
  - up to 925 ML with a maximum EC of 353 \( \mu s/cm \) during 2018;
  - up to 1,250 ML with a maximum EC of 401 \( \mu s/cm \) during 2019; and
  - up to 1,286 ML with a maximum EC of 376 \( \mu s/cm \) during 2020.

- Under wet (10% confidence trace) climate conditions, Sediment Dam 1 is predicted to have a yearly spill volume of:
  - up to 242 ML with a maximum EC of 326 \( \mu s/cm \) during 2018;
  - up to 430 ML with a maximum EC of 337 \( \mu s/cm \) during 2019; and
  - up to 543 ML with a maximum EC of 326 \( \mu s/cm \) during 2020.

- Under median (50% confidence trace) climate conditions, Sediment Dam 1 is predicted to have a yearly spill volume of:
  - Zero (0 ML) spills during 2018;
  - up to 22 ML with a maximum EC of 228 \( \mu s/cm \) during 2019; and
  - up to 87 ML with a maximum EC of 199 \( \mu s/cm \) during 2020.

- Under other climate conditions considered, Sediment Dam 1 is not predicted to spill.

The results predict that the increasing catchment area of Sediment Dam 1 (by 50 ha per year) will have an impact on the frequency and volume of spills. However, the maximum EC is predicted to be less than 500 \( \mu s/cm \), which is below the release limit for “no flow” criteria in the CDM EA Table F3 release limits (see Table 3.2). The predicted EC in the receiving waters is discussed in Section 6.3.8.

The increasing spill frequency and volume into the receiving waters from Sediment Dam 1 highlights the importance of implementing adequate ESC measures to manage TSS.

![Figure 6.8 - Predicted variation in annual spill volumes from Sediment Dam 1 during operations](image-url)
6.3.8 Drainage Line 1 water quality

The two potential sources of receiving waters contamination from the CDM WMS are releases (spills) from Sediment Dam 1 and releases (spills) from the ‘worked’ water dams. The MIA Dam is the only ‘worked’ water dam that has a predicted risk of spilling (with a spill risk less than 5% AEP). All other ‘worked’ water dams are not predicted to spill.

Potential impacts to EC in the receiving waters were assessed for Drainage Line 1 downstream of the CDM at monitoring point WS1 (see Figure 2.1). The potential impact of periodic releases on water quality in Drainage Line 1 was assessed for EC against the compliance criteria for release limits and receiving waters water quality trigger levels in the CDM EA conditions given in Table 3.2 and Table 3.4.

Figure 6.10 shows the predicted variation water quality (EC) in the receiving waters of DL1 at WS1. The results predict the maximum EC in the receiving waters of 401 μs/cm under all climate conditions. The predicted maximum EC in the receiving waters is lower than the trigger level in Table F5 of CDM EA (see Table 3.4) for ‘no flow’ (500 μs/cm) and ‘low’ to ‘High flow’ (1,000 μs/cm) criteria.

No mine water dam releases are predicted to occur into Drainage Line 2.
Figure 6.10 - Predicted variation in maximum EC value in the receiving waters of Drainage Line 1 at WS1

6.3.9 Mine site water balance

Table 6.1 to Table 6.3 present representative mine site water balance results for each year as well as the total 3 year period (2018 to 2020) of mining based on simulation results for a 3 year total rainfall for dry (90th percentile), median (50th percentile) and wet (10th percentile) realisations. It should be recognised that rainfall, runoff, and evaporation of the water balance are highly variable from year to year because they are subject to climatic variability.

The following is of note with respect to the model results:

- Under median and dry climate conditions, site is a net consumer of water over the next 3 years.
- Under wet climate conditions, site is a net producer of water for the next 3 years;
- The total ‘external’ QGC water requirement during CDM operations for the next 3 years are approximately 755 ML, 301 ML and 0 ML for a dry, median and wet rainfall sequence, respectively.
- The total ‘worked’ rainfall and runoff inflows for the next 3 years are approximately 860 ML, 2,136 ML and 3,768 ML for a dry, median and wet rainfall sequence, respectively;
- The predicted water supply from groundwater inflows during the next 3 years of operations is 376 ML; and
- The predicted water lost in rejects entrainment (fines and coarse) during the next 3 years of operations is 786 ML.
Table 6.1 - Representative average annual water balance between 2018 to 2020, median (50th percentile) rainfall sequence (realisation 112)

<table>
<thead>
<tr>
<th>Component</th>
<th>Process</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>Total (3 years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflows</td>
<td>‘Surface’ Water Rainfall Runoff</td>
<td>52</td>
<td>514</td>
<td>192</td>
<td>758</td>
</tr>
<tr>
<td></td>
<td>‘Worked Water Rainfall Runoff</td>
<td>261</td>
<td>1,242</td>
<td>632</td>
<td>2,136</td>
</tr>
<tr>
<td></td>
<td>Net Groundwater</td>
<td>117</td>
<td>121</td>
<td>139</td>
<td>376</td>
</tr>
<tr>
<td></td>
<td>QGC Water</td>
<td>271</td>
<td>29</td>
<td>0</td>
<td>301</td>
</tr>
<tr>
<td></td>
<td>Washed ROM Moisture</td>
<td>257</td>
<td>296</td>
<td>305</td>
<td>858</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>958</td>
<td>2,202</td>
<td>1,268</td>
<td>4,429</td>
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<tr>
<td>Outflows</td>
<td>Evaporation</td>
<td>158</td>
<td>462</td>
<td>558</td>
<td>1,179</td>
</tr>
<tr>
<td></td>
<td>Miscellaneous use</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>301</td>
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<tr>
<td></td>
<td>Dust Suppression</td>
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<td>365</td>
<td>365</td>
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<td></td>
<td>Washed Product Moisture</td>
<td>241</td>
<td>270</td>
<td>275</td>
<td>771</td>
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<tr>
<td></td>
<td>Rejects Entrainment</td>
<td>222</td>
<td>267</td>
<td>282</td>
<td>786</td>
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<tr>
<td></td>
<td>Columboola Creek Sediment Dam Releases</td>
<td>0</td>
<td>270</td>
<td>124</td>
<td>394</td>
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<tr>
<td></td>
<td>Mine Water Releases</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>1,087</td>
<td>1,735</td>
<td>1,705</td>
<td>4,526</td>
</tr>
<tr>
<td>Change in Site Water Inventory</td>
<td></td>
<td>-128</td>
<td>467</td>
<td>-437</td>
<td>-98</td>
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</tbody>
</table>
### Table 6.2 - Representative average annual water balance between 2018 to 2020, dry (90<sup>th</sup> percentile) rainfall sequence (realisation 14)

<table>
<thead>
<tr>
<th>Component</th>
<th>Process</th>
<th>Volume (ML/yr)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>2018</td>
</tr>
<tr>
<td><strong>Inflows</strong></td>
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</tr>
<tr>
<td>‘Surface’ Water Rainfall Runoff</td>
<td></td>
<td>37</td>
</tr>
<tr>
<td>‘Worked Water Rainfall Runoff</td>
<td></td>
<td>186</td>
</tr>
<tr>
<td>Net Groundwater</td>
<td></td>
<td>117</td>
</tr>
<tr>
<td>QGC Water</td>
<td></td>
<td>152</td>
</tr>
<tr>
<td>Washed ROM Moisture</td>
<td></td>
<td>257</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>749</td>
</tr>
<tr>
<td><strong>Outflows</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaporation</td>
<td></td>
<td>155</td>
</tr>
<tr>
<td>Miscellaneous use</td>
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<tr>
<td>Dust Suppression</td>
<td></td>
<td>365</td>
</tr>
<tr>
<td>Washed Product Moisture</td>
<td></td>
<td>241</td>
</tr>
<tr>
<td>Rejects Entrainment</td>
<td></td>
<td>222</td>
</tr>
<tr>
<td>Columboola Creek Sediment Dam Releases</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Mine Water Releases</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>1,084</td>
</tr>
<tr>
<td><strong>Change in Site Water Inventory</strong></td>
<td></td>
<td>-335</td>
</tr>
</tbody>
</table>
### Table 6.3 - Representative average annual water balance between 2018 to 2020, wet (10<sup>th</sup> percentile) rainfall sequence (Realisation 64)

<table>
<thead>
<tr>
<th>Component</th>
<th>Process</th>
<th>Volume (ML/yr)</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>Total (3 years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflows</td>
<td>‘Surface’ Water Rainfall Runoff</td>
<td></td>
<td>147</td>
<td>246</td>
<td>1,054</td>
<td>1,446</td>
</tr>
<tr>
<td></td>
<td>‘Worked Water Rainfall Runoff</td>
<td></td>
<td>659</td>
<td>934</td>
<td>2,175</td>
<td>3,768</td>
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<tr>
<td>Net Groundwater</td>
<td></td>
<td></td>
<td>117</td>
<td>121</td>
<td>139</td>
<td>376</td>
</tr>
<tr>
<td>QGC Water</td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Washed ROM Moisture</td>
<td></td>
<td></td>
<td>257</td>
<td>296</td>
<td>305</td>
<td>858</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>1,179</td>
<td>1,596</td>
<td>3,673</td>
<td>6,449</td>
</tr>
<tr>
<td>Outflows</td>
<td>Evaporation</td>
<td></td>
<td>254</td>
<td>483</td>
<td>773</td>
<td>1,510</td>
</tr>
<tr>
<td>Miscellaneous use</td>
<td></td>
<td></td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>301</td>
</tr>
<tr>
<td>Dust Suppression</td>
<td></td>
<td></td>
<td>365</td>
<td>365</td>
<td>365</td>
<td>1,096</td>
</tr>
<tr>
<td>Washed Product Moisture</td>
<td></td>
<td></td>
<td>241</td>
<td>270</td>
<td>275</td>
<td>771</td>
</tr>
<tr>
<td>Rejects Entrainment</td>
<td></td>
<td></td>
<td>222</td>
<td>267</td>
<td>282</td>
<td>786</td>
</tr>
<tr>
<td>Columboola Creek Sediment Dam Releases</td>
<td></td>
<td></td>
<td>0</td>
<td>118</td>
<td>974</td>
<td>1,092</td>
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<tr>
<td>Mine Water Releases</td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>1,183</td>
<td>1,604</td>
<td>2,769</td>
<td>5,556</td>
</tr>
<tr>
<td>Change in Site Water Inventory</td>
<td></td>
<td></td>
<td>-4</td>
<td>-8</td>
<td>904</td>
<td>892</td>
</tr>
</tbody>
</table>
### 6.3.10 Total site inventory

An assessment was undertaken to estimate forecast mine water inventories (over the next 3-year period) at CDM. The water storages included in the analysis are:

- Raw Water Dam;
- Admin Dam;
- MIA Dam;
- RWD1;
- RD1;
- MWD1;
- WMD1;
- Sediment Dam 1; and
- Pit 1.

Figure 6.11 shows the predicted variation in total mine water inventory. The following is of note:

- Site inventory will increase by 1,000 ML under very wet (1% trace confidence) climate conditions over the next 3 years;
- Site inventory will increase by 485 ML under wet (10% trace confidence) climate conditions over the next 3 years;
- Site inventory will decrease by 40 ML under median (50% trace confidence) climate conditions over the next 3 years;
- Site inventory will decrease by 310 ML under dry (90% trace confidence) climate conditions over the next 3 years; and
- Site inventory will decrease by 359 ML under very dry (99% trace confidence) climate conditions over the next 3 years.

![Figure 6.11 - Predicted variation in total mine water inventory over the next three years](image-url)
6.4 SUMMARY OF RESULTS

The CDM WMP has been developed to manage distinct wet and dry seasons, as well as significant climatic variations from year-to-year. The results of the daily water balance model demonstrate that the proposed WMP requires a secure external water supply and significant on-site water storage to adequately ensure the WMS can cope with the range of seasonal fluctuations and periodic shortfalls and surpluses that could potentially occur over the next three years.

The results of water balance modelling predict the following key details of the WMS:

- Site is a net producer of water under over the wet (10% trace confidence) climate conditions over the next 3 years. Under these conditions the water balance model predicts there is no demand on ‘external’ (QGC) water and up to 917 ML of ‘excess’ water storage is required in WMD1.

- Site is a net consumer of water under median (50% trace confidence) climate conditions over the next 3 years. Under these conditions the water balance model predicts up to 82 ML of ‘external’ (QGC) water and up to 233 ML of ‘excess’ water storage is required in WMD1.

- Site is a net consumer of water under dry (90% trace confidence) climate conditions over the next 3 years. Under these conditions the water balance model predicts up to 554 ML of ‘external’ (QGC) water and no storage required in WMD1.

- There is no predicted risk of exceedance for EC values in the receiving waters specified.

Note that the water balance modelling was undertaken without the inclusion of a controlled release strategy to the receiving waters. However, releases of mine water to the receiving waters may occur, subject to the relevant release criteria in the CDM EA.
7 Surface water monitoring

7.1 OVERVIEW

The CDM EA requirements are based on DEHP’s “Model Water Conditions for Coal Mines in the Fitzroy Basin” (DEHP 2012b), which states that releases may only occur from designated release points when water quality is within defined release limits. CDM’s EA imposes receiving waters trigger levels and release limits that would potentially constrain releases.

Monitoring of water quality is carried out in accordance with the CDM EA and CDM Environmental Monitoring Manual to demonstrate compliance with the CDM EA receiving waters trigger levels and release limits during a release event. The CDM Environmental Monitoring Manual outlines procedures for collecting environmental monitoring data and reporting requirements for compliance with the CDM EA.

Monitoring will be undertaken by a suitably qualified person in accordance with the methods prescribed in the latest edition of the administering authority’s Monitoring and Sampling Manual 2009 (DEHP, 2010).

7.2 EXISTING SURFACE WATER MONITORING LOCATIONS

7.2.1 General

CDM monitors water quality in the receiving waters at locations upstream and downstream of the CDM ML, during mine water release, in mine water storages, ‘external’ QGC water and Pit 1 water.

7.2.2 Receiving water monitoring

Table 7.1 specify the location and sampling frequency for receiving waters, as specified in the CDM EA.

<table>
<thead>
<tr>
<th>Monitoring location</th>
<th>Easting (GDA94)</th>
<th>Northing (GDA94)</th>
<th>Receiving waters</th>
<th>Monitoring Frequency and parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS1</td>
<td>238058</td>
<td>7049622</td>
<td>Drainage Line 1</td>
<td>At least once per flow event and in accordance with Table 3.3 and Table 3.4 during a release</td>
</tr>
<tr>
<td>WS2</td>
<td>234571</td>
<td>7052378</td>
<td>Drainage Line 1</td>
<td></td>
</tr>
<tr>
<td>WS3</td>
<td>235712</td>
<td>7047317</td>
<td>Drainage Line 2</td>
<td></td>
</tr>
<tr>
<td>WS4</td>
<td>234087</td>
<td>7048329</td>
<td>Drainage Line 2 (South arm)</td>
<td></td>
</tr>
<tr>
<td>WS5</td>
<td>234243</td>
<td>7049229</td>
<td>Drainage Line 2 (North arm)</td>
<td></td>
</tr>
</tbody>
</table>

7.2.3 Monitoring during mine water releases

Table 7.1 specify the location and sampling frequency during mine water releases, as specified in the CDM EA.
Table 7.2 - release point monitoring - EA requirements

<table>
<thead>
<tr>
<th>Monitoring location</th>
<th>Easting (GDA94)</th>
<th>Northing (GDA94)</th>
<th>Receiving Waters</th>
<th>Monitoring Frequency and parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sediment Dam 1</td>
<td>238,759</td>
<td>7,052,398</td>
<td>Tributary of Drainage Line 1</td>
<td>In accordance with Table 3.2 and Table 3.3 during a release.</td>
</tr>
<tr>
<td>Raw Water Dam</td>
<td>234,865</td>
<td>7,050,052</td>
<td>Drainage Line 1</td>
<td></td>
</tr>
<tr>
<td>Return Water Dam</td>
<td>234,999</td>
<td>7,047,979</td>
<td>Drainage Line 2</td>
<td></td>
</tr>
<tr>
<td>MIA Dam</td>
<td>235,709</td>
<td>7,049,294</td>
<td>Tributary of Drainage Line 1</td>
<td></td>
</tr>
<tr>
<td>Mine Water Dam 1</td>
<td>236,449</td>
<td>7,053,166</td>
<td>Tributary of Drainage Line 1</td>
<td></td>
</tr>
</tbody>
</table>

7.2.4 Mine water storage monitoring

CDM currently monitor water quality in ‘worked’ water storages at the locations and frequencies described in Table 7.3. One (1) additional dam will be constructed in the next 3 years of operations (WMD1) and will have the same routine monitoring requirements as existing storages.

Table 7.3 - Mine water storages - routine monitoring

<table>
<thead>
<tr>
<th>Monitoring locations</th>
<th>Monitoring Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Water Dam and Admin Dam</td>
<td>Quarterly and in accordance with Table 3.2 and Table 3.3 during a release</td>
</tr>
<tr>
<td>MIA Dam</td>
<td>Quarterly and in accordance with Table 3.2 and Table 3.3 during a release</td>
</tr>
<tr>
<td>Return Water Dams 1</td>
<td>Quarterly and in accordance with Table 3.2 and Table 3.3 during a release</td>
</tr>
<tr>
<td>Mine Water Dams 1</td>
<td>Quarterly and in accordance with Table 3.2 and Table 3.3 during a release</td>
</tr>
<tr>
<td>Water Management Dam 1</td>
<td>Quarterly and in accordance with Table 3.2 and Table 3.3 during a release</td>
</tr>
<tr>
<td>Rejects Dam 1</td>
<td>Quarterly and in accordance with Table 3.2 and Table 3.3 during a release</td>
</tr>
<tr>
<td>Sediment Dam 1</td>
<td>Quarterly and in accordance with Table 3.2 and Table 3.3 during a release</td>
</tr>
<tr>
<td>Pit 1</td>
<td>Annually</td>
</tr>
</tbody>
</table>

The standard field parameters measured and the laboratory analysis undertaken on mine water dam’s samples are listed in Table 7.4.
Table 7.4 - Water quality sampling parameters

<table>
<thead>
<tr>
<th>Laboratory Parameters</th>
<th>Field parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>pH</td>
</tr>
<tr>
<td>Electrical conductivity (EC)</td>
<td>Electrical conductivity (EC)</td>
</tr>
<tr>
<td>Total suspended solids (TSS)</td>
<td>Dissolved oxygen % saturation (DO)</td>
</tr>
<tr>
<td>Total dissolved solids (TDS)</td>
<td>Total dissolved solids (TDS)</td>
</tr>
<tr>
<td>Major cations: Ca, Mg, Na and K</td>
<td>Water temperature</td>
</tr>
<tr>
<td>Major anions: Cl, SO₄, and F</td>
<td>Turbidity (NTU)</td>
</tr>
<tr>
<td>Metals: Al, As, Cd, Cr, Cu, Fe, Pb, Hg, Ni, Zn, B, Co, Mn, Mo, Se, Ag, U and Va (Total and Dissolved (field Filtered))</td>
<td></td>
</tr>
<tr>
<td>Nutrients Ammonia, Nitrate, Hydrocarbons C6-36</td>
<td></td>
</tr>
</tbody>
</table>

7.2.5 ‘External’ QGC water monitoring

The quality of ‘external’ QGC water is monitored weekly during the use of this water as a dust suppressant.

