SARAJI EAST MINING LEASE PROJECT

Environmental Impact Statement

Chapter 7
Aquatic Ecology

BHP

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Saraji East Mining Lease Project

7 Aquatic ecology

7.1 Introduction

This chapter provides an assessment of the potential impacts of the Project on aquatic ecological values within the Project Site and surrounding area. It includes a description of the aquatic environmental values, identification of potential impacts on these values proposed mitigation measures and the residual risks applicable to each potential impact to aquatic ecology.

The underpinning aquatic ecology technical study is presented in **Appendix D-1 Aquatic Ecology Technical Report.**

The scope of this assessment addresses surface water ecology. The assessment of water quality is presented in **Chapter 8 Surface Water Resources**, the assessment of groundwater (including stygofauna) in presented in **Chapter 9 Groundwater** and the assessment of terrestrial ecology in **Chapter 6 Terrestrial Ecology**.

7.2 Legislation and policy

7.2.1 Commonwealth legislation

Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides the legal framework for the protection and management of nationally and internationally threatened flora and fauna (including migratory species), ecological communities, internationally important wetlands, heritage places, the Great Barrier Reef, and Commonwealth marine areas, which are collectively defined as Matters of National Environmental Significance (MNES). Water resources and nuclear actions are also regulated under the EPBC Act.

The EPBC Act provides guidance on whether an action (e.g. a proposed development) is likely to have a significant impact on an MNES. The EPBC Act *Significant Impact Guidelines 1.1* (DotE 2013a) provide guidance in the form of assessment criteria, in relation to significant impacts on threatened species under the EPBC Act.

The Project was referred under the EPBC Act on 5 October 2016. On 18 October 2016 the Department of Energy and Environment (DoEE) deemed the Project a controlled action based on the potential for a significant impact to the following controlling provisions:

- listed threatened species and communities (Sections 18 and 18A)
- a water resource, in relation to coal seam gas development and large coal mining development (Section 240 and 24E).

7.2.2 State legislation

Environmental Protection Act 1994

The *Environmental Protection Act 1994* (EP Act) provides the legislative framework for ecologically sustainable development in Queensland, requiring people, companies and government to take all reasonable and practical steps to protect the environment. The EP Act identifies a range of mechanisms to achieve the objectives of the Act, including establishing Environmental Protection Policies that present the strategies for protecting environmental values.

The *Environmental Protection Regulation 2019* (EP Regulation), pursuant to the EP Act, specifies Environmentally Relevant Activities (ERAs) that are known to have the potential to cause environmental harm. ERAs require a comprehensive Environmental Impact Statement (EIS) or Impact Assessment Report to be prepared as part of the approvals process. Resource developments, including coal mines, are ERAs listed under the EP Regulation.

Environmental Protection (Water and Wetland Biodiversity) Policy 2019

The Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (EPP (Water)) is a strategy for achieving the object of the EP Act. The EPP (Water):

- identifies high ecological value (HEV) waters
- identifies environmental values and management goals for water
- provides water quality guidelines and water quality objectives to enhance or protect the identified environmental values
- provides a framework for decision making about Queensland waters, and requires monitoring of and reporting on the condition of Queensland waters
- provides monitoring and reporting guidelines for the condition of waters.

Environmental values for Queensland waters include the protection of aquatic ecosystems. The components of aquatic ecosystems to be protected are not specified under either the EP Act or the EPP (Water), although the *Monitoring and Sampling Manual* (DES 2018b), pursuant to the EPP (Water), presents guidelines for survey of:

- water and sediment quality
- hydrology
- aquatic habitat
- aquatic biota (including plankton, aquatic plants, macroinvertebrates and fish)
- physical and biogeochemical processes.

Nature Conservation Act 1992

The *Nature Conservation Act 1992* (NC Act) provides for the conservation of Queensland's nature by declaring and managing a protected area network, protecting threatened species and their habitats, regulating the taking of wildlife and co-ordinating nature conservation with Traditional Owners and other land owners.

Protected wildlife listed under the NC Act must be protected from threatening processes, and critical habitat for protected wildlife is required to be protected to the greatest extent possible.

Vegetation Management Act 1999

The *Vegetation Management Act 1999* (VM Act), as updated by the *Vegetation Management and Other Legislation Amendment Act 2018*, regulates the clearing of vegetation to conserve threatened regional ecosystems, protect biodiversity and maintain ecological processes, amongst other purposes.

The VM Act provides for the Department of Natural Resources Mines and Energy (DNRME) Chief Executive to certify various classes of regulated vegetation maps, with regulated vegetation identified as a Matter of State Environmental Significance (MSES). Classes of vegetation under the VM Act include:

- vegetation that is remnant and/or threatened (category B)
- high value regrowth vegetation (category C)
- regrowth vegetation in a wetland, watercourse or drainage feature area within a Great Barrier Reef catchment (category R).

Vegetation in wetland areas and vegetation intersecting a watercourse is also regulated vegetation under the VM Act. Vegetation clearing and development is regulated for Category R vegetation areas, and Riverine Protection Permits are required to clear vegetation in watercourses.

Fisheries Act 1994

The *Fisheries Act 1994* (Fisheries Act) provides for the management and protection of fisheries resources, including regulating development that might impact declared fish habitat areas and fish passage. Queensland's native fish require adequate movement along the state's rivers and streams for their survival. Because of this, any in-stream barriers to fish movement in Queensland are regulated under the Fisheries Act. Waterways which provide fish passage are mapped by the level of risk:

- major risk (purple waterway)
- high risk (red waterway)
- moderate risk (orange waterway)
- low risk (green waterway).

Biosecurity Act 2014

The aim of the *Biosecurity Act 2014* is to manage risks associated with exotic pests and diseases that impact plant and animal industries including aquaculture and wild capture fisheries, tourism, infrastructure including water supply, shipping, biodiversity and the natural environment.

The *Biosecurity Act 2014* defines biosecurity matters, (i.e. prohibited matters which are not yet present in Queensland, and restricted matters which are currently present in Queensland); establishes a general biosecurity obligation and establishes specific obligations in relation to prohibited and restricted matters.

Aquatic pests that are restricted biosecurity matters are identified in Schedule 2 of the *Biosecurity Act 2014* and include:

- diseases
- fish, including but not limited to eastern Gambusia (*Gambusia holbrooki*), carp (*Cyprinus carpio*) and tilapia (*Oreochromis mossambicus*)
- aquatic plants, including but not limited to salvinia (*Salvinia molesta*), water hyacinth (*Eichhornia crassipes*), and cabomba (*Cabomba caroliniana*)
- other plants that are common weeds of riparian areas.