7.3 GROUNDWATER

Groundwater monitoring will be undertaken in accordance with Schedule E of the CDM EA.

7.4 MONITORING FOR IMPROVED WATER BALANCE MODELLING

The site water management plan and water balance modelling for CDM have been undertaken using the available water quantity and quality data. The accuracy of the water balance model should continue to be refined and validated so that it can be confidently used as a reliable predictive tool for assessing compliance with the EA conditions. For continued refinement and validation of the model predictions, the following actions will be taken:

- Regularly monitor storage volumes and water quality in all site storages;
- Record spill volumes and dates from all dams;
- Record the volumes of water which are pumped from Pit 1 to confirm predicted groundwater inflows;
- Record the volumes of water which are pumped between storages together with the direction of pumping (i.e. which storage to which storage); and
- Monitor dust suppression usage at all fill points.
8 Emergency and contingency planning

Emergency responses will be carried out as per the Cameby Downs Mine Emergency Response Plan to assist in managing specific incidents. With respect to water management, the Emergency Response Plan is implemented for a range of potential emergency scenarios:

- Exceedance of design rainfall events;
- Failure of containment structures;
- Loss of electrical supply;
- Supply of critical equipment and spare parts;
- Access to critical control and monitoring points under all weather conditions. Note the pit is accessed via multiple ramps. The water storage and monitoring points are accessed via light vehicle access roads which may be inaccessible for short periods after large rainfall events; and
- Assignment and communication of responsibility of actions (including execution, monitoring and reporting) to relevant CDM site personnel.

Water storages at CDM are operated in accordance with the sites operation procedures.
9 References


Appendix A - Cameby Downs Mine regional and local water quality
Table A.1 - Water quality data summary for the Lower Condamine River base flow

<table>
<thead>
<tr>
<th>Percentiles</th>
<th>Ammonia (ug/L)</th>
<th>NOx (ug/L)</th>
<th>Turbidity (NTU)</th>
<th>TSS (mg/L)</th>
<th>pH</th>
<th>EC (uS/cm)</th>
<th>Sulphate (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>80.0</td>
<td>25</td>
<td>339</td>
<td>208</td>
<td>139</td>
<td>8.1</td>
<td>650</td>
<td>11.0</td>
</tr>
<tr>
<td>70.0</td>
<td>13</td>
<td>25</td>
<td>152</td>
<td>94</td>
<td>8.0</td>
<td>520</td>
<td>9.0</td>
</tr>
<tr>
<td>50.0</td>
<td>6</td>
<td>35</td>
<td>57</td>
<td>51</td>
<td>7.8</td>
<td>376</td>
<td>5.3</td>
</tr>
<tr>
<td>40.0</td>
<td>5</td>
<td>9</td>
<td>34</td>
<td>30</td>
<td>7.6</td>
<td>322</td>
<td>4.5</td>
</tr>
<tr>
<td>20.0</td>
<td>3</td>
<td>2</td>
<td>14</td>
<td>13</td>
<td>7.5</td>
<td>237</td>
<td>3.1</td>
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<tr>
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<td>2</td>
<td>1</td>
<td>7</td>
<td>9.3</td>
<td>7.3</td>
<td>207</td>
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<td>87</td>
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<td>284</td>
<td>348</td>
<td>503</td>
<td>306</td>
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Table A.2 - Water quality data summary for the Lower Condamine River event flow

<table>
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<tr>
<th>Percentiles</th>
<th>Ammonia (ug/L)</th>
<th>NOx (ug/L)</th>
<th>Turbidity (NTU)</th>
<th>TSS (mg/L)</th>
<th>pH</th>
<th>EC (uS/cm)</th>
<th>Sulphate (mg/L)</th>
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<td>1058</td>
<td>1130</td>
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<td>262</td>
<td>6.1</td>
</tr>
<tr>
<td>70.0</td>
<td>62</td>
<td>622</td>
<td>835</td>
<td>940</td>
<td>7.4</td>
<td>243</td>
<td>4.4</td>
</tr>
<tr>
<td>50.0</td>
<td>29</td>
<td>465</td>
<td>490</td>
<td>675</td>
<td>7.3</td>
<td>195</td>
<td>3.6</td>
</tr>
<tr>
<td>40.0</td>
<td>24</td>
<td>396</td>
<td>393</td>
<td>532</td>
<td>7.2</td>
<td>180</td>
<td>3.4</td>
</tr>
<tr>
<td>20.0</td>
<td>15</td>
<td>224</td>
<td>300</td>
<td>262</td>
<td>7.1</td>
<td>136</td>
<td>2.3</td>
</tr>
<tr>
<td>10.0</td>
<td>11</td>
<td>130</td>
<td>204</td>
<td>160</td>
<td>6.9</td>
<td>118</td>
<td>1.6</td>
</tr>
<tr>
<td>No of Samples</td>
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<td>4</td>
<td>33</td>
<td>21</td>
<td>23</td>
<td>39</td>
<td>21</td>
</tr>
</tbody>
</table>

Table A.3 - Water quality data summary for Dogwood Creek base flow

<table>
<thead>
<tr>
<th>Percentiles</th>
<th>Ammonia (ug/L)</th>
<th>NOx (ug/L)</th>
<th>Turbidity (NTU)</th>
<th>TSS (mg/L)</th>
<th>pH</th>
<th>EC (uS/cm)</th>
<th>Sulphate (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>80.0</td>
<td>49</td>
<td>110</td>
<td>271</td>
<td>105</td>
<td>7.6</td>
<td>145</td>
<td>5.0</td>
</tr>
<tr>
<td>70.0</td>
<td>42</td>
<td>99</td>
<td>190</td>
<td>71</td>
<td>7.4</td>
<td>130</td>
<td>4.3</td>
</tr>
<tr>
<td>50.0</td>
<td>29</td>
<td>60</td>
<td>145</td>
<td>48</td>
<td>7.0</td>
<td>113</td>
<td>3.0</td>
</tr>
<tr>
<td>40.0</td>
<td>25</td>
<td>18</td>
<td>119</td>
<td>34</td>
<td>6.9</td>
<td>106</td>
<td>2.6</td>
</tr>
<tr>
<td>20.0</td>
<td>15</td>
<td>6</td>
<td>74</td>
<td>19</td>
<td>6.5</td>
<td>92</td>
<td>1.8</td>
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<tr>
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<td>55</td>
<td>14</td>
<td>6.4</td>
<td>82</td>
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</tr>
<tr>
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<td>15</td>
<td>16</td>
<td>128</td>
<td>75</td>
<td>122</td>
<td>15</td>
<td>69.</td>
</tr>
</tbody>
</table>
Table A.4 - Water quality data summary for Dogwood Creek event flow

<table>
<thead>
<tr>
<th>Percentiles</th>
<th>Ammonia (ug/L)</th>
<th>NOx (ug/L)</th>
<th>Turbidity (NTU)</th>
<th>TSS (mg/L)</th>
<th>pH</th>
<th>EC (uS/cm)</th>
<th>Sulphate (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>80.0</td>
<td>20</td>
<td>270</td>
<td>410</td>
<td>130</td>
<td>7.4</td>
<td>121</td>
<td>8.9</td>
</tr>
<tr>
<td>70.0</td>
<td>20</td>
<td>270</td>
<td>244</td>
<td>86</td>
<td>7.2</td>
<td>108</td>
<td>8.1</td>
</tr>
<tr>
<td>50.0</td>
<td>20</td>
<td>270</td>
<td>195</td>
<td>70</td>
<td>6.8</td>
<td>100</td>
<td>6.2</td>
</tr>
<tr>
<td>40.0</td>
<td>20</td>
<td>270</td>
<td>184</td>
<td>3</td>
<td>6.7</td>
<td>90</td>
<td>5.8</td>
</tr>
<tr>
<td>20.0</td>
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<td>270</td>
<td>155</td>
<td>10</td>
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<td>71</td>
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<td>270</td>
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<td>10</td>
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<td>66</td>
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</tr>
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<td>1</td>
<td>1</td>
<td>12</td>
<td>11</td>
<td>15</td>
<td>19</td>
<td>12</td>
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</table>
### Table A.5 - Drainage Line 1 water quality data statistics at WS2 (2010 to 2017)

<table>
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<tr>
<th></th>
<th>pH</th>
<th>EC (μs/cm)</th>
<th>TSS (mg/L)</th>
<th>As (μg/L)</th>
<th>Cd (μg/L)</th>
<th>Cr (μg/L)</th>
<th>Cu (μg/L)</th>
<th>Ni (μg/L)</th>
<th>Pb (μg/L)</th>
<th>Zn (μg/L)</th>
<th>Hg (μg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>5.6</td>
<td>29</td>
<td>16</td>
<td>1</td>
<td>0.1</td>
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<td>1</td>
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<td>1</td>
<td>6</td>
<td>0.1</td>
</tr>
<tr>
<td>20&lt;sup&gt;th&lt;/sup&gt; percentile</td>
<td>6.5</td>
<td>37</td>
<td>50</td>
<td>1</td>
<td>0.1</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>10</td>
<td>0.1</td>
</tr>
<tr>
<td>Median</td>
<td>6.7</td>
<td>57</td>
<td>102</td>
<td>2</td>
<td>0.1</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>18</td>
<td>0.1</td>
</tr>
<tr>
<td>80&lt;sup&gt;th&lt;/sup&gt; percentile</td>
<td>6.9</td>
<td>67</td>
<td>211</td>
<td>2</td>
<td>0.1</td>
<td>11</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>29</td>
<td>0.1</td>
</tr>
<tr>
<td>Max</td>
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<td>126</td>
<td>941</td>
<td>7</td>
<td>0.4</td>
<td>61</td>
<td>56</td>
<td>31</td>
<td>72</td>
<td>167</td>
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<td>61</td>
<td>27</td>
<td>56</td>
<td>61</td>
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<td>61</td>
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### Table A.6 - Drainage Line 2 water quality data statistics at WS4 and WS5 (2010 to 2017)

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<th>pH</th>
<th>EC (μs/cm)</th>
<th>TSS (mg/L)</th>
<th>As (μg/L)</th>
<th>Cd (μg/L)</th>
<th>Cr (μg/L)</th>
<th>Cu (μg/L)</th>
<th>Ni (μg/L)</th>
<th>Pb (μg/L)</th>
<th>Zn (μg/L)</th>
<th>Hg (μg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>5.5</td>
<td>22</td>
<td>12</td>
<td>1</td>
<td>0.1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>0.1</td>
</tr>
<tr>
<td>20&lt;sup&gt;th&lt;/sup&gt; percentile</td>
<td>6.4</td>
<td>42</td>
<td>44</td>
<td>1</td>
<td>0.1</td>
<td>8</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>12</td>
<td>0.1</td>
</tr>
<tr>
<td>Median</td>
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<td>61</td>
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<td>12</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>19</td>
<td>0.1</td>
</tr>
<tr>
<td>80&lt;sup&gt;th&lt;/sup&gt; percentile</td>
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<td>80</td>
<td>222</td>
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<td>21</td>
<td>8</td>
<td>9</td>
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<td>31</td>
<td>0.1</td>
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<tr>
<td>Max</td>
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<td>202</td>
<td>1470</td>
<td>5</td>
<td>1.0</td>
<td>55</td>
<td>11</td>
<td>26</td>
<td>21</td>
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<td>No of Samples</td>
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Table A.7 - Drainage Line 1 and Drainage Line 2 combined water quality data statistics (2010 to 2017)

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<th>EC (μs/cm)</th>
<th>TSS (mg/L)</th>
<th>As (μg/L)</th>
<th>Cd (μg/L)</th>
<th>Cr (μg/L)</th>
<th>Cu (μg/L)</th>
<th>Ni (μg/L)</th>
<th>Pb (μg/L)</th>
<th>Zn (μg/L)</th>
<th>Hg (μg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>5.5</td>
<td>22</td>
<td>12</td>
<td>1.0</td>
<td>0.1</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>5.0</td>
<td>0.1</td>
</tr>
<tr>
<td>20th percentile</td>
<td>6.4</td>
<td>40</td>
<td>47</td>
<td>1.0</td>
<td>0.1</td>
<td>5.0</td>
<td>2.8</td>
<td>3.0</td>
<td>2.8</td>
<td>11.0</td>
<td>0.1</td>
</tr>
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<td>Median</td>
<td>6.6</td>
<td>59</td>
<td>88</td>
<td>2.0</td>
<td>0.1</td>
<td>10.0</td>
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<td>5.0</td>
<td>4.0</td>
<td>19.0</td>
<td>0.1</td>
</tr>
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<td>80th percentile</td>
<td>6.9</td>
<td>67</td>
<td>216</td>
<td>2.0</td>
<td>0.1</td>
<td>16.2</td>
<td>7.0</td>
<td>7.0</td>
<td>8.0</td>
<td>30.0</td>
<td>0.1</td>
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<tr>
<td>Max</td>
<td>7.2</td>
<td>202</td>
<td>1470</td>
<td>7.0</td>
<td>1.0</td>
<td>61.0</td>
<td>56.0</td>
<td>31.0</td>
<td>72.0</td>
<td>167.0</td>
<td>1.0</td>
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<td>No of Samples</td>
<td>165</td>
<td>63</td>
<td>171</td>
<td>175</td>
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<td>175</td>
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Appendix B - Cameby Downs Mine storage water quality
Table B.1 - Water Quality Data Summary (2010-2017) - Sediment Dam 1

<table>
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<tr>
<th>Parameter</th>
<th>Unit</th>
<th>No. of Samples</th>
<th>Min.</th>
<th>10%ile</th>
<th>Median</th>
<th>90%ile</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH (lab)</td>
<td></td>
<td>41</td>
<td>6.0</td>
<td>6.1</td>
<td>6.4</td>
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<td>9.2</td>
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<tr>
<td>pH(field)</td>
<td></td>
<td>47</td>
<td>5.8</td>
<td>6.4</td>
<td>7.3</td>
<td>8.6</td>
<td>9.2</td>
</tr>
<tr>
<td>Conductivity (lab)</td>
<td>µS/cm</td>
<td>40</td>
<td>180</td>
<td>208</td>
<td>324</td>
<td>422</td>
<td>640</td>
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<td>Conductivity (field)</td>
<td>µS/cm</td>
<td>45</td>
<td>7</td>
<td>122</td>
<td>317</td>
<td>437</td>
<td>1300</td>
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<td>TSS</td>
<td>mg/L</td>
<td>26</td>
<td>59</td>
<td>235</td>
<td>700</td>
<td>2210</td>
<td>3140</td>
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Metals

<table>
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<th>Unit</th>
<th>No. of Samples</th>
<th>Min.</th>
<th>10%ile</th>
<th>Median</th>
<th>90%ile</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>mg/L</td>
<td>37</td>
<td>0.001</td>
<td>0.003</td>
<td>0.004</td>
<td>0.011</td>
<td>0.017</td>
</tr>
<tr>
<td>Cadmium</td>
<td>mg/L</td>
<td>37</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0002</td>
<td>0.0003</td>
<td>0.0030</td>
</tr>
<tr>
<td>Chromium</td>
<td>mg/L</td>
<td>37</td>
<td>0.001</td>
<td>0.012</td>
<td>0.033</td>
<td>0.064</td>
<td>0.808</td>
</tr>
<tr>
<td>Copper</td>
<td>mg/L</td>
<td>37</td>
<td>0.0001</td>
<td>0.0196</td>
<td>0.0440</td>
<td>0.0644</td>
<td>0.1030</td>
</tr>
<tr>
<td>Nickel</td>
<td>mg/L</td>
<td>37</td>
<td>0.002</td>
<td>0.014</td>
<td>0.023</td>
<td>0.031</td>
<td>0.094</td>
</tr>
<tr>
<td>Lead</td>
<td>mg/L</td>
<td>37</td>
<td>0.001</td>
<td>0.016</td>
<td>0.038</td>
<td>0.051</td>
<td>0.098</td>
</tr>
<tr>
<td>Zinc</td>
<td>mg/L</td>
<td>37</td>
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<td>0.062</td>
<td>0.122</td>
<td>0.187</td>
<td>0.327</td>
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<td>Mercury</td>
<td>mg/L</td>
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<td>0.0001</td>
<td>0.0001</td>
<td>0.0005</td>
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Table B.2 - Water Quality Data Summary (2010-2017) - Raw Water Dam

<table>
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<th>Parameter</th>
<th>Unit</th>
<th>No. of Samples</th>
<th>Min.</th>
<th>10%ile</th>
<th>Median</th>
<th>90%ile</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH (lab)</td>
<td></td>
<td>27</td>
<td>5.4</td>
<td>7.9</td>
<td>8.6</td>
<td>9.1</td>
<td>9.3</td>
</tr>
<tr>
<td>pH(field)</td>
<td></td>
<td>33</td>
<td>7.3</td>
<td>8.2</td>
<td>8.5</td>
<td>8.9</td>
<td>9.0</td>
</tr>
<tr>
<td>Conductivity (lab)</td>
<td>µS/cm</td>
<td>26</td>
<td>1630</td>
<td>1990</td>
<td>4765</td>
<td>10950</td>
<td>13200</td>
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<tr>
<td>Conductivity (field)</td>
<td>µS/cm</td>
<td>19</td>
<td>1798</td>
<td>2574</td>
<td>3170</td>
<td>5704</td>
<td>6752</td>
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<tr>
<td>TSS</td>
<td>mg/L</td>
<td>15</td>
<td>6</td>
<td>14.4</td>
<td>25</td>
<td>67</td>
<td>1030</td>
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Metals