7.3 Methodology

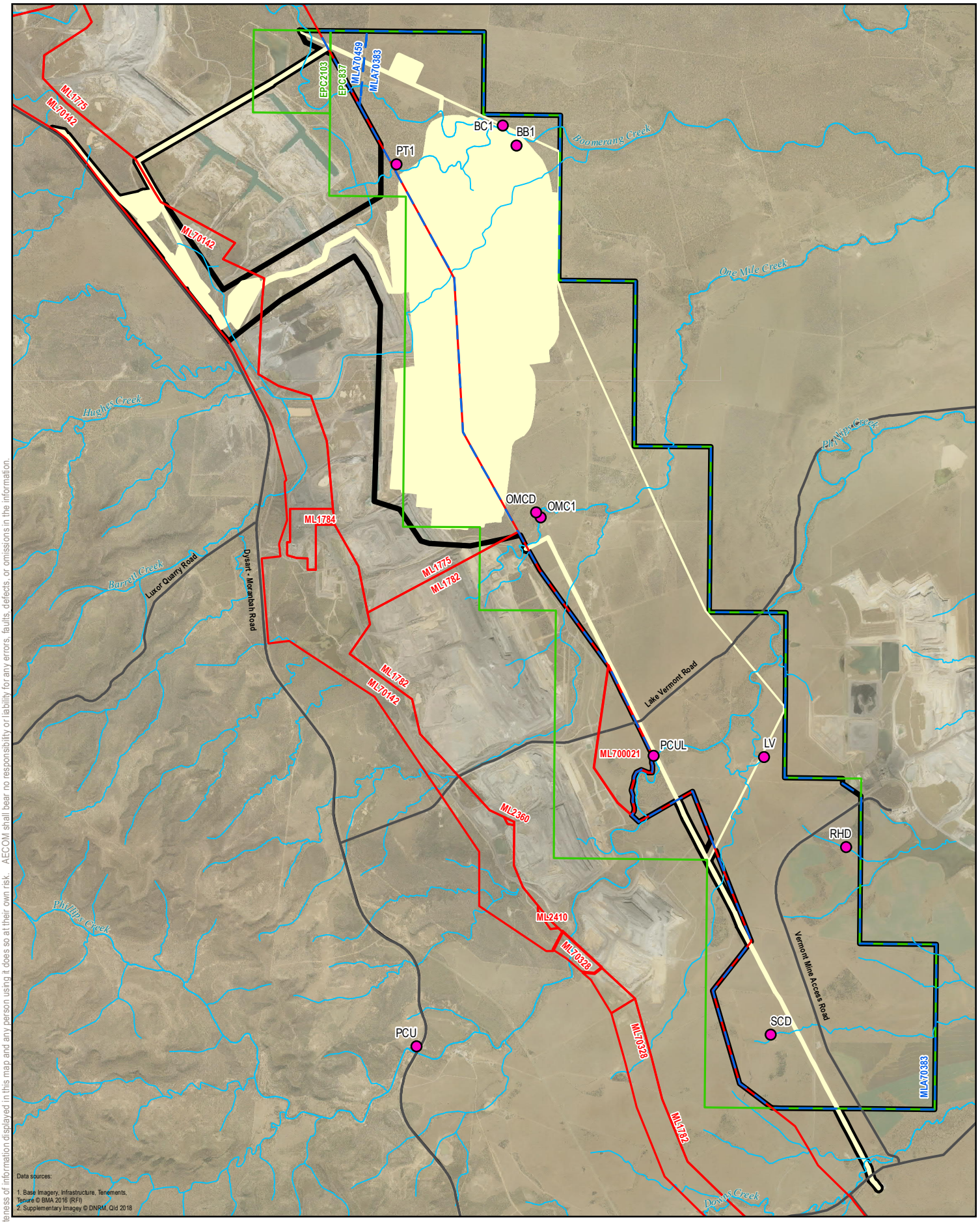
7.3.1 Desktop approach

A desktop approach was used to provide a description of the aquatic ecology and aquatic environmental values in and surrounding the Project Site. This included a review of:

- aquatic MNES under the EPBC Act
- aquatic matters protected under Queensland legislation, including:
  - threatened freshwater species under the NC Act, supported by a search of Queensland's Wildlife Online database
  - features that support fisheries resources (e. g. waterway barrier works layer), pursuant to the Fisheries Act
  - wetland protection areas under the EP Regulation
  - HEV waters as defined under the EPP (Water)
  - freshwater-dependent regulated vegetation (e. g. category B, C or R vegetation) within wetlands, watercourses or drainage features listed under the VM Act
- mapped aquatic ecological features, including floodplains, wetlands and surface-expression groundwater dependent ecosystems
- publicly available hydrological data for the DNRME gauging station 130410A on the Isaac River at Deverill
- relevant literature, including published and unpublished technical reports, scientific papers, and conservation advice statements for any MNES identified, including:
  - DoEE online EPBC Act Protected Matters Search Tool (PMST)
  - Queensland's Department of Environment and Science (DES) Wildlife Online database
  - DoEE species profile and threats database
  - DoEE conservation advice for the identified aquatic MNES
  - published scientific literature
- the aquatic ecology baseline studies completed in December 2007 and April 2010 (SKM 2011) with survey site locations shown in Table 7.1 and Figure 7-1
- data contained in frc environmental's in-house bio-physical database.

Table 7.1 Survey sites for the aquatic ecology baseline studies

Site name	Description	Latitude	Longitude
PCU	Phillips Creek Upstream	-22.520	148.305
PCUL	Phillips Creek Upstream of Lease	-22.461	148.356
PT1	Plumtree Creek 1	-22.342	148.299
RHD	Railway Head Dam	-22.479	148.398
SCD	Southern Creek Dam	-22.517	148.382
BB1	Boomerang Billabong 1	-22.338	148.325
BC1	Boomerang Creek 1	-22.334	148.322
LV	Lake Vermont	-22.461	148.380
OMC1	One Mile Creek	-22.413	148.331
OMCD	One Mile Creek Dam	-22.412	148.330



LEGEND

- Project Site
- Project Footprint
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Public Road
- Survey Sites

Figure 7-1
Project Area and Survey Sites for the Aquatic Ecology Baseline Studies

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Saraji East Mining Lease Project

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Kilometres

Scale: 1:110,000 (when printed at A4)

Projection: Map Grid of Australia - Zone 55 (GDA94)

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7.3.2 Assessment of environmental values

The aquatic environmental values in and surrounding the Project Site were assessed using the criteria in Table 7.2. In-stream and riparian areas were assessed separately.

Table 7.2 Criteria used to assess environmental values

Aquatic ecological value	Criteria/description
High	Known or likely occurrence of aquatic MNES and/or threatened species protected under NC Act and/or HEV Waters under the EPP (Water).
Moderate	Aquatic MNES, threatened species protected under NC Act and HEV waters unlikely to occur, but suitable habitat for non-listed aquatic species of turtles and fish is present. Regulated vegetation categories under the VM Act may be present in riparian areas, and watercourses may be important for fish passage under the Fisheries Act (mapped as having higher than low risk of impact to fish passage by waterway barriers).
Low	Ephemeral watercourse without refugial pools; limited aquatic habitat features present; likely to provide low quality habitat for non-listed aquatic species during high flow events only.

7.3.3 Impact assessment

The assessment of impacts comprised:

- a risk-based assessment, with the level of risk being an outcome of the consequence and likelihood of the potential impact (Table 7.3 to Table 7.5)
- specific assessment of potential impacts to aquatic MNES using the *Significant Impact Guidelines 1.1* (DoEE 2013).

To determine the applicable aquatic MNES species and ecological communities, the PMST database was searched on 14 September 2016 and the following aquatic MNES were listed as potentially occurring within and surrounding the Project Site:

- white-throated snapping turtle (*Elseya albagula*) (critically endangered)
- Fitzroy River turtle (*Rheodytes leukops*) (vulnerable).