<table>
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<tr>
<th>Parameter</th>
<th>Unit</th>
<th>No. of Samples</th>
<th>Min.</th>
<th>10%ile</th>
<th>Median</th>
<th>90%ile</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>mg/L</td>
<td>27</td>
<td>0.0004</td>
<td>0.001</td>
<td>0.002</td>
<td>0.003</td>
<td>0.003</td>
</tr>
<tr>
<td>Cadmium</td>
<td>mg/L</td>
<td>27</td>
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<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.003</td>
</tr>
<tr>
<td>Chromium</td>
<td>mg/L</td>
<td>27</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.0104</td>
<td>0.808</td>
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<tr>
<td>Copper</td>
<td>mg/L</td>
<td>27</td>
<td>0.0001</td>
<td>0.001</td>
<td>0.002</td>
<td>0.0048</td>
<td>0.014</td>
</tr>
<tr>
<td>Nickel</td>
<td>mg/L</td>
<td>27</td>
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<td>0.002</td>
<td>0.003</td>
<td>0.0076</td>
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</tr>
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<td>Lead</td>
<td>mg/L</td>
<td>27</td>
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<td>0.001</td>
<td>0.001</td>
<td>0.0072</td>
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<td>mg/L</td>
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<td>0.005</td>
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<td>0.0366</td>
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<td>mg/L</td>
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<td>0.0001</td>
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### Table B.3 - Water Quality Data Summary (2010-2016) - Return Water Dam 1

<table>
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<th>Min.</th>
<th>10%ile</th>
<th>Median</th>
<th>90%ile</th>
<th>Max</th>
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</thead>
<tbody>
<tr>
<td>pH (lab)</td>
<td></td>
<td>31</td>
<td>7.4</td>
<td>7.9</td>
<td>8.3</td>
<td>8.9</td>
<td>9.4</td>
</tr>
<tr>
<td>pH(field)</td>
<td></td>
<td>32</td>
<td>6.5</td>
<td>7.9</td>
<td>8.4</td>
<td>8.8</td>
<td>9.2</td>
</tr>
<tr>
<td>Conductivity (lab)</td>
<td>µS/cm</td>
<td>25</td>
<td>2010</td>
<td>3080</td>
<td>5770</td>
<td>11600</td>
<td>15000</td>
</tr>
<tr>
<td>Conductivity (field)</td>
<td>µS/cm</td>
<td>30</td>
<td>689</td>
<td>751</td>
<td>3814</td>
<td>7436</td>
<td>9940</td>
</tr>
<tr>
<td>TSS</td>
<td>mg/L</td>
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<td>5</td>
<td>11.9</td>
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<td>66</td>
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#### Total Metals

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<th>Min</th>
<th>10%ile</th>
<th>Median</th>
<th>90%ile</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>mg/L</td>
<td>31</td>
<td>0.001</td>
<td>0.001</td>
<td>0.002</td>
<td>0.004</td>
<td>0.005</td>
</tr>
<tr>
<td>Cadmium</td>
<td>mg/L</td>
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<td>0.001</td>
<td>0.0001</td>
<td>0.0002</td>
<td>0.004</td>
</tr>
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<td>Chromium</td>
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<td>0.001</td>
<td>0.001</td>
<td>0.028</td>
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<td>Copper</td>
<td>mg/L</td>
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<td>0.001</td>
<td>0.002</td>
<td>0.012</td>
<td>0.014</td>
</tr>
<tr>
<td>Nickel</td>
<td>mg/L</td>
<td>31</td>
<td>0.001</td>
<td>0.002</td>
<td>0.004</td>
<td>0.016</td>
<td>0.023</td>
</tr>
<tr>
<td>Lead</td>
<td>mg/L</td>
<td>31</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.015</td>
<td>0.017</td>
</tr>
<tr>
<td>Zinc</td>
<td>mg/L</td>
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<td>0.005</td>
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<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0005</td>
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</table>

#### Filtered Metals *

<table>
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<th>Parameter</th>
<th>Unit</th>
<th>No. of Samples</th>
<th>Min</th>
<th>10%ile</th>
<th>Median</th>
<th>90%ile</th>
<th>Max</th>
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</thead>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Arsenic</td>
<td>mg/L</td>
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<td>&lt;0.001</td>
<td></td>
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<tr>
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<td>mg/L</td>
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<td>&lt;0.0001</td>
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</tr>
<tr>
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<td>mg/L</td>
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<td>&lt;0.001</td>
<td></td>
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<tr>
<td>Cobalt</td>
<td>mg/L</td>
<td>1</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td>mg/L</td>
<td>1</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead</td>
<td>mg/L</td>
<td>1</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manganese</td>
<td>mg/L</td>
<td>1</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Molybdenum</td>
<td>mg/L</td>
<td>1</td>
<td>0.007</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Nickel</td>
<td>mg/L</td>
<td>1</td>
<td>0.002</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Selenium</td>
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<td>&lt;0.01</td>
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<tr>
<td>Silver</td>
<td>mg/L</td>
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<td>&lt;0.001</td>
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<tr>
<td>Uranium</td>
<td>mg/L</td>
<td>1</td>
<td>&lt;0.001</td>
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<td></td>
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</tr>
<tr>
<td>Vanadium</td>
<td>mg/L</td>
<td>1</td>
<td>&lt;0.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td>mg/L</td>
<td>1</td>
<td>&lt;0.005</td>
<td></td>
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<tr>
<td>Boron</td>
<td>mg/L</td>
<td>1</td>
<td>0.06</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron</td>
<td>mg/L</td>
<td>1</td>
<td>&lt;0.05</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mercury</td>
<td>mg/L</td>
<td>1</td>
<td>&lt;0.0001</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

#### Nutrients *

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>No. of Samples</th>
<th>Min</th>
<th>10%ile</th>
<th>Median</th>
<th>90%ile</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia as N</td>
<td>mg/L</td>
<td>1</td>
<td>0.02</td>
<td></td>
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</tr>
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<td>Nitrite as N</td>
<td>mg/L</td>
<td>1</td>
<td>&lt;0.01</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Nitrate as N</td>
<td>mg/L</td>
<td>1</td>
<td>0.07</td>
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<td></td>
</tr>
<tr>
<td>Nitrite + Nitrate as N</td>
<td>mg/L</td>
<td>1</td>
<td>0.07</td>
<td></td>
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</tbody>
</table>

* sample taken on 2 March 2018
### Table B.4 - Water Quality Data Summary (2010-2016) - MIA Dam

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>No. of Samples</th>
<th>Min.</th>
<th>10%ile</th>
<th>Median</th>
<th>90%ile</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH (lab)</td>
<td></td>
<td>32</td>
<td>6.5</td>
<td>6.7</td>
<td>7.4</td>
<td>8.4</td>
<td>9.3</td>
</tr>
<tr>
<td>pH(field)</td>
<td></td>
<td>32</td>
<td>6.6</td>
<td>7.3</td>
<td>8.1</td>
<td>8.7</td>
<td>9.3</td>
</tr>
<tr>
<td>Conductivity (lab)</td>
<td>µS/cm</td>
<td>25</td>
<td>262</td>
<td>314</td>
<td>1080</td>
<td>2978</td>
<td>3690</td>
</tr>
<tr>
<td>Conductivity (field)</td>
<td></td>
<td>30</td>
<td>247</td>
<td>381</td>
<td>1322</td>
<td>2256</td>
<td>3990</td>
</tr>
<tr>
<td>TSS</td>
<td>mg/L</td>
<td>14</td>
<td>5</td>
<td>16</td>
<td>80</td>
<td>831</td>
<td>913</td>
</tr>
</tbody>
</table>

**Metals**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>No. of Samples</th>
<th>Min.</th>
<th>10%ile</th>
<th>Median</th>
<th>90%ile</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>mg/L</td>
<td>32</td>
<td>0.001</td>
<td>0.011</td>
<td>0.003</td>
<td>0.005</td>
<td>0.009</td>
</tr>
<tr>
<td>Cadmium</td>
<td>mg/L</td>
<td>32</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0003</td>
</tr>
<tr>
<td>Chromium</td>
<td>mg/L</td>
<td>32</td>
<td>0.001</td>
<td>0.0031</td>
<td>0.0315</td>
<td>0.052</td>
<td>0.072</td>
</tr>
<tr>
<td>Copper</td>
<td>mg/L</td>
<td>32</td>
<td>0.001</td>
<td>0.0032</td>
<td>0.014</td>
<td>0.0229</td>
<td>0.039</td>
</tr>
<tr>
<td>Nickel</td>
<td>mg/L</td>
<td>32</td>
<td>0.001</td>
<td>0.0051</td>
<td>0.0165</td>
<td>0.0257</td>
<td>0.034</td>
</tr>
<tr>
<td>Lead</td>
<td>mg/L</td>
<td>32</td>
<td>0.001</td>
<td>0.0032</td>
<td>0.0235</td>
<td>0.0326</td>
<td>0.052</td>
</tr>
<tr>
<td>Zinc</td>
<td>mg/L</td>
<td>32</td>
<td>0.005</td>
<td>0.0183</td>
<td>0.0695</td>
<td>0.1058</td>
<td>0.204</td>
</tr>
<tr>
<td>Mercury</td>
<td>mg/L</td>
<td>32</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0005</td>
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</table>

### Table B.5 - Water Quality Data Summary (2010-2016) - Mine Water Dam

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>No. of Samples</th>
<th>Min.</th>
<th>10%ile</th>
<th>Median</th>
<th>90%ile</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH (lab)</td>
<td></td>
<td>25</td>
<td>6.6</td>
<td>7.2</td>
<td>8.2</td>
<td>8.9</td>
<td>9.3</td>
</tr>
<tr>
<td>pH(field)</td>
<td></td>
<td>45</td>
<td>7.4</td>
<td>7.8</td>
<td>8.3</td>
<td>9.0</td>
<td>9.7</td>
</tr>
<tr>
<td>Conductivity (lab)</td>
<td>µS/cm</td>
<td>24</td>
<td>459</td>
<td>1000</td>
<td>2225</td>
<td>7063</td>
<td>9860</td>
</tr>
<tr>
<td>Conductivity (field)</td>
<td></td>
<td>42</td>
<td>130</td>
<td>1251</td>
<td>3800</td>
<td>8575</td>
<td>9141</td>
</tr>
<tr>
<td>TSS</td>
<td>mg/L</td>
<td>13</td>
<td>16</td>
<td>23</td>
<td>57</td>
<td>291</td>
<td>1790</td>
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</table>

**Metals**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>No. of Samples</th>
<th>Min.</th>
<th>10%ile</th>
<th>Median</th>
<th>90%ile</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>mg/L</td>
<td>25</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.004</td>
<td>0.006</td>
</tr>
<tr>
<td>Cadmium</td>
<td>mg/L</td>
<td>25</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.00016</td>
<td>0.0003</td>
</tr>
<tr>
<td>Chromium</td>
<td>mg/L</td>
<td>25</td>
<td>0.001</td>
<td>0.001</td>
<td>0.002</td>
<td>0.029</td>
<td>0.046</td>
</tr>
<tr>
<td>Copper</td>
<td>mg/L</td>
<td>25</td>
<td>0.001</td>
<td>0.001</td>
<td>0.002</td>
<td>0.011</td>
<td>0.064</td>
</tr>
<tr>
<td>Nickel</td>
<td>mg/L</td>
<td>25</td>
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<td>0.002</td>
<td>0.003</td>
<td>0.013</td>
<td>0.280</td>
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<tr>
<td>Lead</td>
<td>mg/L</td>
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<td>0.001</td>
<td>0.001</td>
<td>0.014</td>
<td>0.046</td>
</tr>
<tr>
<td>Zinc</td>
<td>mg/L</td>
<td>25</td>
<td>0.005</td>
<td>0.005</td>
<td>0.010</td>
<td>0.042</td>
<td>0.185</td>
</tr>
<tr>
<td>Mercury</td>
<td>mg/L</td>
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<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
<tr>
<td>Parameter</td>
<td>Unit</td>
<td>No. of Samples</td>
<td>Min.</td>
<td>10%ile</td>
<td>Median</td>
<td>90%ile</td>
<td>Max</td>
</tr>
<tr>
<td>--------------------</td>
<td>------</td>
<td>---------------</td>
<td>------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>------</td>
</tr>
<tr>
<td>pH (lab)</td>
<td></td>
<td>13</td>
<td>4.5</td>
<td>6.7</td>
<td>8.3</td>
<td>8.8</td>
<td>8.9</td>
</tr>
<tr>
<td>pH (field)</td>
<td></td>
<td>23</td>
<td>2.4</td>
<td>6.9</td>
<td>8.4</td>
<td>8.9</td>
<td>10.3</td>
</tr>
<tr>
<td>Conductivity (lab)</td>
<td>μS/cm</td>
<td>13</td>
<td>1870</td>
<td>2332</td>
<td>3920</td>
<td>16100</td>
<td>29700</td>
</tr>
<tr>
<td>Conductivity (field)</td>
<td>μS/cm</td>
<td>17</td>
<td>2230</td>
<td>2360</td>
<td>4860</td>
<td>11260</td>
<td>16800</td>
</tr>
<tr>
<td>TSS</td>
<td>mg/L</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metals</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arsenic</td>
<td>mg/L</td>
<td>21</td>
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<td>0.002</td>
<td>0.004</td>
<td>0.037</td>
<td>0.763</td>
</tr>
<tr>
<td>Cadmium</td>
<td>mg/L</td>
<td>17</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0003</td>
<td>0.02084</td>
<td>0.0401</td>
</tr>
<tr>
<td>Chromium</td>
<td>mg/L</td>
<td>14</td>
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<td>0.001</td>
<td>0.002</td>
<td>0.054</td>
<td>0.117</td>
</tr>
<tr>
<td>Copper</td>
<td>mg/L</td>
<td>23</td>
<td>0.001</td>
<td>0.002</td>
<td>0.004</td>
<td>0.320</td>
<td>2.730</td>
</tr>
<tr>
<td>Nickel</td>
<td>mg/L</td>
<td>16</td>
<td>0.001</td>
<td>0.001</td>
<td>0.009</td>
<td>0.253</td>
<td>2.000</td>
</tr>
<tr>
<td>Lead</td>
<td>mg/L</td>
<td>4</td>
<td>0.000</td>
<td>0.000</td>
<td>0.001</td>
<td>0.002</td>
<td>0.003</td>
</tr>
<tr>
<td>Zinc</td>
<td>mg/L</td>
<td>23</td>
<td>0.002</td>
<td>0.003</td>
<td>0.009</td>
<td>0.356</td>
<td>1.390</td>
</tr>
<tr>
<td>Mercury</td>
<td>mg/L</td>
<td>16</td>
<td>0.0001</td>
<td>0.006</td>
<td>0.026</td>
<td>6.01</td>
<td>18.7</td>
</tr>
</tbody>
</table>
Appendix C- Cameby downs mine water balance model set-up
C1.1 OVERVIEW

CDM water balance models were set-up to represent the existing and proposed mine water management systems, and simulate the operation of the major components of the water management system including:

- Historical climatic variability - rainfall and evaporation;
- Catchment runoff and collection;
- Pit dewatering;
- Pump transfers;
- Water storage filling, spilling, evaporation and leakage;
- Process water extraction, usage and return; and
- Regional groundwater inflows.

The following sections provide details of information relating to the set-up and calibration of the CDM water balance model.

C1.2 CLIMATE DATA AND SIMULATION METHODOLOGY

C1.2.1 Climate data

The CDM site has a sub-tropical climate regime with distinct wet (October to March) and dry (April to September) seasons. The average daily minimum and maximum temperatures at Miles (near Cameby Downs) range between 4°C (in July) and 33°C (in January). The monthly and annual rainfall and evaporation variations at Cameby Downs are described below.

C1.2.2 Rainfall

Table C.1 shows summary details of rainfall recording stations located within the vicinity of CDM for the respective periods of record from the Commonwealth Bureau of Meteorology (BoM) and DNRM. The locations of the various stations are shown in Figure 1.1.

In addition, synthetic rainfall data was available for the CDM site from the Queensland Climate Change Centre of Excellence (QCCCE) SILO Data Drill Service. The CDM site SILO Data Drill data have been derived by interpolation of recorded rainfall data between regional stations as described by Jeffreys et al. (2001). The Data Drill Service has provided a continuous daily rainfall data set over the 128 years between 1889 and 2017.
Table C.1 - Summary details of rainfall and stream gauging stations

<table>
<thead>
<tr>
<th>Station ID (See Figure 1.1)</th>
<th>Station Number</th>
<th>Station Name</th>
<th>Station Type</th>
<th>Period of Record</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>42025</td>
<td>Horse Creek</td>
<td>Continuous</td>
<td>1999 - Current</td>
</tr>
<tr>
<td>2</td>
<td>41020</td>
<td>Seven Oaks</td>
<td>Continuous</td>
<td>1998 - Current</td>
</tr>
<tr>
<td>3</td>
<td>35029</td>
<td>Giligulgul</td>
<td>Continuous</td>
<td>1998 - Current</td>
</tr>
<tr>
<td>4</td>
<td>42109</td>
<td>Dungaden</td>
<td>Daily</td>
<td>1976 - 2013 (closed)</td>
</tr>
<tr>
<td>5</td>
<td>422202B</td>
<td>Dogwood Creek at Gilweir</td>
<td>Stream Flow</td>
<td>1949 - Current</td>
</tr>
<tr>
<td>6</td>
<td>042023</td>
<td>Mile Post Office</td>
<td>Daily</td>
<td>1989 - Current</td>
</tr>
</tbody>
</table>

Table C.2 compares mean monthly and annual rainfalls recorded at the Miles Post Office daily rainfall station (No. 042023) with the SILO Data Drill data for the 128 year period of record (1889 - 2017). Annual values are shown for “water years”, commencing in October.

The recorded mean monthly and annual rainfalls at Miles Post Office correlate well with the Data Drill data for the 128 year period of data. The average monthly rainfalls at CDM exhibit distinctly wet (October to March) and dry (April to September) seasons during the year, with a dry season low of 27.7 mm in August and a wet season high of 88.6 mm in December. The wet season average monthly rainfalls (54.2 mm to 88.6 mm) are significantly higher than the equivalent dry season monthly rainfalls (27.7 mm to 38.6 mm). The recorded mean annual rainfall at the Miles Post Office site over the period 1889 to 2017 is approximately 650 mm.

Table C.2 - Mean monthly and annual rainfall and evaporation at the Cameby Downs site

<table>
<thead>
<tr>
<th>Month</th>
<th>Mean Monthly Rainfall and Evaporation (mm) (1889 - 2017)</th>
<th>Mile Post Office (042023)</th>
<th>Data Drill Rain</th>
<th>Data Drill Pan Evaporation</th>
</tr>
</thead>
<tbody>
<tr>
<td>October</td>
<td>53.4</td>
<td>54.2</td>
<td>192.7</td>
<td></td>
</tr>
<tr>
<td>November</td>
<td>64.5</td>
<td>64.0</td>
<td>213.6</td>
<td></td>
</tr>
<tr>
<td>December</td>
<td>91.2</td>
<td>88.6</td>
<td>233.9</td>
<td></td>
</tr>
<tr>
<td>January</td>
<td>96.1</td>
<td>88.2</td>
<td>231.3</td>
<td></td>
</tr>
<tr>
<td>February</td>
<td>73.6</td>
<td>72.7</td>
<td>192.0</td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>59.7</td>
<td>58.9</td>
<td>182.3</td>
<td></td>
</tr>
<tr>
<td>April</td>
<td>36.2</td>
<td>33.7</td>
<td>134.5</td>
<td></td>
</tr>
<tr>
<td>May</td>
<td>38.8</td>
<td>36.9</td>
<td>94.6</td>
<td></td>
</tr>
<tr>
<td>June</td>
<td>39.3</td>
<td>38.6</td>
<td>70.4</td>
<td></td>
</tr>
<tr>
<td>July</td>
<td>36.5</td>
<td>35.5</td>
<td>79.5</td>
<td></td>
</tr>
<tr>
<td>August</td>
<td>29.5</td>
<td>27.7</td>
<td>110.3</td>
<td></td>
</tr>
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<td>September</td>
<td>32</td>
<td>31.4</td>
<td>149.5</td>
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</tr>
<tr>
<td>Annual</td>
<td>651 mm/yr</td>
<td>630 mm/yr</td>
<td>1885 mm/yr</td>
<td></td>
</tr>
</tbody>
</table>

C1.2.3 Evaporation

Table C.2 shows the mean monthly and annual (pan) evaporation values obtained from the Data Drill data for the 128 year period between 1889 and 2017. The average annual pan evaporation at the CDM site is estimated to be approximately 1,885 mm, which is approximately 3 times the average annual rainfall. The evaporation
rate is high throughout the year, with the highest evaporation rates occurring in the
months between October and March. Evaporation rates are generally much higher than
rainfall in all months.

C1.2.4 Existing Water Management System Configuration

Figure 1.2 (in the main report) shows the locations of key existing water management
infrastructure at Cameby Downs Mine.

Based on a review of CDM documentation and discussions with site personnel, existing
water management system operating rules are provided in Table C.3.

C1.3 SITE WATER DEMANDS

The major water demands at the CDM site are for:

- Coal Handling and Processing Plant (CHPP) use;
- Dust suppression on haul roads; and
- Industrial and Infrastructure use (such as vehicle wash-down).

Table C.4 shows a summary of the adopted daily water demands for the CDM site for
existing CDM mining conditions. Note that industrial and infrastructure water use have
been combined into a single lumped demand.

<table>
<thead>
<tr>
<th>Water Demand</th>
<th>ML/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHPP demand</td>
<td>2.6 to 3.2</td>
</tr>
<tr>
<td>Dust suppression demand</td>
<td>1.0</td>
</tr>
<tr>
<td>Industrial/Truck Wash Losses demand</td>
<td>0.3</td>
</tr>
<tr>
<td>Total Water Usage demand</td>
<td>3.9 to 4.5</td>
</tr>
</tbody>
</table>

C1.3.1 CHPP

Table C.5 shows the assumed moisture rates of the CHPP. Table C.6 shows the adopted
throughput of washed ROM coal feed into the CHPP, washed product coal, fine rejects
slurry and coarse rejects out of the CHPP at the CDM. Table C.7 shows the existing and
future operation daily water balances for the CHPP, including an estimate of the required
makeup water supply. CHPP throughputs are based on projections advised by CDM.

<table>
<thead>
<tr>
<th>Coal type</th>
<th>Water Fraction %w/w</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washed ROM coal</td>
<td>10%</td>
</tr>
<tr>
<td>Washed product coal</td>
<td>13.3%</td>
</tr>
<tr>
<td>Fine rejects</td>
<td>75%</td>
</tr>
<tr>
<td>Coarse rejects</td>
<td>10%</td>
</tr>
<tr>
<td>Fines entrainment</td>
<td>19.1%</td>
</tr>
</tbody>
</table>
### Table C.3 - Cameby Downs Mine - Existing Water Management System Operating Rules

<table>
<thead>
<tr>
<th>Node Name</th>
<th>Operating Rules</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘External’ QGC Water</td>
<td>Supplies to Raw Water Dam as required at a maximum rate of up to 4ML/d.</td>
</tr>
<tr>
<td>CHPP</td>
<td>Supplied from RWD1 and Raw Water Dam</td>
</tr>
<tr>
<td>Dust Suppression</td>
<td>Supplied from Open Pit, Sediment Dam 1 and MWD1</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>Supplied from Raw Water Dam</td>
</tr>
<tr>
<td>Pit 1</td>
<td>Receives groundwater inflows.</td>
</tr>
<tr>
<td></td>
<td>Supplies water to Dust Suppression.</td>
</tr>
<tr>
<td></td>
<td>Continuous dewatering to MWD1</td>
</tr>
<tr>
<td></td>
<td>Receives coarse rejects</td>
</tr>
<tr>
<td></td>
<td>Receives fine rejects from 2020</td>
</tr>
<tr>
<td>Raw Water Dam</td>
<td>Supplies CHPP and Miscellaneous</td>
</tr>
<tr>
<td></td>
<td>Receives from MWD1, RWD1, MIA Dam, WMD1</td>
</tr>
<tr>
<td></td>
<td>Transfers to WMD1, MWD1</td>
</tr>
<tr>
<td></td>
<td>Minimum operating volume of 30 ML for fire water system operation.</td>
</tr>
<tr>
<td></td>
<td>Maximum Operation volume of 75 ML</td>
</tr>
<tr>
<td>Return Water Dam 1</td>
<td>Supplies to the CHPP demand.</td>
</tr>
<tr>
<td></td>
<td>Receives pump transfers from Rejects Dam 1</td>
</tr>
<tr>
<td></td>
<td>Overflows to Receiving Waters.</td>
</tr>
<tr>
<td></td>
<td>Maximum operating volume set at 75 ML</td>
</tr>
<tr>
<td>MIA Dam 2</td>
<td>Transfers to Raw Water Dam and WMD1</td>
</tr>
<tr>
<td></td>
<td>Overflows to Receiving Waters.</td>
</tr>
<tr>
<td></td>
<td>Maximum operating volume set at 350 ML</td>
</tr>
<tr>
<td>Mine Water Dam 1</td>
<td>Receives pumped transfers from Pit 1</td>
</tr>
<tr>
<td></td>
<td>Supplies to the Dust Suppression demand.</td>
</tr>
<tr>
<td></td>
<td>Transfers to Raw Water Dam at WMD1 at 60l/s.</td>
</tr>
<tr>
<td></td>
<td>Overflows to Receiving Waters.</td>
</tr>
<tr>
<td></td>
<td>Maximum operating volume set at 75 ML</td>
</tr>
<tr>
<td>Rejects Dam (and Decant Pond)</td>
<td>Receives fine rejects from CHPP</td>
</tr>
<tr>
<td></td>
<td>Decant water pumped to RWD1</td>
</tr>
<tr>
<td></td>
<td>Overflows to RWD1</td>
</tr>
<tr>
<td>Sediment Dam 1</td>
<td>Supplies to the Dust Suppression demand.</td>
</tr>
<tr>
<td></td>
<td>Overflows to Receiving Waters.</td>
</tr>
<tr>
<td>Water Management Dam 1</td>
<td>Receives pumped transfers from MWD1 and Pit 1</td>
</tr>
<tr>
<td></td>
<td>Transfers to Raw Water Dam and MWD1 at 100 l/s.</td>
</tr>
<tr>
<td></td>
<td>Overflows to Receiving Waters.</td>
</tr>
<tr>
<td></td>
<td>Maximum operating volume set at 2,000 ML</td>
</tr>
<tr>
<td>Receiving Waters</td>
<td>Receives storage overflows from the following locations:</td>
</tr>
<tr>
<td></td>
<td>MIA Dam</td>
</tr>
<tr>
<td></td>
<td>Sediment Dam 1.</td>
</tr>
</tbody>
</table>
Table C.6 - Adopted solids rates for the CHPP, 2018 to 2020

<table>
<thead>
<tr>
<th>Description</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washed ROM coal dry tonnage (Mtpa)</td>
<td>2.31</td>
<td>2.66</td>
<td>2.74</td>
</tr>
<tr>
<td>Washed product coal dry tonnes (Mtpa)</td>
<td>1.57</td>
<td>1.76</td>
<td>1.79</td>
</tr>
<tr>
<td>Fine rejects (Mtpa)</td>
<td>0.30</td>
<td>0.36</td>
<td>0.38</td>
</tr>
<tr>
<td>Coarse rejects (Mtpa)</td>
<td>0.44</td>
<td>0.54</td>
<td>0.57</td>
</tr>
</tbody>
</table>

Table C.6 - Adopted CHPP daily water balance, 2018 to 2020

<table>
<thead>
<tr>
<th>Description</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washed ROM coal (ML/day)</td>
<td>0.70</td>
<td>0.81</td>
<td>0.83</td>
</tr>
<tr>
<td>Washed product coal (ML/day)</td>
<td>-0.66</td>
<td>-0.74</td>
<td>-0.75</td>
</tr>
<tr>
<td>Fines rejects Slurry (ML/day)</td>
<td>-2.48</td>
<td>-2.97</td>
<td>-3.13</td>
</tr>
<tr>
<td>Coarse and fine tailing entrainment (ML/day)</td>
<td>-0.61</td>
<td>-0.73</td>
<td>-0.77</td>
</tr>
<tr>
<td>CHPP water demand (ML/day)</td>
<td>2.58</td>
<td>3.06</td>
<td>3.22</td>
</tr>
</tbody>
</table>

C1.3.2 Dust Suppression

Based on information provided by CDM, an average dust suppression usage of 1 ML/d was adopted. For modelling purposes, dust suppression was sourced according to the following priority:

- MWD1;
- Open Pit; and
- Sediment Dam.

MWD1 will also receive water from WMD1 to maintain a supply to dust suppression before using Sediment Dam 1. Only when Sediment Dam 1 is unable to supply dust suppression is water transferred from the Raw Water Dam, which is supplied by ‘external’ QGC water in dry periods.

C1.4 WATER SUPPLY SOURCES

C1.4.1 ‘External’ QGC Water

‘External’ water from the QGC gas field operations is supplied to the existing CDM site. Water is currently pumped to the Raw Water Dam from the Glen Eden Pond at a rate of up to 4ML/d. Water stored in the RWD is used for truck wash areas, industrial washdown areas and has a source of makeup water to the CHPP. This water may also be used for dust suppression (in the event that all other mine water sources have been used up) in accordance with the BUA.

C1.4.2 Groundwater Inflows

The predicted groundwater inflows for the CDM were provided by AGE (2018). A variable groundwater inflow rate is predicted over the life of the mine. The daily inflow rates to Pit 1 over the simulation period are:

- 0.32 ML/day during 2018;
- 0.33 ML/day during 2019; and
- 0.38 ML/day during 2020.
C1.5 CONTROLLED RELEASES

Controlled releases to the receiving waters from ‘worked’ water storages and Sediment Dam 1 were not modelled. Notwithstanding this, controlled releases from these storages to the receiving waters from mine water dams and sediment dams may be undertaken if the water quality is within the release limits and downstream receiving waters trigger levels limits specified in the CDM.

C1.6 CATCHMENTS

Catchment areas for each of the site storages and pits have been estimated using topographic information provided by CDM (current as at November 2017) and relevant supporting documentation. A summary of the adopted catchment areas for the future mine site is provided in Table C.7. Figure C.4 shows the current catchment areas draining to the CDM storages.

Table C.7 - CDM Storage Catchment Areas (ha)

<table>
<thead>
<tr>
<th>Storage ID</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Water Dam</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Admin Dam</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>MIA Dam</td>
<td>88</td>
<td>88</td>
<td>88</td>
</tr>
<tr>
<td>MWD1</td>
<td>4.8</td>
<td>4.8</td>
<td>4.8</td>
</tr>
<tr>
<td>RWD1</td>
<td>1.4</td>
<td>1.4</td>
<td>1.4</td>
</tr>
<tr>
<td>RD1</td>
<td>63</td>
<td>63</td>
<td>63</td>
</tr>
<tr>
<td>WMD1</td>
<td>59</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>Sediment Dam 1</td>
<td>344</td>
<td>394</td>
<td>445</td>
</tr>
<tr>
<td>Pit 1</td>
<td>193</td>
<td>193</td>
<td>193</td>
</tr>
</tbody>
</table>

C1.7 CATCHMENT RUNOFF

C1.7.1 Mine site runoff parameters

The AWBM model was used to represent the runoff characteristics of different land use types within local mine site catchments. AWBM uses a group of connected conceptual storages (3 surface storages and 1 groundwater storage) to represent a catchment. Water in the conceptual storages is replenished by rainfall and reduced by evapotranspiration. Simulated surface runoff occurs when these storages fill and overflow. The model parameters define the depth and relative area of each of the storages, as well as the rate of water flux between storages.

To accurately simulate the site water balance, it is necessary to define the runoff characteristics of the various catchment surface (land use) types. The following land use classifications were used:

- Natural - representing undisturbed area as well as rehabilitated areas;
- Industrial - representing areas disturbed by mining such as, haul roads and plant areas (including industrial and cleared areas);
- Spoil - representing uncompacted dumped overburden material;
- Pit - representing the open pit area; and
- Rejects - Representing active reject dams.

Table C.8 shows the adopted AWBM parameters for the various catchment types at the mine site. The AWBM model parameters were determined on the basis of the OPSIM model calibration results and previous experience with similar catchments.
The runoff characteristics of the mine site catchments will be monitored to verify the adopted runoff characteristics for active spoil dumps and natural catchments to confirm the accuracy of the predicted results.

Table C.8 - Adopted AWBM parameters

<table>
<thead>
<tr>
<th>Parameter ID</th>
<th>Parameter ID</th>
<th>Dogwood Ck</th>
<th>Site - Natural</th>
<th>Industrial</th>
<th>Active Spoil</th>
<th>Rehabilitated</th>
<th>Open Pit</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>90</td>
<td>90</td>
<td>12</td>
<td>15</td>
<td>90</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>C2</td>
<td>150</td>
<td>150</td>
<td>21</td>
<td>40</td>
<td>150</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>280</td>
<td>280</td>
<td>0</td>
<td>120</td>
<td>280</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td>0.134</td>
<td>0.134</td>
<td>0.1</td>
<td>0.134</td>
<td>0.134</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td>0.433</td>
<td>0.433</td>
<td>0.9</td>
<td>0.433</td>
<td>0.433</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>BFI</td>
<td>0.25</td>
<td>0.25</td>
<td>0</td>
<td>0.3</td>
<td>0.25</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Kb</td>
<td>0.97</td>
<td>0.97</td>
<td>0</td>
<td>0.96</td>
<td>0.97</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Ks</td>
<td>0.77</td>
<td>0.77</td>
<td>0</td>
<td>0</td>
<td>0.77</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

C1.7.1 Receiving waters runoff AWBM model validation

The AWBM model was calibrated to the recorded daily Dogwood Creek flows at Gilweir station between October 1969 and December 2016, using the Rainfall Runoff Library (RRL) developed by the CRC for Catchment Hydrology (Podger, 2004). SILO Data Drill rainfalls for the CDM site were used for catchment rainfalls. The model was calibrated to achieve a daily flow duration curve similar to the recorded data. Figure C.5 shows a comparison of the recorded and predicted daily flow duration curves (in ML/d) for Dogwood Creek at Gilweir station. Table C.8 shows the validated AWBM model parameters.

C1.7.1 Runoff water quality

The OPSIM model has been configured to use salinity (as EC) as an indicator of water quality, by assigning representative EC concentrations to runoff from various catchment types and other inflow sources of water. EC for runoff from the various catchment types are largely based on monitoring data provided by CDM (see Section 3 and Section 4). Table C.9 shows the EC values adopted for this assessment.