All other MNES that the PMST search identified were considered to be outside the scope of this chapter (i.e. not aquatic species). Further information on other MNES can be found in **Chapter 21 Matters of National Environmental Significance**.

Table 7.3 Ratings used to assess the consequence of potential impacts

Rating	Consequence of potential impacts
High	Catastrophic, irreversible or critical long term environmental harm or loss; significant harm or loss of sensitive components of the environment; significant harm or loss of protected components of the environment, such as protected wetlands or MNES.
Moderate	Significant short-term but reversible harm to sensitive components of the environment; minor environmental harm to protected components of the environment, such as protected wetlands or MNES.
Low	Unfavourable impact with no lasting harm to the environment, excluding sensitive and protected components of the environment.

Table 7.4 Ratings used to assess the likelihood of potential impacts

Rating	Likelihood of potential impacts
High	Almost certain or high likelihood of the impact occurring; has occurred recently in a similar scenario; likely to happen commonly.
Moderate	Likely or probably could happen; would not happen very commonly.
Low	Possible but unlikely to happen; would happen rarely if at all.

Table 7.5 Environmental risk matrix

Risk matrix		Likelihood		
		Low	**Moderate**	**High**
Consequence	**High**	Moderate	High	High
	Moderate	Low	Moderate	High
	Low	Low	Low	Moderate

7.4 Description of environmental values

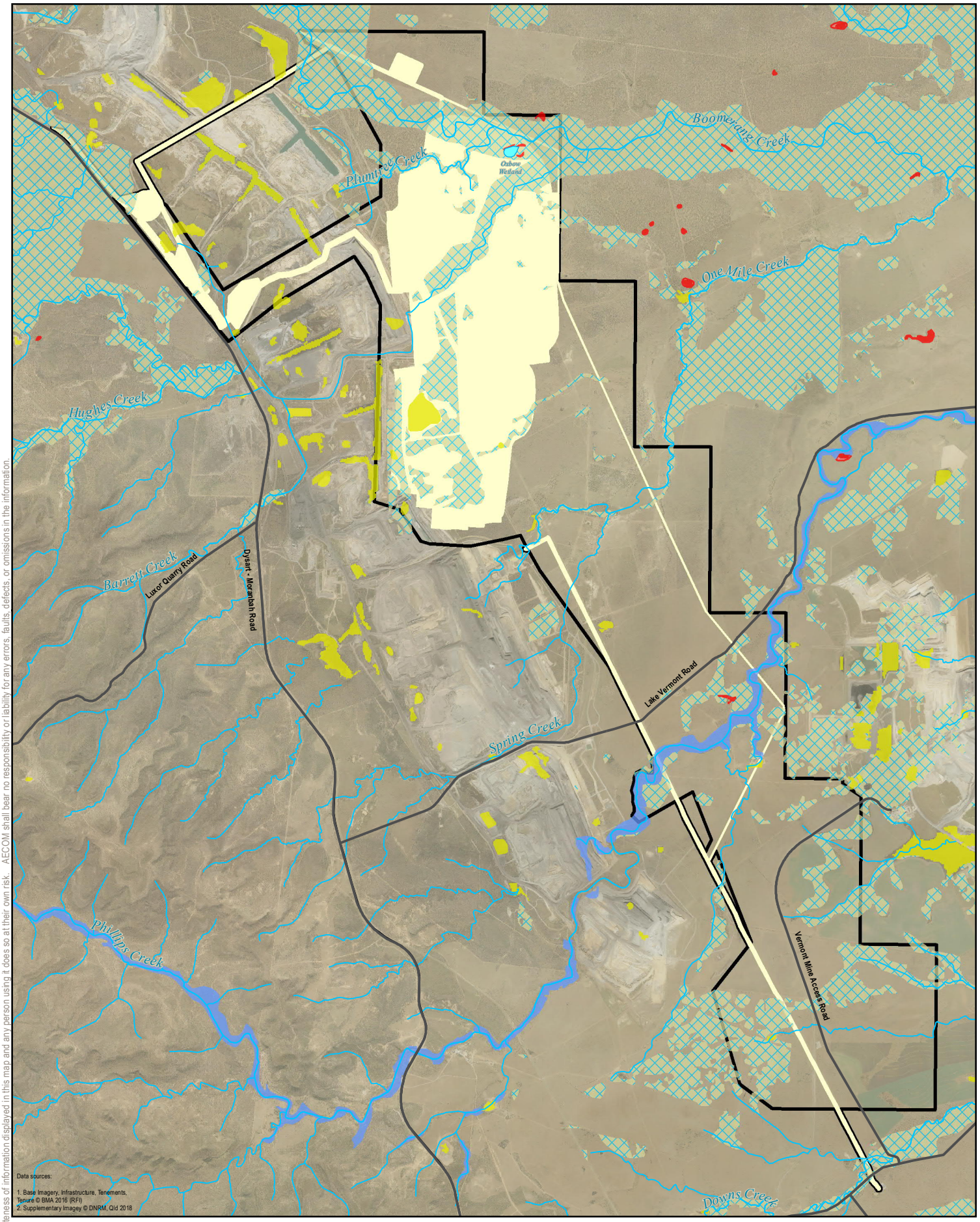
7.4.1 Aquatic habitat features

The Project Site is on floodplain, with watercourses having well-defined channels that follow an irregular sinuous pattern. There are no HEV waters or surface expression groundwater dependent ecosystems (GDEs) in or surrounding the Project Site. There are mapped lacustrine and palustrine wetlands surrounding the Project Site, but relatively few mapped wetlands within the Project Site. The Isaac River is mapped as a riverine wetland, and Phillips Creek and the Isaac River have mapped riverine regional ecosystems in their riparian zones. Figure 7-2 illustrates the above habitats.

Figure 7-1 identifies the watercourses surrounding the Project Site, which include Plumtree, Hughes, Spring, Boomerang, One Mile and Phillips Creek. These watercourses are highly ephemeral, and aquatic habitat is dominated by small isolated pools within the channel interspersed with large areas of dry stream bed, with larger pools typically found in artificial waterbodies. Larger pools are likely to be perennial or near-perennial and important refugial habitat for aquatic fauna. Smaller shallower pools provide aquatic habitat for briefer periods after rainfall.

Riparian vegetation within the Project Site was identified as being disturbed to highly disturbed at all survey sites, with spare to low cover of native Eucalyptus trees comprising the canopy at natural watercourse sites; pasture grasses (e. g. buffel grass) dominated the ground stratum.

Figure 7-3 illustrates the mapped regulated vegetation surrounding the Project Site.



LEGEND

- Project Site
- Project Footprint
- Public Road
- Oxbow Wetland

Wetlands

- Riverine RE
- Lacustrine Waterbody
- Palustrine Waterbody
- Palustrine RE
- RE 1-50% Wetland

N

Figure 7-2
Other Mapped Aquatic Features

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Saraji East Mining Lease Project

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Kilometres

Scale: 1:110,000 (when printed at A4)

Projection: Map Grid of Australia - Zone 55 (GDA94)

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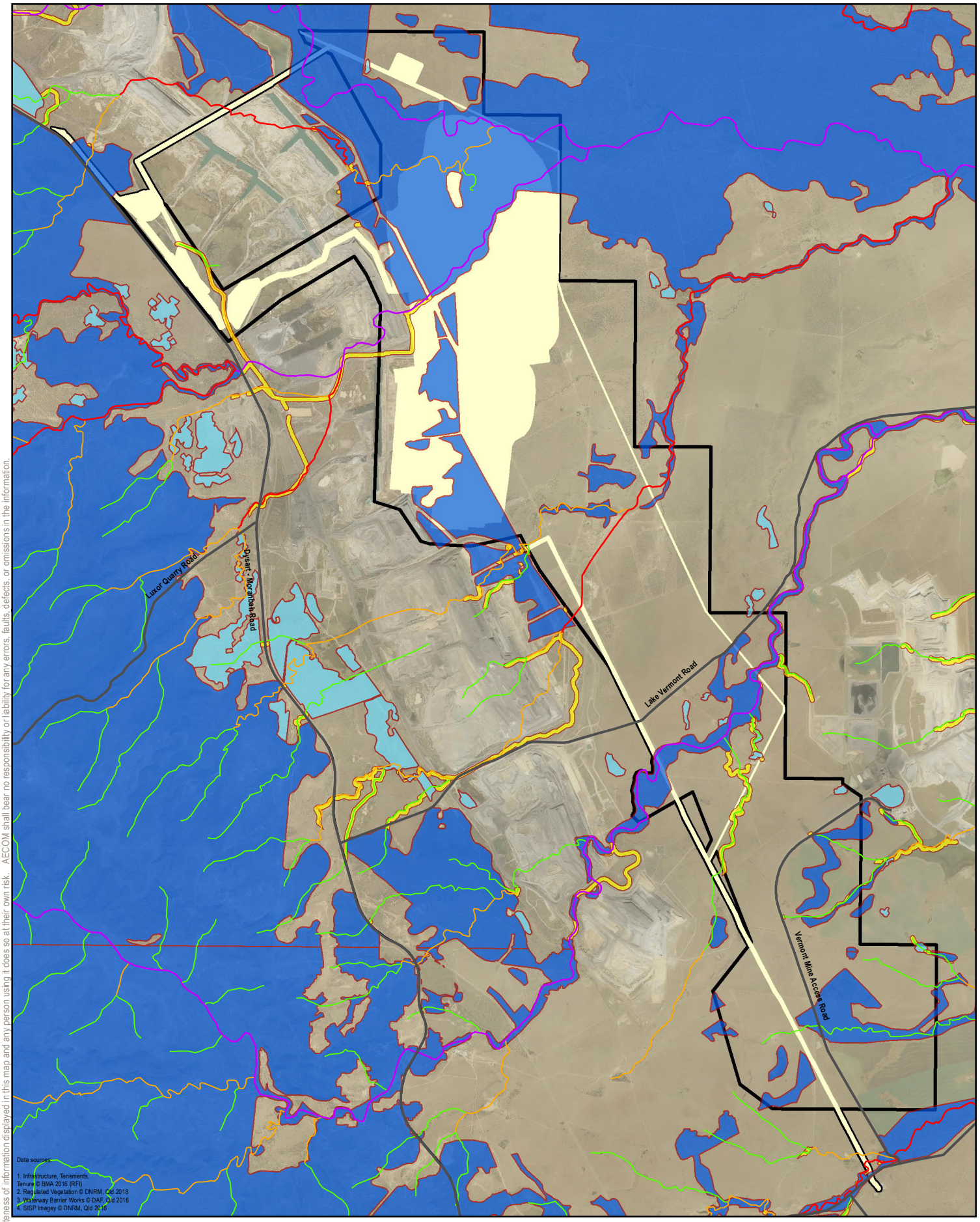