Table C.9 - Adopted runoff parameters for EC

<table>
<thead>
<tr>
<th>Land use</th>
<th>Adopted EC (µS/cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Spoil</td>
<td>200</td>
</tr>
<tr>
<td>Natural/Rehabilitation</td>
<td>100</td>
</tr>
<tr>
<td>Groundwater</td>
<td>7,500</td>
</tr>
<tr>
<td>Rejects</td>
<td>1,500</td>
</tr>
<tr>
<td>Industrial</td>
<td>2,000</td>
</tr>
<tr>
<td>External water</td>
<td>2,500</td>
</tr>
<tr>
<td></td>
<td>Recorded WQ data in Sediment Dam 1</td>
</tr>
<tr>
<td></td>
<td>Recorded WQ data in W51 and W53</td>
</tr>
<tr>
<td></td>
<td>Recorded WQ data in Pit 1</td>
</tr>
<tr>
<td></td>
<td>Recorded WQ data in Rejects Dam 1</td>
</tr>
<tr>
<td></td>
<td>Recorded WQ data in MIA Dam</td>
</tr>
<tr>
<td></td>
<td>Recorded WQ data in Raw Water Dam</td>
</tr>
</tbody>
</table>
Figure C.4 - Cameby Downs Mine - modelled site storage catchment areas
Figure C.5 - Recorded vs predicted daily flow duration curves, Dogwood Creek at Gilweir Station
Cameby Downs
Continued Operations Project
Environmental Values Assessment

ATTACHMENT 3

Receiving Environment Monitoring Program
Comeby Downs Mine
Receiving Environment Monitoring Program (REMP)
September 2018
Cameby Downs Mine
Receiving Environment Monitoring Program (REMP)

6 September 2018

Prepared for:
Syntech Resources Pty Ltd
C/- Yancoal Australia Ltd
Boonal Haul Road
Blackwater QLD 4717

Report by:
DPM Envirosciences Pty Ltd
ABN: 54 602 226 460
PO Box 1298 Mooloolaba QLD 4557
Ph: 0427 694 433

DPM Ref: DPM16022_RPT REMP_6Sep2018
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**Cameby Downs Mine**  
Receiving Environment Monitoring Program (REMP)  
6 September 2018

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<th>Copies</th>
<th>Recipient</th>
</tr>
</thead>
</table>
| 1 ecopy| Daniel Jones  
Environment and Community Manager  
Yancoal Australia Ltd  
C/- Resource Strategies Pty Ltd |
| 1 ecopy| DPM Files                                      |

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By

**DPM Envirosiences Pty Ltd**  
ABN: 54 602 226 460  
PO Box 1298 Mooloolaba QLD 4557

David Moore  
Principal Environmental Scientist
“This page has been left blank intentionally”
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INTRODUCTION

The Cameby Downs Mine is owned and operated by Syntech Resources Pty Ltd (Syntech Resources) and is managed by Yancoal Australia Ltd (Yancoal). Syntech Resources has lodged an amendment application to the Cameby Downs Mine Environmental Authority (EA) EPML00900113 in accordance with section 224 of the Queensland Environmental Protection Act 1994 (EP Act) to approve the Cameby Downs Mine Continued Operations Project (the Project).

The approved Cameby Downs Mine is located approximately 360 kilometres (km) west-north-west of Brisbane in the Western Downs Regional Council local government area. The Cameby Downs Mine has been operating for eight years, with excavation of overburden commencing in July 2010 and first coal excavated in August of that year. The coal handling and preparation plant was commissioned in November 2010 with first railing of coal occurring in December 2010.

The Project involves the extension of operations within Mining Lease (ML) 50233 and into Mining Lease Applications (MLAs) 50258, 50259, 50260 and 50269 and an increase in the run-of-mine coal mining rate from the currently approved 2.8 million tonnes per annum (Mtpa) to 3.5 Mtpa. The Project life would be for approximately 75 years.

DPM Envirosciences Pty Ltd (DPM Envirosciences) was commissioned by Syntech Resources to develop a Receiving Environment Monitoring Program (REMP) for the Project. The Cameby Downs Mine currently operates under EA EPML00900113 (effect date of 8 July 2016).

This REMP sets out the design of the REMP for the Cameby Downs Mine, including the Project. This REMP was completed while existing operations at the Cameby Downs Mine were in effect. This document has been designed for the Project in accordance with the Receiving environment monitoring program guideline (EHP 2014).

REMPs are designed to monitor and assess the potential impacts of controlled or uncontrolled releases of wastewater and associated contaminants to the environment from a regulated activity (EHP 2014). The monitoring programs evaluate whether the discharge limits or other imposed conditions have been successful in maintaining or protecting receiving environment values over time (EHP 2014).

The key indicators that will be monitored in the REMP include flow, bank stability, aquatic habitat, surface water quality, stream sediment quality, aquatic flora and aquatic macroinvertebrate community composition.
1.1 Aims and objectives

The REMP characterises the receiving environment of the Cameby Downs Mine and establishes a monitoring program to monitor potential impacts from the mining operation.

The REMP aims to:
- describe the background condition of drainage lines in the receiving environment, including a description of key communities and ‘reference’ surface water quality characteristics;
- describe relevant environmental values (EVs) and the water quality objectives (WQOs) for the receiving waters;
- monitor temporal and spatial changes in the environment (natural or otherwise); and
- establish the procedure for developing project-specific WQOs.

1.2 Literature review

The following documents guided the development of this REMP:
- EA EPML00900113;
- *Receiving Environment Monitoring Program Guideline* (EHP 2014);
- *Model Mining Conditions Guideline* (EHP 2017a);
- *Queensland Water Quality Guidelines* (QWQG) (EHP 2009a);
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC / ARMCANZ 2000);
- *Revision of the ANZECC / ARMCANZ Sediment Quality Guidelines* (CSIRO 2010);
- Environmental Protection (Water) Policy 2009 (EPP Water);
- *Technical Guideline – Licencing: Wastewater Release to Queensland Waters* (EHP 2012);
- Aquatic Ecology Assessment for the Cameby Downs Continued Operations Project (DPM Envirosiences 2018);
- Healthy Waters Management Plan (HWMP) for the Murray-Darling and Bulloo Basins (EHP 2016); and

Draft documentation has been released by the Department of Environment and Science (DES) in 2018 and is currently the subject of final consultation under the EPP Water on the environmental values (EVs), aquatic ecosystem protection mapping and water quality objectives (WQOs) for all surface water and groundwater of the Queensland Murray-Darling Basin (QMDB). As these draft EVs, mapping and WQOs are yet to be finalised, no further consideration is made in this REMP.
2 DESCRIPTION OF RECEIVING ENVIRONMENT

2.1 Characteristics of potential mine-affected water releases

The characteristics of potential mine-affected water releases are different at each mine site and will vary depending on the stage of the mine. The Cameby Downs Mine will maintain data pertaining to the quality and quantity of water releases (if any). This data will be examined prior to each REMP sampling event and will be included in subsequent REMP reporting.

2.2 Description of receiving waters

The Cameby Downs Mine is located approximately 32 km west of Chinchilla and 16 km east of Miles along the Warrego Highway (Figure 1). The Cameby Downs Mine is located within the Condamine River basin and in the Dogwood Creek sub-basin. The drainage lines draining the Cameby Downs Mine are ephemeral and are expected to only flow for relatively short duration following intense or sustained rainfall and runoff in the catchment. Semi-permanent to permanent waterholes occur within the Cameby Downs Mine area and downstream, due to clay rich substrates. These waterholes are likely to provide refuge for aquatic species during the drier months of the year.

The Cameby Downs Mine is located high in the catchment with first order streams (Strahler, 1952) draining both north and south from the mining area. The northern section flows in a general north-west direction into Punch-Bowl Creek and turns west until it flows into Dogwood Creek. Dogwood Creek then flows south through Miles. The southern section (and majority) of the Cameby Downs Mine drains to the south. The majority of these drainage lines start out as first order streams and join to make Drainage Line 1. Drainage Line 2 then flows in a general south-west direction until it joins Dogwood Creek approximately 7.5 km south (downstream) of Miles.

2.3 Rainfall and hydrology

The drainage lines at the Cameby Downs Mine are subject to seasonality, which can be broadly categorised as either dry season or wet season. Rainfall across the Cameby Downs Mine is expected to be greatest in mid-summer, with the lowest rainfall expected to occur in late winter, as inferred from data collected at the Miles Post Office monitoring station 42023 (BoM 2016) (Figure 2), located approximately 14 km west of the Cameby Downs Mine.
The drainage lines at the Cameby Downs Mine are ephemeral and expected to experience flow only after sustained or intense rainfall in the catchment. Stream flows are expected to be highly variable, with most channels drying out during winter to early spring when rainfall and runoff is historically low. During these times, aquatic fauna are likely to concentrate in senescing pools. As a consequence, physical attributes, water quality, and the composition of aquatic flora and fauna communities are expected to be highly variable over time.

Historical flow and river height monitoring data (1949-2016) for Dogwood Creek at Gilweir (DNRM monitoring station 422202B), located approximately 5 km south of Miles, provides an indication of the local flow regime. It is noted that although Dogwood Creek receives runoff from the Cameby Downs Mine, this gauging station is upstream of the confluence with Drainage Line 1, which also receives runoff from the mine. However, historical flow and river height data for this monitoring station suggests that waterways of the broader area are likely to incur reduced flows between March and September (Figure 3) (DNRM 2016).
2.4 Adjacent land use

Land use in the vicinity of the Cameby Downs Mine includes grazing and coal seam gas operations. Grazing intensity generally ranges from light to moderate. Coal seam gas wells are relatively low in number within the Cameby Downs Mine area; however, there is a high number of wells to the south (on the other side of the Warrego highway).

2.5 Flow

Drainage lines within and surrounding the Cameby Downs Mines are ephemeral and have a variable flow regime, often only flowing after heavy sustained rainfalls and for short periods. Periods of no flow can affect biological communities as drainage lines can dry up. Ephemeral drainage lines, such as those within the receiving environment of the Cameby Downs Mine, often have poorer aquatic macroinvertebrate species diversity than more permanent systems (EHP 2009b). Flow data will assist in understanding the ephemerality of drainage lines in the receiving environment and how this may affect observed changes in aquatic ecology.

2.6 Bank stability / erosion

Small amounts of local catchment erosion are present throughout the system. Bank stability is generally good, with 50-80% of the stream banks covered with vegetation (DPM Envirosciences 2018). There is some potential for erosion within the system during extreme flooding. Riparian zone widths ranged from 10-15m throughout the Cameby Downs Mine (DPM Envirosciences 2018).
2.7 Aquatic habitat

Aquatic habitats were generally in fair condition at the time of assessment by AARC in 2010 (AARC 2013) and by DPM Envirosciences in 2017 (DPM Envirosciences 2018). Aquatic habitat attributes such as detritus, sticks, branches and logs provided instream habitat and refugia for aquatic fauna during flow events. Substrate complexity was poor, with most substrates consisting of silt / clay and / or sand, and lacking in pebble, cobble and boulder substrates. Both shallow and deep pool habitats were found in both the northern and southern draining drainage lines.

2.8 Surface water quality

Existing surface water quality data for the Cameby Downs Mine includes physico-chemical parameters from five water quality data loggers (Figure 4), comprising:

- WS1 – Drainage Line 1 downstream;
- WS2 – Drainage Line 1 upstream;
- WS3 – Drainage Line 2 downstream;
- WS4 – Drainage Line 2 upstream; and
- WS5 – Drainage Line 2 tributary upstream.

Upstream sites (WS2 and WS4, no data for WS5) are characterised by low conductivity and variable pH. Downstream sites (WS1 and WS3) are characterised by variable conductivity, variable pH, high turbidity and variable dissolved oxygen levels. The greatest variability is generally found at WS3 – Drainage Line 2 downstream.

A summary of water quality around the Cameby Downs Mine is provided in Section 3.5 of the Cameby Downs Mine Water Management Plan (WRM 2017).

2.9 Stream sediment

Syntech Resources currently collect stream sediment data from Cameby Downs Mine in accordance with Condition F5 – Stream sediment contaminant levels of EA EPML 00900113.

2.10 Aquatic flora

The latest aquatic ecology assessment within the Cameby Downs Mine area identified 11 species of aquatic plants (DPM Envirosciences 2018), none of which are listed as Endangered, Vulnerable or Near Threatened (EVNT) under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) or the Queensland Nature Conservation Act 1992 (NC Act). One Priority species was detected, being water primrose (*Ludwigia peploides* subsp. *montevidensis*), at a farm dam within the Cameby Downs Mine. The lack of diversity and abundance of aquatic flora throughout the Cameby Downs Mine area is likely a result of the harsh physical conditions and land use (cattle grazing and trampling). Seasonal variation in climate conditions will also effect the diversity and abundance of aquatic flora.
2.11 Aquatic macroinvertebrates

No aquatic macroinvertebrates or macro-crustaceans are listed as EVNT or Priority species for the Balonne-Condamine drainage basin in Queensland. An assessment undertaken in July 2016 (DPM Envirosciences 2018) recorded a total of 39 taxa from 1,905 aquatic macroinvertebrates collected from six sites across the Study area. This assessment found that the dominant taxa-rich orders were Coleoptera (beetles) and Diptera (true flies). Other orders recorded included Decapoda (in this case prawns, shrimp and yabbies), Acarina (mites), Ephemeroptera (mayflies), Hemiptera (aquatic bugs), Trichoptera (caddis flies), Epiproctophora (dragonflies), Zygoptera (damselflies), Lepidoptera (aquatic caterpillars), Gastropoda (aquatic snails), Collembola (springtails), Ostracoda (seed shrimp), Copepoda (copepods) and Cladocera (water fleas), Oligochaeta (segmented worms) and Turbellaria (flatworms).

Aquatic macroinvertebrate assemblages throughout the Cameby Downs Mine area generally comprised slightly impaired to severely impaired communities (DPM Envirosciences 2018) as defined by the AusRivAS models (DNRM 2001). It was noted, however, that caution should be applied to AusRivAS ratings in ephemeral systems. Seasonal rainfall conditions in ephemeral systems can result in pools that have only recently formed (i.e. within 1-4 weeks) and sampling of these pools can result in a reflection of seasonality rather than catchment impacts.

2.12 Fish

AARC (2013) and DPM Envirosciences (2018) recorded seven fish species during surveys undertaken in January 2010 and July 2016, respectively. Four of these species are native, while three species are introduced. These species were:

- Golden perch (*Macquaria australasica*) – size range 250-300 mm
- Spangled perch (*Leiopotherapon uniclor*) – size range 130-140 mm
- Glassfish (*Ambassis agassizi*) – 35 mm
- Gudgeon (*Hypseleotris sp.*) – size range 30-50 mm
- European carp (*Cyprinus carpio*) – 300 mm (introduced species)
- Goldfish (*Carassius auratus*) – 200 mm (introduced species)
- Mosquitofish (*Gambusia holbrooki*) – 25-30 mm (introduced species).

No EVNT fish species were captured in either survey (AARC 2013; DPM Envirosciences 2018). Due to habitat requirements, it is unlikely that EVNT fishes would occur within waterbodies of the Cameby Downs Mine as either resident or transient occurrences (DPM Envirosciences 2018). However, habitat for the EVNT species Murray Cod (*Maccullochella peelii*) and silver perch (*Bidyanus bidyanus*) occur in larger waterways of the broader catchment.

2.13 Summary

The ecological health of drainage lines at the Cameby Downs Mine are considered to be poor to moderate and representative of ephemeral systems that have undergone historic land clearing and historic and current cattle grazing. Agricultural development (particularly cattle grazing) and water extraction within the region is likely to have had a negative impact on surface water quality and the physical characteristics of aquatic habitat.
3 ENVIRONMENTAL VALUES

Environmental values are the qualities of waterways to be protected from activities in the catchment. Protecting environmental values aims to ensure healthy aquatic ecosystems and waterways that are safe and suitable for community use. Environmental values reflect the ecological, social and economic values and uses of the waterway (Such as stock water, swimming, fishing and agriculture).

The processes to identify EVs and determine WQOs are based on the National Water Quality Management Strategy: Implementation Guidelines (NWQMS 1998) and further outlined in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ 2000).

EVs and WQOs for the Maranoa-Balonne (and Lower Condamine) Sub-basin are being developed by the DES. DES has been developing the EV’s and WQO’s in collaboration with the Queensland Murray Darling Committee (QMDC). DES has republished a draft report by QMDC entitled Healthy Waters Management Plan Draft Environmental Values and Community Consultation Report (EHP 2017b). Although this document is only in draft form, it is likely to be used to inform the subsequent development of EV’s, WQO’s and future water quality guidelines under the EPP Water.

Based on EHP (2017b), the receiving surface waters downstream of the Cameby Downs Mine are located in the Dogwood Creek zone. The surface water EVs nominated for protection for this zone are:

- Aquatic ecosystems;
- Irrigation;
- Farm supply/use;
- Stock water;
- Human consumer;
- Primary recreation;
- Visual recreation;
- Drinking water; and
- Cultural and spiritual values.

3.1 Risks to environmental values of the receiving environment

It is expected that the release of mine-affected into the receiving environment may influence the following parameters to varying degrees:

- water quality;
- sediment quality;
- flow;
- aquatic habitat, including bank stability, presence of benthic or filamentous algae, and suitability of habitat for aquatic fauna; and
- biological communities (aquatic fauna in particular).

3.2 Conceptual model of stressors to the receiving environment

Existing and proposed stressors to the receiving environment have been evaluated with a conceptual model to visualise the potential surface water quality impacts associated with mine water releases, to determine the most appropriate locations for REMP monitoring sites, and to confirm suitability of the monitoring indicators proposed (Figure 6).
CONCEPTUAL MODEL OF STRESSORS TO THE RECEIVING ENVIRONMENT

**Upstream Zone**
Land use predominantly native forest. Ephemeral flow following sustained or intense rainfall and runoff in the catchment. Runoff water quality expected to be high, with low levels of physical stressors (sediment load and salinity), neutral pH, low levels of chemical stressors (nutrients) and negligible toxicants (metals and hydrocarbons).

**Incidental runoff from disturbed areas**
Potential for diffuse release of stressors in surface water inadvertently released following sustained or intense rainfall. Potential to affect ecosystem health in receiving waters, such as sensitive aquatic macroinvertebrate taxa.

**Raw Water Dam**
Point source release in times of flow, when storage levels necessitate release. Expected to exhibit low physical stressors (sediment load and salinity), low chemical stressors (nutrients), and low toxicant levels (metals). Potential to affect ecosystem health in receiving waters, such as sensitive aquatic macroinvertebrate taxa.

**Return Water Dam**
Point source release in times of flow, when storage levels necessitate release. Expected to exhibit moderate physical stressors (sediment load and salinity), low chemical stressors (nutrients), and low toxicant levels (metals). Potential to affect ecosystem health in receiving waters, such as sensitive aquatic macroinvertebrate taxa.

**Mine Water Dam**
Point source release in times of flow, when storage levels necessitate release. Expected to exhibit moderate to high physical stressors (sediment load and salinity), moderate chemical stressors (nutrients), and moderate levels of toxicants (metals). Potential to affect ecosystem health in receiving waters, such as sensitive aquatic macroinvertebrate taxa.