Data sources:

1. Infrastructure, Tenements, Tenure © BMA 2016 (RFI)
2. Regulated Vegetation © DNRM, Qld 2018
3. Waterway Barrier Works © DAF, Qld 2016
4. SISP Imagey © DNRM, Qld 2018

LEGEND

- Project Site
- Project Footprint
- Public Road

Risk of Impact

- 1 - Low
- 2 - Moderate
- 3 - High
- 4 - Major

Regulated Vegetation

- Category B area
- Category C area
- Category R area

N

Figure 7-3
Regulated Vegetation and Fish Passage

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Saraji East Mining Lease Project

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Kilometres

Scale: 1:110,000 (when printed at A4)

Projection: Map Grid of Australia - Zone 55 (GDA94)

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7.4.2 Fish passage

The relevant fisheries resources within and surrounding the Project Site are protected under the Fisheries Act; the Fisheries Act relates to the provision of and associated risks to fish passage from waterway barrier works on different sizes watercourses.

Figure 7-3 and Table 7.6 illustrates the mapped fish passage risks of watercourses within the Project Site.

Table 7.6 Fish passage ratings

Creek name	Creek rating
Phillips Creek	Purple (major)
Boomerang Creek	Purple (major)
One Mile Creek	Red (high)
Hughes Creek	Red (high)
Plumtree Creek	Orange (moderate)

Smaller upstream tributaries of these watercourses have low (green) risk of impact from waterway barrier works as they are outside the Project Site and will not be impacted by the Project.

7.4.3 Aquatic flora and fauna

The baseline aquatic ecology surveys (SKM 2011) reported generally low cover of aquatic plants, with no Endangered, Vulnerable or Near Threatened (EVNT) species recorded.

There were two individuals of eastern long-necked turtle (*Chelodina longicolis*) recorded and eleven species of fish identified. The fish species are all common and are tolerant of harsh environmental conditions (variable flow and fluctuating water quality) that are typical of ephemeral watercourses of the region.

The two aquatic MNES identified in the PMST (white-throated snapping turtle and Fitzroy River turtle) do not have any known populations within 80 kilometres (km) of the Project Site.

7.4.4 Assessment of environmental values

The in-stream aquatic environmental value of watercourses within and surrounding the Project Site was assessed as moderate using the criteria presented in Table 7.2. The watercourses provide favourable habitat for common species of fish, invertebrates and aquatic plants, noting that in-stream aquatic habitat is typically temporary and restricted to isolated pools. Aquatic MNES, threatened aquatic species and HEV waters are not reported to occur within or surrounding the Project Site, although regulated vegetation types occur in the riparian zone and watercourses of the Project Site, which are important corridors for fish passage.

All aquatic species recorded from watercourses within and surrounding the Project Site are tolerant of ephemeral flow and variable water quality and all are common and widespread in the region. No sensitive aquatic environmental receptors are likely to occur in watercourses in or surrounding the Project Site.

Refer to **Appendix D-1 Aquatic Ecology Technical Report** for a detailed discussion on the existing environmental values.

7.5 Potential impacts

The Project's construction and operational phases have the potential to cause a number of potential impacts upon the aquatic ecology of the Project Site and surrounds. The following sections describe these potential impacts.

7.5.1 Subsidence

Underground mining operations are proposed beneath the lower reaches of Plumtree, Boomerang and Hughes Creeks, and a tributary of One Mile Creek. Subsidence of these watercourses may result in lowered sections of stream bed with changes in bed level. This may alter natural water flow patterns and restrict the movement of fish, especially during low flow conditions, and potentially result in fish stranded in subsided areas. Many of the fish native to ephemeral systems in central Queensland migrate up and downstream and between different habitats at particular stages of their lifecycle, especially at the start of the wet season. Blockages to fish passage may mean that ephemeral wet season aquatic habitat do not become available to fish and turtles or may mean that fish and turtles cannot move to dry season refugial habitat at the end of the wet season, and thus perish. Hydrological and biological connectivity between the Isaac River and upper catchment areas of these watercourses may be adversely impacted. Erosion may cause bank failure and in-filling of the channel, which would also create a barrier to fish.

7.5.2 Water quality

Unplanned discharges of mine affected water (MAW) to watercourses may occur from overspilling, seepage or failure of the water management dams. Run-off from overburden stockpiles and leachate may also contribute to uncontrolled discharges of MAW.

Unplanned discharges have the potential to impact on water quality and aquatic ecology in the receiving environment. Unplanned discharges of MAW may not have the same water quality and flow conditions that control any impact to the receiving environment associated with planned discharges. Therefore, unplanned discharges may have a greater impact on the receiving environment than planned discharges, noting that the Project does not include any planned discharges of MAW.

7.5.3 Watercourse crossings

Construction of watercourse crossings for proposed access roads, haul roads, rail lines and pipelines (or other linear infrastructure) may disturb bank and bed sediments, leading to increases in localised turbidity and sediment deposition. This is especially pertinent where construction occurs during the wet season. After installation of crossings, stream beds and banks may continue to erode during high flows in the absence of appropriate bed and bank stabilisation and rehabilitation. This may result in an increase in channel width and a loss in channel definition, which results in loss of aquatic habitat for fauna.

Poorly constructed watercourse crossings may also create waterway barriers that prevent or impede movements of aquatic fauna during flow events.

7.5.4 Vegetation clearing and earthworks

There is a high potential for soil erosion and sedimentation of watercourses following vegetation clearing and earthworks, especially during the wet season when rainfall and run-off intensity is greatest. Stockpiles of soil may also cause increased turbidity and sedimentation of watercourses where rainfall and run-off washes soil to watercourses.

Increased turbidity may negatively impact fish and macroinvertebrates, because highly turbid water reduces respiratory and feeding efficiency (Schlosser 1978, cited in Russell and Hales 1993). Increased turbidity may also adversely affect submerged aquatic plants as light penetration (required for photosynthesis) is reduced.

Reduced light penetration can also lead to a reduction in temperature throughout the water column (DNRM, 1998).

Small increases in turbidity would be unlikely to have a significant impact on aquatic ecology, as aquatic species of the region are tolerant of moderate turbidity. However, significant increases in turbidity could adversely impact the health, feeding and breeding ecology of some species of macroinvertebrates and fishes, and aquatic plant growth within and downstream of the Project Site.

Sedimentation of watercourses can impact aquatic ecology by smothering stream beds with fine material, and decreasing bed roughness and reducing habitat diversity (e. g. smothering divers substrate types such as sand, and gravels and cobbles, smothering woody debris, making pools shallower, and in-filling under-cut banks that provide important habitat for fish). Decreases in available habitat for aquatic fauna due to sedimentation could reduce breeding opportunities and increase predation (e.g. by birds); thus, may cause a localised decline in abundance and diversity of aquatic species.

7.5.5 Operation and maintenance of vehicles

Fuels, oils and other chemicals required for the operation of vehicles and mining machinery are toxic to aquatic flora and fauna at relatively low concentrations. Fuel spills are most likely to enter watercourses via an accidental spill on the roads near watercourse crossings; or when there are construction activities adjacent to watercourses. A significant fuel spill to waterways (in the order of tens or hundreds of litres) is likely to have a locally significant impact on both flora and fauna, with the size of spill and the volume of water in the creeks being the most significant factors influencing the length of stream impacted. Other wastes associated with vehicle and machine maintenance also have the potential to contribute to the degradation of aquatic ecosystems.

Vehicles and machinery can also be vectors of dispersal for aquatic biosecurity matters such as listed aquatic weeds. Aquatic weeds can reduce the habitat quality of watercourses for native fish, and dense growth of aquatic weeds can cause a barrier to fish passage. The spread of aquatic weeds (e.g. through vehicle movements) listed under the *Biosecurity Act 2014*, is a breach of this legislation.

7.6 Mitigation measures

7.6.1 Subsidence

Impacts from subsidence will be managed through the development and implementation of a Subsidence Management Plan (**Appendix K-2**) that considers:

- erosion protection measures, including revegetation as appropriate
- where practical, riverbed earthworks will be undertaken to re-profile waterways to a natural state
- development and implementation of a receiving environment monitoring program (REMP).