**Sediment Dam**
Point source release in times of flow, when storage levels necessitate release. Expected to exhibit low to moderate physical stressors (sediment load and salinity), low to moderate chemical stressors (nutrients), and low to moderate levels of toxicants (metals). Potential to affect ecosystem health in receiving waters, such as sensitive aquatic macroinvertebrate taxa.

**Incidental runoff from disturbed areas**
Potential for diffuse release of stressors in surface water inadvertently released following sustained or intense rainfall. Potential to affect ecosystem health in receiving waters, such as sensitive aquatic macroinvertebrate taxa.

**Downstream Zone 1**
Downstream of Mining Lease and other tributaries draining agricultural land and areas of coal seam gas extraction. Expected to exhibit low physical stressors (sediment load and salinity), neutral pH, low to moderate chemical stressors (nutrients) and low levels of toxicants (metals and hydrocarbons). Potential to affect ecosystem health in receiving waters, such as sensitive aquatic macroinvertebrate taxa.

**Incidental runoff from disturbed areas**
Potential for diffuse release of stressors in surface water inadvertently released following sustained or intense rainfall. Potential to affect ecosystem health in receiving waters, such as sensitive aquatic macroinvertebrate taxa.

**Downstream Zone 2**
Downstream of Mining Lease and other tributaries draining agricultural land and areas of coal seam gas extraction. Expected to exhibit low physical stressors (sediment load and salinity), neutral pH, low to moderate chemical stressors (nutrients) and low levels of toxicants (metals and hydrocarbons). Potential to affect ecosystem health in receiving waters, such as sensitive aquatic macroinvertebrate taxa.
4 WATER QUALITY OBJECTIVES

4.1 Default water quality objectives

The indicators and water quality guidelines relevant to the above surface water EVs are listed in the QWQG and ANZECC & ARMCANZ (2000). The conditions of waterways located in the vicinity of the Cameby Downs Mine are classified as Level 2: slightly to moderately disturbed ecosystems under the QWQG. Cameby Downs Mine have adopted the Model Mine Conditions receiving waters trigger levels, which are based on the ANZECC & ARMCANZ (2000) values for aquatic ecosystem protection.

A summary of the default trigger values is provided in Sections 3.3 and 3.4 of the Cameby Downs Mine Water Management Plan (WRM 2017).

4.2 Deriving project-specific guideline values for assessment of impacts in aquatic ecosystems

The QWQG (EHP 2009a) state that in order to develop project-specific (also termed local or site-specific) guideline values, a minimum of 12 data points per site must be collected for three or more reference sites. These data points must be collected over a minimum 12 month period. However, 24 months is preferable as it captures data over two complete annual cycles (wet and dry seasons).

Interim Project-specific guidelines can be developed when ≥8 and ≤12 data points have been collected and must be collected over a minimum of 12 months (EHP 2009a). Interim guideline values are subject to further refinement after more data is collected. As a minimum, interim and Project-specific guidelines should be updated yearly.

Project-specific guideline values will be developed using background sites that are not influenced by activities of the Cameby Downs Mine. These background sites will follow (where possible) the definition of a reference site as described by the QWQG (EHP 2009a) where a reference site is defined as a site where:

- there is no intensive agriculture (such as the use of irrigation and agrochemicals; dryland grazing is not included in this category), extractive industry, major urban areas or point source wastewater discharge within 20 km upstream; and
- the seasonal flow regime is not greatly altered by water abstraction or regulation.

DES will use surface water quality data from reference sites in their regional monitoring program to derive regional WQOs in the future. The background sites for the REMP may not meet the criteria for a reference site, due to the long term impacts from cattle grazing, land clearing and seasonal water flow regulation (farm dams). However, data from the background sites will be analysed in the same way in order to derive interim and project-specific WQOs.

Data collected from reference sites is used to estimate percentile values, which in turn are used to derive guidelines. For slightly to moderately disturbed waters the 20th and 80th percentiles of reference site values are used (EHP 2009a). It is important to note that data collected during high flow, base flow or nil flow periods should not be pooled when using the data to derive trigger values given the significant differences in water quality that often occur (EHP 2014).
4.3 Sediment quality guidelines

The stream sediment quality guidelines (SQG) for the suite of metals and metalloids to be monitored during the REMP are listed in Table 1. If the concentrations in the Cameby Downs Mine area are below the ‘SQG – Low’ value, they can be considered to be low risk and no further action is required. If they are between the ‘SQG – Low’ and ‘SQG – High’ values, then investigation of background levels in the area would be required. Where concentrations exceed the ‘SQG – High’ values, then further investigation of factors affecting bioavailability will be required (CSIRO 2013).

Due to the limitations in deriving site-specific guidelines in whole sediment fractions (due to variation in particle size distribution between sites and binding of different metals to different particle sizes) the default SQG values will be used (Table 1). These will only apply to samples in the whole sediment fraction (i.e. <2 mm particle size).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>SQG – Low (mg/kg)</th>
<th>SQG – High (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminium</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Arsenic</td>
<td>20</td>
<td>70</td>
</tr>
<tr>
<td>Boron</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Cadmium</td>
<td>1.5</td>
<td>10</td>
</tr>
<tr>
<td>Chromium</td>
<td>80</td>
<td>370</td>
</tr>
<tr>
<td>Cobalt</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Copper</td>
<td>65</td>
<td>270</td>
</tr>
<tr>
<td>Iron</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Lead</td>
<td>50</td>
<td>220</td>
</tr>
<tr>
<td>Manganese</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Mercury</td>
<td>0.15</td>
<td>1</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Nickel</td>
<td>21</td>
<td>52</td>
</tr>
<tr>
<td>Selenium</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Silver</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Uranium</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Vanadium</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Zinc</td>
<td>200</td>
<td>410</td>
</tr>
</tbody>
</table>

N/A = no trigger value available
5 MONITORING PROGRAM

The conceptual model of stressors (Section 3.2) was used to identify suitable locations for monitoring as part of this REMP (Table 2). This includes the receiving water and sediment monitoring locations (WS1 to WS5) currently monitored by Syntech Resources under the existing EA EPML00900113, and five new locations (Table 2). Initially, five upstream sites and five downstream (receiving environment) sites will be monitored as part of the REMP (Figure 6). This will transition to four upstream sites and four downstream sites as the Project progresses (as monitoring sites WS1 and WS2 are made redundant) (Tables 2 and 3).

Indicators to be monitored are listed in Section 5.13. The rationale behind the selection of sites is discussed in Section 5.13. Should monitoring detect impacts to the downstream sites, additional sites may be added to the program. At the time of writing this REMP, the spatial extent of the receiving environment had not been defined in the EA. Due to the high prevalence of coal seam gas wells (and their potential impacts) south of the Warrego Highway, no monitoring sites have been proposed in this area.
## Table 2: Proposed receiving environment monitoring site locations

<table>
<thead>
<tr>
<th>Site</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Description</th>
<th>Upstream or receiving</th>
<th>Potentially contaminating activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS1*</td>
<td>-26.6502</td>
<td>150.3683</td>
<td>Located on Drainage Line 1, directly downstream of the existing Mining Lease boundary</td>
<td>Receiving</td>
<td>Mining operations: Rejects emplacement, stock piles, spoil, creek diversion. Grazing.</td>
</tr>
<tr>
<td>DL1 DS</td>
<td>-26.6755</td>
<td>150.3593</td>
<td>Located downstream of Drainage Lines 1 and 2, downstream of all EA release points.</td>
<td>Receiving</td>
<td>Mining operations: Rejects emplacement, stock piles, spoil, creek diversion. Grazing.</td>
</tr>
<tr>
<td>WS2*</td>
<td>-26.6234</td>
<td>150.3344</td>
<td>Located on Drainage Line 1, upstream of Ryalls Rd</td>
<td>Upstream</td>
<td>Grazing</td>
</tr>
<tr>
<td>DL1 US</td>
<td>-26.6284</td>
<td>150.3185</td>
<td>Located on Drainage Line 1, upstream of Ryalls Rd</td>
<td>Upstream</td>
<td>Grazing</td>
</tr>
<tr>
<td>WS3*</td>
<td>-26.6681</td>
<td>150.3413</td>
<td>Located on Drainage Line 2, directly downstream of the mining lease boundary</td>
<td>Receiving</td>
<td>Mining operations: Rejects emplacement, stock piles, Coal Handling and Processing Plant. Grazing.</td>
</tr>
<tr>
<td>WS4*</td>
<td>-26.6589</td>
<td>150.3290</td>
<td>Tributary of Drainage Line 2, upstream of Ryalls Rd</td>
<td>Upstream</td>
<td>Grazing</td>
</tr>
<tr>
<td>WS5*</td>
<td>-26.6529</td>
<td>150.3302</td>
<td>Located on Drainage Line 2, upstream of Ryalls Rd</td>
<td>Upstream</td>
<td>Grazing</td>
</tr>
<tr>
<td>DL3 US</td>
<td>-26.6467</td>
<td>150.4111</td>
<td>Located on Drainage Line 3, to the east of Cameby Downs Mine</td>
<td>Upstream</td>
<td>Grazing</td>
</tr>
<tr>
<td>DL3 DS</td>
<td>-26.6762</td>
<td>150.3653</td>
<td>Located on Drainage Line 3, just within the Mining Lease Application boundary</td>
<td>Receiving</td>
<td>Mining operations: spoil. Grazing.</td>
</tr>
<tr>
<td>PB DS</td>
<td>-26.5516</td>
<td>150.2555</td>
<td>Located on Punch Bowl Creek, downstream of the confluence of drainage lines 5, 6 and 7.</td>
<td>Receiving</td>
<td>Mining operations: spoil. Grazing.</td>
</tr>
</tbody>
</table>

Notes:
* Consistent with Environmental Authority EPML00900113.
5.1 Monitoring sites

Sampling site locations were chosen with regard to the following attributes:

- location with respect to Cameby Downs Mine;
- previous monitoring locations and monitoring history;
- adjacent land uses (including coal seam gas wells and farming);
- location along the creek;
- physical properties (provision of comparable sites);
- accessibility;
- likelihood of sufficient water for sampling; and
- the conceptual model of stressors (Section 3.2).

5.2 Timing

Receiving water monitoring will continue at the frequency identified in the EA, being at least once during each flow event, and daily during the release of waters from the licenced release points (Sediment Dam 1, Raw Water Dam, Return Water Dam, MIA Dam and Mine Water Dam 1). Sediment monitoring will continue at the frequency identified in the EA, being half-yearly (December and June).

Aquatic macroinvertebrate sampling will be conducted twice-yearly, notably in the early wet (October to December – when flow has been established for at least four weeks) and late wet (May to July – when recessional base flows have declined to a sampleable level, without significant flood peaks), in line with the Queensland AusRivAS sampling seasons (DNRM 2001). It is noted, however, that due to the ephemeral nature of the drainage lines in and around the Cameby Downs Mine, timing of the surveys is subject to rainfall and stream flow conditions and as such may occur outside of these sampling periods. Each survey will monitor the indicators listed in Section 5.3. For safety and data integrity reasons, surveys will not be undertaken during flood.

The monitoring frequency is summarised in Table 3.
### Table 3: Proposed monitoring frequency

<table>
<thead>
<tr>
<th>Site</th>
<th>Surface water quality^</th>
<th>Sediment quality^</th>
<th>Aquatic macroinvertebrates, aquatic flora and habitat assessment^</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS1 (site to transition to DLS DS)</td>
<td>At least once during each flow event, and daily during the release of waters from dams*</td>
<td>Half-yearly (December and June)*</td>
<td>-</td>
</tr>
<tr>
<td>DL1 DS</td>
<td>At least once during each flow event, and daily during the release of waters from dams</td>
<td>Half-yearly (December and June)</td>
<td>Twice-yearly (early wet and late wet)</td>
</tr>
<tr>
<td>WS2 (site to transition to DL1 US)</td>
<td>At least once during each flow event, and daily during the release of waters from dams*</td>
<td>Half-yearly (December and June)*</td>
<td>-</td>
</tr>
<tr>
<td>DL1 US</td>
<td>At least once during each flow event, and daily during the release of waters from dams</td>
<td>Half-yearly (December and June)</td>
<td>Twice-yearly (early wet and late wet)</td>
</tr>
<tr>
<td>WS3</td>
<td>At least once during each flow event, and daily during the release of waters from dams*</td>
<td>Half-yearly (December and June)*</td>
<td>Twice-yearly (early wet and late wet)</td>
</tr>
<tr>
<td>WS4</td>
<td>At least once during each flow event, and daily during the release of waters from dams*</td>
<td>Half-yearly (December and June)*</td>
<td>Twice-yearly (early wet and late wet)</td>
</tr>
<tr>
<td>WS5</td>
<td>At least once during each flow event, and daily during the release of waters from dams*</td>
<td>Half-yearly (December and June)*</td>
<td>Twice-yearly (early wet and late wet)</td>
</tr>
<tr>
<td>DL3 US</td>
<td>At least once during each flow event, and daily during the release of waters from dams</td>
<td>Half-yearly (December and June)</td>
<td>Twice-yearly (early wet and late wet)</td>
</tr>
<tr>
<td>DL3 DS</td>
<td>At least once during each flow event, and daily during the release of waters from dams</td>
<td>Half-yearly (December and June)</td>
<td>Twice-yearly (early wet and late wet)</td>
</tr>
<tr>
<td>PB DS</td>
<td>At least once during each flow event, and daily during the release of waters from dams</td>
<td>Half-yearly (December and June)</td>
<td>Twice-yearly (early wet and late wet)</td>
</tr>
</tbody>
</table>

**Notes:**
* Consistent with Environmental Authority EPML00900113.
^ No sampling would be undertaken during flood events due to safety considerations.
5.3 Indicators to be monitored

Indicators to be monitored in the REMP surveys include:

- flow;
- bank stability;
- aquatic habitat;
- surface water quality;
- stream sediment quality;
- aquatic flora; and
- aquatic macroinvertebrates.

Each of the indicators will be monitored at each site, except for DS5 and DS7 where only water quality samples will be collected (due to the small catchment size).

It is noted that any release monitoring undertaken for compliance with the release limits of the Cameby Downs Mine EA will be carried out and reported to DES through a process separate to this REMP.

5.3.1 Flow

Flow will be monitored using the Cameby Downs Mine’s existing gauging / flow stations. It is understood that flow stations are positioned both upstream and downstream of the current mining lease for Drainage Lines 1 and 2. Flow will be measured in height (metres) and volume (cubic metres per seconds). It is noted that the flow station at WS1 (Drainage Line 1 downstream) will need to be moved when Drainage Line 1 is diverted.

5.3.2 Bank stability

Observations of bank stability will be recorded at each monitoring site during field sampling. Observations will be recorded on the data sheets alongside aquatic habitat and site conditions. Observations to be recorded will include bank shape, bank stability, stream bed stability, channel shape, stream width and channel width.

5.3.3 Aquatic habitat

Aquatic habitat attributes will be described at each site following Queensland AusRivAS protocols (DNRM 2001) to establish a general description of the environment of each site and its immediate surrounds. This information will include, but is not limited to:

- bankfull height and width;
- stream width;
- flow level;
- water colour and odour;
- adjacent land use;
- habitat attributes and proportion of each habitat type present in the reach (as defined by a 100m section of the stream);
- description of substrate (including substrate odour);
- reach characteristics;
- pollution sources;
- general signs of disturbance;
- water depth and velocity; and
- width, cover and composition of riparian vegetation.
Plan-forms will be obtained at each site and will include dimensions such as bankfull height, bankfull width, depth, wetted width and normal width, as well as key habitat features. Photographs will also be obtained at each site, including upstream, left bank, downstream and right bank directions.

Each site will also be given a habitat assessment score using the River Bio-assessment Program datasheet (DNRM 2001).

5.3.4 Surface water quality

Field sampling

Physico-chemical water quality parameters will be measured in situ at each site using hand-held water quality meters that have been calibrated to manufacturer’s specifications. The following parameters will be recorded at each site at a depth of 10-20 cm (if sufficient depth exists):

- temperature (°C);
- dissolved oxygen (% saturation and mg/L);
- pH;
- electrical conductivity (µS/cm); and
- Turbidity (NTU).

In addition to the parameters above, a water sample will also be collected for analysis at each site. Field sampling methods will follow the Monitoring and Sampling Manual 2009 (EHP 2009b). Water samples will be collected directly from the waterbody (creek / dam / pool) into sample containers (provided by a NATA accredited laboratory). Water samples for dissolved metals will be field filtered (using disposable syringes, 0.8 µm pre-filters and 0.45 µm filters). Samples will be preserved and stored according to laboratory instructions and delivered to the laboratory within the specified holding times.

Surface water quality sampling will occur in conjunction with REMP sampling (i.e. twice per year). Actual flow at the time of sampling (measured in cusecs) will be calculated.

Laboratory results

Water samples will be analysed by a NATA accredited laboratory. The following parameters will be tested:

- hardness (mg/L);
- alkalinity (mgCaCO3/L);
- nitrate (mgN/L);
- nitrite (mgN/L);
- ammonia (mgN/L);
- total nitrogen (mg/L);
- total phosphorus (mg/L);
- filterable reactive phosphorus (mg/L);
- sulphate (mgS/L);
- sodium (mg/L);
- fluoride (mg/L);
- total suspended solids (mg/L);
- total dissolved solids (mg/L);
- Petroleum hydrocarbons (if visible slick exists);
  - C6-C9 fraction (µg/L);
  - C10-C36 fraction (µg/L);
- total and dissolved metals and metalloids (µg/L):
- aluminium;
- arsenic;
- boron;
- cadmium;
- chromium;
- cobalt;
- copper;
- iron;
- lead;
- mercury;
- manganese;
- molybdenum;
- nickel;
- selenium;
- silver;
- uranium;
- vanadium; and
- zinc.

The initial parameter list has been generated with a cautious approach. Parameters that show consistent results under the limit or reporting (LOR) or that show constant levels will be reviewed for their continued suitability within the REMP.

Data analysis

Water quality data will be compared against the relevant guidelines values. The published guideline values (i.e. QWQG and ANZECC / ARMCANZ guidelines) do not necessarily reflect the site conditions. Therefore, where possible, Project-specific guideline values will be derived using the approach detailed in Section 4.2. Receiving (downstream) sites will also be compared to their relevant background (upstream) site/s. Where this review indicates that water quality in the receiving environment may have been impacted by a discharge event, the significance of impacts will be identified and discussed.

Future monitoring of dissolved (field filtered) metals will be undertaken to determine suitable ‘locally derived’ trigger values for four metals (i.e. chromium, copper, lead and zinc), but until such time as adequate monitoring data is collected, the model mine conditions values will be adopted.

Data analyses will be undertaken by an experienced aquatic ecologist and will include an assessment of statistical significance as well as ecological meaningfulness. Statistical analyses will be undertaken to determine if there has been a significant impact to water quality from any releases of mine-affected water. This will include the use of a two-way analysis of variance (ANOVA) for key water quality parameters as appropriate, using data from before each discharge event (if available) and from upstream sites. A significant difference (at significance level of 95%) at the receiving environment sites over time, compared to changes at the background sites, may indicate potential impacts in the event of a discharge.
Quality assurance and quality control

Field sampling will be conducted by a suitable trained and competent person in accordance with Standard (AS) AS5667 Water Quality Sampling, and in accordance with the Monitoring and Sampling Manual 2009 (EHP 2009b). In summary, the following procedures will be applied:

- Surface water samples will be collected at each site using a new, untreated, laboratory supplied bottle. The sample will be decanted from this untreated bottle into the relevant laboratory treated bottle/s, so as not to lose any sample preserving acids. Bottles will not be rinsed prior to sample collection.
- If the sample cannot be collected straight into the sample bottle, the container it is collected in (such as a bucket or other form of sampler) will be thoroughly rinsed with ambient site water to ensure it is not contaminated.
- Powderless gloves will be used when collecting all water samples, and care will be taken not to touch the inside of any sampling containers, or to place open bottles / jars or their lids onto the ground or other contaminated surfaces.
- A field blank will be prepared in the field using deionised water (provided by the laboratory) to confirm the reliability of field handling procedures and to ensure that no cross contamination has occurred.
- A duplicate water sample will be taken at one site to confirm the analytical reliability of the laboratory analysis.
- Filtering of water samples for nutrients and metals will be undertaken in the field.
- Samples will be stored under the appropriate holding conditions for each parameter and delivered to the laboratory within the appropriate holding times (as specified by the laboratory), in accordance with the security and transport protocols outlined in the Monitoring and Sampling Manual (EHP 2009b).
- A chain of custody form will be completed for all samples sent to the laboratory.
- Samples will be analysed by a NATA-accredited laboratory, and laboratory duplicates and blanks will be analysed in accordance with NATA-accredited protocols.

5.3.5 Stream sediment quality

Field sampling

Stream sediment will be monitored in conjunction with surface water quality monitoring. Stream sediment will be collected from the bed of the channel at each site. Stream sediment samples will be analysed for the parameters below in both the whole (<2mm) and fine (<63µm) sediment fractions. The whole sediment fraction will be analysed to allow comparison against the relevant guideline values while the fine sediment fraction is collected and analysed to assist in the interpretation of the biological data. The fine sediment fractions are more bioavailable to aquatic macroinvertebrates through ingestion and direct contact than larger sediments. Collection of stream sediment samples from where aquatic macroinvertebrates are collected allows direct comparison of the fine sediment fraction to aquatic macroinvertebrate communities.

Samples will be collected by a suitably trained and competent person in accordance with AS/NZS 5667.12 – guidance on sampling of bottom sediments and in accordance with the Handbook for Sediment Quality Assessment (Simpson et al. 2005).

Samples will be collected from the stream bed where aquatic macroinvertebrate samples are collected. A composite sample will be obtained from 10 points within the sampling area to a depth of 5 cm. The sample will be emptied into a bucket or other intermediate container, which has been thoroughly washed with ambient site water, and the sediment mixed and placed into the sample jar / bag using a stainless steel trowel. Any rocks greater than 25 mm will be manually removed from the sample.
Laboratory analysis

Stream sediment samples will be analysed by a NATA-accredited laboratory. The following parameters will be analysed for both whole and fine fractions:

- particle size distribution (See Table 4);
- total metals and metalloids (mg/kg):
  - aluminium;
  - arsenic;
  - boron;
  - cadmium;
  - chromium;
  - cobalt;
  - copper;
  - iron;
  - lead;
  - manganese;
  - mercury;
  - molybdenum;
  - nickel;
  - selenium;
  - silver;
  - uranium;
  - vanadium; and
  - zinc.

Table 4: Classification and size ranges for particle size distribution analysis

<table>
<thead>
<tr>
<th>Classification</th>
<th>Size range (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silt / clay</td>
<td>&lt;0.063</td>
</tr>
<tr>
<td>Fine sand</td>
<td>0.063 to 0.212</td>
</tr>
<tr>
<td>Small-medium sand</td>
<td>0.212 to 0.3</td>
</tr>
<tr>
<td>Large-medium sand</td>
<td>0.3 to 0.6</td>
</tr>
<tr>
<td>Coarse sand</td>
<td>0.6 to 2.0</td>
</tr>
<tr>
<td>Gravel</td>
<td>&gt;2.0</td>
</tr>
</tbody>
</table>

Data analysis

Stream sediment quality data (whole fraction only) will be compared to the relevant guideline values (Table 1). Receiving (downstream) sites will also be compared to the relevant upstream site for both whole and fine fraction data. The fine sediment fraction data will be used in conjunction with the aquatic macroinvertebrate data.

Concentrations below the ‘SQG – Low’ value (Table 1) at receiving sites will be considered low risk and will result in no further action. Concentrations between the ‘SQG – Low’ and ‘SQG – High’ values will be compared against background levels in the area. Concentrations exceeding the ‘SQG – High’ values will be further investigated for factors affecting bioavailability in accordance with (CSIRO 2013). Any marked change in sediment quality that cannot be explained by natural variation (e.g. a bushfire event in the catchment) may indicate potential impacts of the mine discharge.
Quality Assurance and Quality Control

Field sampling will be undertaken by a suitably trained and competent person in accordance with Australian Standard (AS) AS5667.1 *Guidance on Sampling of Bottom Sediments*, and in accordance with the *Handbook for Sediment Quality Assessment* (Simpson et al. 2005). In summary, the following procedures will be applied:

- Wherever possible, the jar / bag will not be rinsed prior to sample collection.
- Powderless gloves will be used when collecting all sediment samples, and care will be taken not to touch the inside of any sampling containers, or to place open jars / bags or their lids onto the ground or other contaminated surfaces.
- The container the sample is collected in (such as a bucket or other form of sampler) and sampling tool (i.e. stainless steel trowel) will be thoroughly rinsed with ambient site water to ensure is not contaminated.
- Samples will be refrigerated under the appropriate holding conditions for each parameter until delivered to the laboratory within the appropriate holding time (as advised by the analytical laboratory), in accordance with the security and transport protocols outlined in the *Monitoring and Sampling Manual* (EHP 2009b).
- A chain of custody form will be completed for all samples sent to the laboratory.
- Samples will be analysed by a NATA-accredited laboratory.

5.3.6 Aquatic flora

Aquatic plant (macrophyte) communities are expected to vary seasonally in response to climatic conditions (i.e. flooding flows, extended dry seasons, extended wet seasons). Aquatic plants surveys will be conducted in conjunction with aquatic habitat and aquatic macroinvertebrate surveys twice per year (autumn and spring). Presence / absence surveys of aquatic plants will be undertaken at each site. This will involve a systematic survey of aquatic plants for a 100 m reach. Aquatic plant specimens will be identified to species using available literature and keys. Algae (apart from branching algae, which are macrophytes) will not be identified during this REMP.

5.3.7 Aquatic macroinvertebrates

Field sampling

Aquatic macroinvertebrates will be collected from bed and edge habitats (total of two samples) at each site (where sufficient wetted habitat is encountered) by an AusRivAS accredited ecologist following AusRivAS protocols (DNRM 2001). Exceptions to this are for sites DS5 and DS7, where aquatic macroinvertebrate sampling is not proposed (Section 5.3).

A standard sized dip net with 250 µm mesh will be used to sample aquatic macroinvertebrates. Edge samples will be collected over a 10 m stretch of the waterbody by disturbing aquatic habitat with the net and collector’s feet. The net will be swept in an upwards motion alongside the bank to collect any dislodged material and aquatic macroinvertebrates. Bed samples will be collected over a 10 m stretch of the waterbody by disturbing the bed with the collector’s feet, the net will be swept through the downstream plume to collect dislodged material and aquatic macroinvertebrates. The collected material will be transferred to plastic sorting trays, where the contents will be sorted and live-picked (with pipettes and forceps) according to AusRivAS protocols. Picked specimens will be placed into specimen jars with 70% ethanol. Field picking will be conducted by an AusRivAS accredited ecologist.
Laboratory identification

Aquatic macroinvertebrates will be identified by appropriately trained personnel (e.g. AusRivAS accredited taxonomist), using a stereo microscope. Specimens will be preserved in ethanol and identified to family level or a lower / higher taxonomic level as per the Queensland AusRivAS protocols. The identification and abundance of all taxa will be recorded.

Data analysis

Standard data analyses will be applied, including:

- taxonomic richness;
- total number of PET (Plecoptera, Ephemeroptera and Trichoptera) families and percentage of PET – as a measure of disturbance sensitive taxa;
- SIGNAL 2 (Revised Stream Invertebrate Grade Number – Average Level) – as an indicator of habitat quality and environmental stressors; and
- AusRivAS Observed to Expected (AusRivAS OE50) indices.

The resulting indices will be compared against relevant guidelines. The QWQG do not provide set biological guidelines for the Condamine River catchment (EHP 2009a). Table 4.4.3 (EHP 2009a) recommends that the median lie within the 20th/80th percentile of reference range. These guidelines may take some time to be generated (as data is collected and becomes available). Local guidelines will be developed for taxa richness, PET taxa richness and SIGNAL 2 using data from the upstream sites (US1, US2 and US3) in this REMP. The AusRivAS OE50 values will be derived from the AusRivAS model, comparing the observed taxonomic assemblages to those which would be expected under ‘reference’ conditions in the broader catchment.

Data analysis will be undertaken by an experienced aquatic ecologist and will focus on biological meaningfulness rather than statistical significance. Data will be interpreted using the taxonomic richness, PET, SIGNAL 2 and OE50 indices. This will include a comparison and discussion of any variation in results both within sites (over time) and among sites (upstream to downstream). Any marked change in macroinvertebrate assemblages, such as a drop from one AusRivAS category to another (e.g. Band B to Band C), that cannot be explained by natural variation (e.g. hot or dry conditions) may indicate potential impacts of the mine discharge.

5.4 Reporting

An annual report will be produced after the late wet season sampling event (i.e. after the May-July sampling). This will allow the assessment of potential impacts over the wet season period where runoff and potential discharges may have occurred. The annual report will:

- meet the requirements of the EA;
- integrate monitoring data for the reporting period, including:
  - water quality data collected during the previous 12 months;
  - water quality data collected during the REMP sampling events;
  - sediment quality data collected during the REMP sampling events;
  - aquatic habitat characteristics and river bio-assessment scores;
  - aquatic flora data collected during the REMP sampling events;
  - aquatic macroinvertebrate data collected during the REMP sampling events;
- update historical datasets and assess all data for trends over time;
- provide an assessment of background water quality and assimilative capacity of any contaminants monitored;
- provide an assessment of any impacts to the EVs of the receiving environment associated with the release of mine-affected water, which may include recommendations for further monitoring or assessment;
- review the suitability of discharge conditions and limits to protect EVs; and
- provide recommendations regarding any requisite changes to the monitoring program.

Raw water quality data (i.e. laboratory certificates) collected during the REMP surveys will be appended to the annual report. All relevant data sheets will also be appended to ensure data continuity and preservation.

5.5 REMP review

Data would be reviewed annually and the REMP would be updated as appropriate. Based on the results of the monitoring program, the appropriateness of the monitoring program design for meeting the objectives of the program will be assessed and discussed. Outcomes from this review, along with any recommendations from the annual report, and changes in statutory requirements or EVs would be updated in the REMP before the next sampling round is due to commence.
REFERENCES


Department of Environment and Heritage Protection (EHP) 2014, *Receiving environment monitoring program guideline – For use with environmentally relevant activities under the Environmental Protection Act 1994*. EHP, Brisbane.


Dear Daniel,


This letter is provided in response to a request from Syntech Resources Pty Ltd to undertake a peer review of the Cameby Downs Continued Operations Project (CDCOP) Groundwater Impact Assessment prepared by Australasian Groundwater and Environment Pty Ltd (AGE) dated 19 June 2018 (Version 05.03).

It is understood the CDCOP Groundwater Impact Assessment is to be used in support of an Environmental Values Assessment (EVA) for an amendment application under the Queensland (Qld) *Environmental Protection Act 1994* and separate Referral to the Commonwealth Minister for the Environment as to whether it constitutes a ‘controlled action’ and therefore may require approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

1. **Documentation**

The CDCOP Groundwater Impact Assessment prepared by AGE, dated 19 June 2018, subject to review comprised the main report and appendices as follows:

- **Main Report**, including:
  - Section 1: Introduction
  - Section 2: Regulatory Framework
  - Section 3: Environmental Setting
  - Section 4: Groundwater Monitoring Network
  - Section 5: Geological Setting
  - Section 6: Hydrogeology
  - Section 7: Conceptual Groundwater Model
  - Section 8: Environmental Value of Groundwater
  - Section 9: Impact Assessment
  - Section 10: EPBC Act Significant Impact on Water Resources Guidelines
  - Section 11: Groundwater Monitoring Strategy / Program
  - Section 12: Conclusions
  - Section 13: References

- **Appendix A**: IESC Guidelines
- **Appendix B**: Cameby Downs Mine – Water Quality Data (April 2009 to January 2016)
- **Appendix C**: Summary of DNRME Registered Bores within a 10 km Buffer Zone
- **Appendix D**: Bore Census (October 2017)
- **Appendix E**: Numerical Modelling Report, including:
2. Review Methodology

The CDCOP Groundwater Impact Assessment has been reviewed according to the Model Appraisal checklist in the Murray-Darling Basin Commission (MDBC) Groundwater Flow Modelling Guideline (2001). While the Australian Groundwater Modelling Guidelines (Barnett et al., 2012) issued by National Water Commission (NWC) includes a more detailed ‘yes/no’ checklist, the MDBC (2001) checklist has been used because it includes a graded assessment which is considered to be a better indicator of the model performance in this case.

A detailed assessment has been made in terms of the MDBC (2001) peer review checklist in Table 1.
Table 1 – Groundwater Model Appraisal: CDCOP Groundwater Modelling

<table>
<thead>
<tr>
<th>Q</th>
<th>Question</th>
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<th>Score 0</th>
<th>Score 1</th>
<th>Score 3</th>
<th>Score 5</th>
<th>Max. Score (0, 1, 3, 5)</th>
<th>Comment</th>
</tr>
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<tr>
<td>1.0</td>
<td>The Report</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Is there a clear statement of project objectives in the modelling report?</td>
<td>Missing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Section E1.</td>
</tr>
<tr>
<td>1.2</td>
<td>Is the level of model complexity clear or acknowledged?</td>
<td>Missing</td>
<td></td>
<td></td>
<td>No</td>
<td>Yes</td>
<td></td>
<td>Table E1.1. Notwithstanding, it is recognised that Table E1.1 in the Groundwater Impact Assessment (AGE, 2018) includes a self-assessment against the NWC 2012 checklist which concludes that the groundwater model is classified between a Class 2 and Class 3 model suitable for predicting groundwater responses to changes in applied stress or hydrological conditions, and the evaluation and management of potential impacts.</td>
</tr>
<tr>
<td>1.3</td>
<td>Is a water or mass balance reported?</td>
<td>Missing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Section E2.4.7. Mass balance of transient simulation generally less than 0.5%.</td>
</tr>
<tr>
<td>1.4</td>
<td>Has the modelling study satisfied project objectives?</td>
<td>Missing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Section 1 recognises Qld Government Department Information Request under EP Act. Section 2.1 and Section 10 recognises the Commonwealth requirements and guidelines. The model predicts the volumetric take of groundwater, changes in regional groundwater levels and impacts on private bore water levels due to the Project and cumulatively. The modelling also addresses cumulative impacts of the proposal as well as the incremental impacts of the proposal in relation to impacts from existing approved mining and CSG. Long-term post-project recovery has been addressed. Model sensitivity has also been assessed.</td>
</tr>
<tr>
<td>1.5</td>
<td>Are the model results of any practical use?</td>
<td>No</td>
<td></td>
<td></td>
<td>Maybe</td>
<td>Yes</td>
<td></td>
<td>Section 2.3. The model calculates the groundwater take which will be of practical use for future groundwater licensing under the Qld Water Act 2000.</td>
</tr>
<tr>
<td>2.0</td>
<td>Data Analysis</td>
<td>Missing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>Has hydrogeology data been collected and analysed?</td>
<td>Missing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sections 4, 5 and 6. Includes Syntech groundwater monitoring network and additional bore data collected as part of studies for the Surat Cumulative Management Area. In-situ permeability tests. Airlift yield data. 103 groundwater samples between April 2009 and June 2017. Bore census (Appendix D) demonstrates no significant groundwater use by landholders; nearest water supply</td>
</tr>
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</table>

0356_L03a_review letter_18-07-17
<table>
<thead>
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<th>Question</th>
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</thead>
<tbody>
<tr>
<td>2.2</td>
<td>Are groundwater contours or flow directions presented?</td>
<td>Missing</td>
<td></td>
<td>Deficient</td>
<td>Adequate</td>
<td>Very Good</td>
<td></td>
<td></td>
<td>bore located 6.5 km south of ML boundary. Geology seam floor/overburden thicknesses across lease based on exploration drilling.</td>
</tr>
<tr>
<td>2.3</td>
<td>Have all potential recharge data been collected and analysed? (rainfall, streamflow, irrigation, floods, etc.)</td>
<td>Missing</td>
<td></td>
<td>Deficient</td>
<td>Adequate</td>
<td>Very Good</td>
<td></td>
<td></td>
<td>Figure 6.3. Localised only. Additional groundwater monitoring network proposed (Figure 11.1) will allow for contours and flow directions to be extended.</td>
</tr>
<tr>
<td>2.4</td>
<td>Have all potential discharge data been collected and analysed? (abstraction, evapotranspiration, drainage, springflow, etc.)</td>
<td>Missing</td>
<td></td>
<td>Deficient</td>
<td>Adequate</td>
<td>Very Good</td>
<td></td>
<td></td>
<td>Section 3.3 and Section 6.8. Only rainfall data available for the area. Recharge is assessed to be low as reported in the OGIA 2012 UWIR report (GHD, 2012). Groundwater recharge to stratigraphic units is described in Section 6 (Quaternary and Tertiary sediments). Bore census (Appendix D) revealed no irrigation. Thin surficial units across area limit flood recharge (NB: Condamine floodplain 17 km south of the CDCOP).</td>
</tr>
<tr>
<td>2.5</td>
<td>Have the recharge and discharge datasets been analysed for their groundwater response?</td>
<td>Missing</td>
<td></td>
<td>Deficient</td>
<td>Adequate</td>
<td>Very Good</td>
<td></td>
<td></td>
<td>Section 3.3 (Evaporation). Section 8.1. Section 10.2. Ephemeral drainage lines. Bore census (Appendix D) revealed no significant groundwater use by landholders. No springs identified. Abstraction data by neighbouring gas operations not publicly available, however CSG drawdown predictions were captured in UWIR 2016 groundwater model and used consistently (Section E2.4.6). Shallowest reported groundwater levels in excess of 15 m below ground surface limit potential to support groundwater dependent ecosystems (GDEs).</td>
</tr>
<tr>
<td>2.6</td>
<td>Are groundwater hydrographs used for calibration?</td>
<td>No</td>
<td></td>
<td>Maybe</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td>Appendix E1. Simulated and observed hydrographs are presented for 10 bores.</td>
</tr>
<tr>
<td>2.7</td>
<td>Have consistent data unit and standard geometrical datums been used?</td>
<td>No</td>
<td></td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td>Is the conceptual model consistent with project objectives and the required model complexity?</td>
<td>Unknown</td>
<td></td>
<td>No</td>
<td>Maybe</td>
<td>Yes</td>
<td></td>
<td></td>
<td>Section E1. Conceptual model has been developed progressively over several generations of model development for the project. In current study, AGE reviewed all new information to assess whether it changes the current understanding of the groundwater system. Section E2.1 explains the conceptualisation has remained unchanged.</td>
</tr>
<tr>
<td>Q</td>
<td>Question</td>
<td>Not Applicable or Unknown</td>
<td>Score 0</td>
<td>Score 1</td>
<td>Score 3</td>
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<td>Max. Score (0, 1, 3, 5)</td>
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<td>--------------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>3.2</td>
<td>Is there a clear description of the conceptual model?</td>
<td>Missing</td>
<td>Deficient</td>
<td>Adequate</td>
<td></td>
<td></td>
<td>Very Good</td>
<td>Section 7. Describes the geology, recharge/discharge mechanisms, flow directions and groundwater quality.</td>
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<tr>
<td>3.3</td>
<td>Is there a graphical representation of the modeller’s conceptualisation?</td>
<td>Missing</td>
<td>Deficient</td>
<td>Adequate</td>
<td></td>
<td></td>
<td>Very Good</td>
<td>Figure 7.1.</td>
<td></td>
</tr>
<tr>
<td>3.4</td>
<td>Is the conceptual model unnecessarily simple or unnecessarily complex?</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0</td>
<td>Model Design</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>4.1</td>
<td>Is the spatial extent of the model appropriate?</td>
<td>No</td>
<td>Maybe</td>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
<td>Figure E2.1. 35 km from northwest to southeast and 23 km from northeast to southwest, covering an area of 787 km². Model design is sufficiently extensive to prevent significant drawdown intersecting model boundaries. Natural hydrogeological boundaries and catchment boundaries have been adopted where possible. Figure E2.2. Three-layer model. All overburden strata above the target coal seams has been represented as a single homogeneous layer, increasing in thickness downdip to the south/southwest. Cell sizes range from 50m x 50m (within the mining area) to 500 m by 500 m, with 102,400 rectangular cells per layer, of which 82,384 are active (i.e. total 247,152 cells).</td>
<td></td>
</tr>
<tr>
<td>4.2</td>
<td>Are the applied boundary conditions plausible and unrestrictive?</td>
<td>Missing</td>
<td>Deficient</td>
<td>Adequate</td>
<td></td>
<td></td>
<td>Very Good</td>
<td>Section E2.4.6. Coal seam sub-crop in the north to northeast is plausible as it would be unlikely to propagate north due to the overall groundwater flow direction to the south/southwest. No overburden confining layer included. This is expected to be conservative with respect to long-term regional impacts. Figures 9.6-9.9. Demonstrate CDCOP alone is unrestrictive. Figure 9.10-9.11. Demonstrates cumulative drawdown impacts attributable principally (up to 100%) to CSG impacts and extends across much of the model domain (and beyond).</td>
<td></td>
</tr>
<tr>
<td>4.3</td>
<td>Is the software appropriate for the objectives of the study?</td>
<td>No</td>
<td>Maybe</td>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
<td>MODFLOW-USG.</td>
<td></td>
</tr>
<tr>
<td>5.0</td>
<td>Calibration</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>5.1</td>
<td>Is there sufficient evidence provided for model calibration?</td>
<td>Missing</td>
<td>Deficient</td>
<td>Adequate</td>
<td></td>
<td></td>
<td>Very Good</td>
<td>Section E3.1, Figure E3.1 and Appendix E1. Transient calibration against water levels for period 2010-2015. Calibrated against all available bores at site and exploration holes.</td>
<td></td>
</tr>
<tr>
<td>Q</td>
<td>Question</td>
<td>Score 0</td>
<td>Score 1</td>
<td>Score 2</td>
<td>Score 3</td>
<td>Score 4</td>
<td>Max. Score</td>
<td>Comment</td>
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<tr>
<td>5.2</td>
<td>Is the model sufficiently calibrated against spatial observations?</td>
<td>Missing</td>
<td>Deficient</td>
<td>Adequate</td>
<td>Very Good</td>
<td></td>
<td></td>
<td>Figure E3.1. All bores are located within the footprint of the proposed mine. More regional observation data would be necessary to ensure full model calibration, which would improve prediction reliability. Additional groundwater monitoring network is proposed (Figure 11.1) will allow for future recalibration and model refinement if necessary.</td>
<td></td>
</tr>
<tr>
<td>5.3</td>
<td>Is the model sufficiently calibrated against temporal observations?</td>
<td>Missing</td>
<td>Deficient</td>
<td>Adequate</td>
<td>Very Good</td>
<td></td>
<td></td>
<td>Appendix E1. Reasonably good match with absolute levels; calibration with trends less good – actual drawdown trends steeper than predicted. May lead to under-prediction of long-term drawdowns. Additional groundwater monitoring network proposed (Figure 11.1) will allow for future recalibration and model refinement if necessary.</td>
<td></td>
</tr>
<tr>
<td>5.4</td>
<td>Are calibrated parameter distributions and ranges plausible?</td>
<td>Unknown</td>
<td>No</td>
<td>Maybe</td>
<td>Yes</td>
<td></td>
<td></td>
<td>Table E2.2. Comparisons also made with OGIA 2016 UWIR groundwater model technical report values.</td>
<td></td>
</tr>
<tr>
<td>5.5</td>
<td>Does the calibration statistic satisfy agreed performance criteria?</td>
<td>Missing</td>
<td>Deficient</td>
<td>Adequate</td>
<td>Very Good</td>
<td></td>
<td></td>
<td>Standardised root mean square ($sRMS$) of 8.9%. The model meets the Australian Groundwater Modelling Guidelines criterion of 10% or lower.</td>
<td></td>
</tr>
<tr>
<td>5.6</td>
<td>Are there good reasons for not meeting agreed performance criteria?</td>
<td>Missing</td>
<td>Deficient</td>
<td>Adequate</td>
<td>Very Good</td>
<td></td>
<td></td>
<td>While it does meet the $sRMS$ criterion, it is recognised that a lower value would most likely be achieved through inclusion of heterogeneity to the aquifer parameters (as well as depth dependence).</td>
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<tr>
<td>6.0</td>
<td>Verification (Not a Necessary Step)</td>
<td></td>
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<tr>
<td>6.1</td>
<td>Is there sufficient evidence provided for model verification?</td>
<td>Missing</td>
<td>Deficient</td>
<td>Adequate</td>
<td>Very Good</td>
<td></td>
<td></td>
<td>Appendix E3. The 2015 groundwater model predictions were used to verify that current updates to the model did not fundamentally change the model prediction capability. Section E2.2 describes the groundwater modelling history for the site.</td>
<td></td>
</tr>
<tr>
<td>6.2</td>
<td>Does the reserved dataset include stresses consistent with the prediction scenarios?</td>
<td>Unknown</td>
<td>No</td>
<td>Maybe</td>
<td>Yes</td>
<td></td>
<td></td>
<td>Yes, but impacts to date much less than predicted.</td>
<td></td>
</tr>
<tr>
<td>6.3</td>
<td>Are there good reasons for unsatisfactory verification?</td>
<td>Missing</td>
<td>Deficient</td>
<td>Adequate</td>
<td>Very Good</td>
<td></td>
<td></td>
<td>Section 9.2. Predicted inflows small. Actual inflows non-existent for most part. Predicted inflows may be accounted for by evaporation of face seepage. If evaporation were allowed for, predicted seepages would likely be consistent with the generally dry mining conditions experienced.</td>
<td></td>
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<tr>
<td>7.0</td>
<td>Prediction</td>
<td></td>
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<tr>
<td>7.1</td>
<td>Have multiple scenarios been run for climate variability?</td>
<td>Missing</td>
<td>Deficient</td>
<td>Adequate</td>
<td>Very Good</td>
<td></td>
<td></td>
<td>One average climate scenario in accordance with standard practice. Sensitivity analysis included +/- 0.5 order of magnitude change to recharge rate.</td>
<td></td>
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<tr>
<td>Q</td>
<td>Question</td>
<td>Not Applicable or Unknown</td>
<td>Score 0</td>
<td>Score 1</td>
<td>Score 2</td>
<td>Score 3</td>
<td>Score 4</td>
<td>Score 5</td>
<td>Max. Score</td>
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<tr>
<td>7.2</td>
<td>Have multiple scenarios been run for operational / management alternatives?</td>
<td>Missing</td>
<td>Deficient</td>
<td>Adequate</td>
<td>Very Good</td>
<td></td>
<td></td>
<td></td>
<td>Four model scenarios: (1) current approved mine plan (Figure E2.3) [with CSG abstraction]; (2) CDCOP mine plan (Figure E2.4) [with CSG abstraction]; (3) No mine (with CSG abstraction) [null run]; and (4) No mine and no CSG abstraction. Multiple scenarios allow for: -CDCOP incremental impacts [2] minus [1]]; -CDCOP and approved mine cumulative impacts [2] minus [3]]; -CD and CSG cumulative impacts [2] minus [4]. Post-mining recovery (steady state, not long-term transient). Long-term transient prediction for post-mining recovery would be preferred, nevertheless steady-state post-mining recovery modelling is fit-for-purpose. Future transient modelling to assess rate of post-mining recovery, would be a helpful improvement measure.</td>
</tr>
<tr>
<td>7.3</td>
<td>Is the time horizon for prediction comparable with the length of the calibration / verification period?</td>
<td>Missing</td>
<td>No</td>
<td>Maybe</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td>July 2010 – December 2016 (26 stress periods) was used to compare the model performance with field data (calibration) as well as performance (verification) of the previous 2015 groundwater model. The prediction period extends from January 2017 – December 2090 (296 stress periods).</td>
</tr>
<tr>
<td>7.4</td>
<td>Are the model predictions plausible?</td>
<td>No</td>
<td>Maybe</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Plausible mine inflows, drawdown magnitudes and extents. Supported by sensitivity analysis.</td>
</tr>
<tr>
<td>8.0</td>
<td>Sensitivity Analysis</td>
<td></td>
<td></td>
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<tr>
<td>8.1</td>
<td>Is the sensitivity analysis sufficiently intensive for key parameters?</td>
<td>Missing</td>
<td>Deficient</td>
<td>Adequate</td>
<td>Very Good</td>
<td></td>
<td></td>
<td></td>
<td>Key parameters included hydraulic conductivity, specific storage and specific yield, and recharge. +/- ½ order of magnitude change.</td>
</tr>
<tr>
<td>8.2</td>
<td>Are sensitivity results used to qualify the reliability of model calibration?</td>
<td>Missing</td>
<td>Deficient</td>
<td>Adequate</td>
<td>Very Good</td>
<td></td>
<td></td>
<td></td>
<td>Section E4.1. Mine inflows and drawdown extents not highly sensitive to changes in hydraulic conductivity. Both are moderately sensitive to changes in storage and more highly sensitive to changes in recharge rate. Negligible actual inflows during calibration period supports adopted recharge rate values. Insufficient regional water level data to compare with predictions makes evaluating sensitivity of drawdown extent predictions less reliable.</td>
</tr>
<tr>
<td>8.3</td>
<td>Are sensitivity results used to qualify the accuracy of model prediction?</td>
<td>Missing</td>
<td>Deficient</td>
<td>Adequate</td>
<td>Very Good</td>
<td></td>
<td></td>
<td></td>
<td>Section E4.1. Higher predicted water inflows relative to lack of observed inflows suggests model predictions are conservative.</td>
</tr>
<tr>
<td>Q</td>
<td>Question</td>
<td>Not Applicable or Unknown</td>
<td>Score 0</td>
<td>Score 1</td>
<td>Score 3</td>
<td>Score 5</td>
<td>Score Max. Score (0, 1, 3, 5)</td>
<td>Comment</td>
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</tr>
<tr>
<td>9.0</td>
<td>Uncertainty Analysis</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>9.1</td>
<td>If required by the project brief, is uncertainty quantified in any way?</td>
<td>Missing</td>
<td>No</td>
<td>Maybe</td>
<td>Yes</td>
<td></td>
<td></td>
<td>Section E.4 (Figure E4.4). As above, the sensitivity analysis was extended to explore potential uncertainty in model predictions (e.g. pit inflows and drawdown) resulting from changes in hydraulic conductivity, specific storage and specific yield, and recharge. The sensitivity analysis results show that similar to the base case predictions, no registered groundwater supply bores would be impacted. Rigorous Monte Carlo uncertainty analysis therefore not considered warranted.</td>
<td></td>
</tr>
</tbody>
</table>
3. **Conclusions**

I consider that the groundwater impact assessment report prepared by AGE is acceptable, and should be sufficient to answer any questions or concerns that may be raised by the Queensland and Federal regulators.

The modelling has been undertaken generally in accordance with the Australian groundwater modelling guidelines, and an appropriate level of complexity for the approval process. The relationship of the current groundwater model with the original model developed in 2004 and subsequent updated version in 2010 are well explained.

I agree with AGE’s assessment that the model is satisfactory for the project, taking account of the fact that the model has been previously verified, the groundwater quality is generally poor and there are few if any groundwater users in the project vicinity, including environmental users. The bore census undertaken in 2017 has verified that the local usage of groundwater is very limited.

It is concluded that the CDCOP Groundwater Impact Assessment is sufficient and ‘fit for purpose’ in support of the EVA and Referral and, in terms of the assessment of groundwater-related impacts, it has:

- modelled the predicted mine inflows and drawdown during mining and post-mining (including cumulative drawdown);
- assessed the potential environmental impacts; and
- concluded the likelihood and significance of impacts on groundwater resources.

The proposed groundwater monitoring strategy / program is considered to be appropriate, particularly as there are no landholder water supply bores located within the predicted drawdown extents by the CDCOP alone and recognising the existing poorer groundwater quality (i.e. brackish to highly saline).

I trust the above comments address the requirements of this peer review. Please contact me with any questions.

Yours faithfully,

Peter Dundon

Director
3 July 2018

Yancoal Australia
c/o Resource Strategies Pty Ltd
PO Box 18426
Milton QLD 4064

Attention: Lucas Burns

Dear Lucas

Cameby Downs Continued Operations Project
Noise, Vibration and Blasting Assessment
Summary of Peer Review

I had previously undertaken a peer review of Simpson Engineering Group’s (SEG) Noise and Vibration Assessment of the Cameby Downs Continued Operations Project. In that process, I had:

- Reviewed the initial draft report (document 160606DN01A5.docx dated 5 September 2017),
- Provided comments/recommendations back to SEG and the project team based on my review of the initial draft report,
- Reviewed the revised draft report (document 160606DN01A6.docx dated 31 October 2017),
- Provided further feedback to SEG and the project team based on my review of the revised draft report,
- Participated in a teleconference with the project team on 15 November 2017, and

At the time of issuing my letter (dated 16 November 2017), I was generally satisfied that SEG and the project team have addressed my comments / recommendations.

Subsequent to the above, the mine operating life was extended from 70 to 75 years by Yancoal, along with changes to the mine design. As a consequence of these changes, SEG has issued a revised report (document 160606DN01A11 dated 13 June 2018) which I have now reviewed.

I am generally satisfied that SEG’s revised report is appropriate for the proposed mine design changes. The revised report still addresses my comments / recommendations and SEG have included (amongst other revisions that I consider appropriate) a 5th modelling scenario to cover the life of the mine.

See following my assessment of whether the then Department of Environment and Heritage Protection’s (now Department of Environment and Science’s) information requests have been addressed in the revised SEG report.
a) Further to the information stated on page 53 of the ‘consideration report’ submitted with the application, provide a noise and vibration assessment that assess [sic] the potential impacts of the proposed Project expansion, including:

(i) consideration of the values and objectives in the Environmental Protection (Noise) Policy 2008;
Addressed

(ii) consideration of the requirements in the Departmental Guideline Application requirements for activities with noise impacts (ESR/2015/1838);
Addressed

(iii) noise modelling to predict potential impacts from the Project;
Addressed

(iv) a description of the environmental values of the acoustic environment in an surrounding the Project areas including sensitive receptors, site topography and built environment, and background noise levels;
Addressed

(v) identification of the potential impacts of the Project including noise sources and levels for the life of the Project; and
Addressed

(vi) proposed mitigation measures for minimising noise impacts.
Addressed

Should you require any further information, please do not hesitate to contact me.

Yours sincerely

SHANE ELKIN
Technical Director – Acoustics & Vibration