7.6.2 Water quality

All dams for the Project will be constructed in accordance with the Department of Environment and Science (DES) *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* (DES, 2016) and will be above the Q100 flood line. Seepage from, and failure of, these dams is also unlikely because they will be compliant with regulator approved engineering and design specifications.

Surface runoff and leachate from the overburden waste dumps will be captured by drains and sediment basins, run-off from potentially contaminated areas will be collected through a segregated mine water management system that drains to an appropriately sized water storage (further information on the mine water balance is provided in **Chapter 8 Surface Water Resources**). Surface water quality will be monitored in accordance with a site Water Management Plan. The Water Management Plan will be developed prior to

construction and include baseline data on surface water flows and quality, trigger levels for investigations and a monitoring program.

7.6.3 Watercourse crossings

Watercourses within the Project Site are mapped as moderate, high or major risk of impact to fish passage. The design and construction of road and rail crossings, as well as any other watercourse crossing by linear infrastructure (e.g. pipes for water supply), will ensure that fish passage is maintained throughout these watercourses. Reduced light within culverts wider than 50 metres (m) can potentially impact fish passage; however, no watercourse crossing associated with the Project are proposed to be greater than 50 m in width.

Where practical, road, rail and pipeline crossings of watercourses will be constructed in the dry season, when watercourses are dry, and rainfall is unlikely. Crossing locations will preferentially be selected in areas where the bank gradient is low, and areas where riparian vegetation in good condition will be avoided as far as practical. Ongoing impacts associated with erosion or failing banks can be mitigated by implementing appropriate rehabilitation (refer **Chapter 5 Land Resources** and **Appendix K-1 Rehabilitation Management Plan**).

Where creek crossings are in areas with either pooled or flowing water, isolation of the workspace will minimise impacts to water quality. The isolation should be designed such that where practicable:

- it is completed within one work-day
- downstream flow is maintained around the workspace by using appropriately sized pumps and flumes
- sediment-laden water is pumped into sumps or onto grassed areas that which will trap sediments
- upon completion of construction, the downstream dam is removed first, then the upstream dam is slowly removed, to allow water to flush the sediment from the workspace area.

Where culverts are used, their design and installation can significantly influence fish passage. BMA will consult with the Department of Agriculture and Fisheries (DAF) during stream crossing design and for the design of culverts. It should be noted that under the Planning Regulation 2017, BMA will be exempt from obtaining any on-lease waterway barrier works approvals for operational works within fish passage.

7.6.4 Vegetation clearing and earthworks

The impact of increased turbidity on aquatic ecology associated with vegetation clearing, earthworks and stockpiles of soil is anticipated to be minimal because the extent of clearing needed is low; the Mine Infrastructure Area (MIA) will be constructed on land that is already cleared and mining will be underground. However, further impact mitigation will be achieved by implementation an erosion and sediment control plan (ESCP), and implementation of a rehabilitation management plan.

The ESCP will be developed prior to construction and include:

- sediment dams will be constructed prior to vegetation clearing and earthworks
- vegetation clearing and earthworks will be undertaken in incremental stages over the life of the mine where practical
- timing clearing and earthworks for construction of creek crossings or diversions to occur in the dry season where practical
- where practical, erosion control devices will be placed in ditches and drainage lines running from cleared areas, especially on slopes and levee banks

- where practical, contour banks, ditches or similar will be formed across cleared slopes to direct runoff towards surrounding vegetation or sediment dams, and away from creeks
- where appropriate, buffer zones will be retained to maintain and enhance riparian vegetation
- ongoing, proactive erosion and sediment control, including in-stream controls at strategic locations (such as stream crossings) during significant earthworks, installation and operation of incidental mine gas management infrastructure to minimise release of sediment to waterways
- routine inspection and monitoring to ensure the effective implementation of erosion and sediment controls.

When working in the riparian zone associated with Phillips Creek, use of low impact work (i.e. pruning vegetation instead of clearing) will be implemented

7.6.5 Operation and maintenance of vehicles

The storage and use of fuels, oils and batteries will be in accordance with *Australian Standard 1940:2017 – The storage and handling of flammable and combustible liquids*.

Use of equipment that is susceptible to spills and/or leakages of fuels will have appropriate spills kits located local to the equipment, with kits that can contain and cleans spills on land, in dry watercourses and wet watercourses being available at all times.

It is unlikely that a direct spill will occur within a watercourse; however, should a spill occur then this will be reported in line with the BMA operating procedures with relevant stakeholders being contacted as necessary.

All vehicles and machinery arriving to and leaving site will be subject to strict weed hygiene protocols to control the spread of weeds.

7.7 Residual impacts

The consequence of impact from each source of impact was assessed as moderate (Table 7.3), but the likelihood of impact was low where the identified mitigations were applied (Table 7.4). Therefore, there was low risk of adverse impact to the aquatic environmental values of watercourses in and surrounding the Project Site (Table 7.5).

The two aquatic MNES identified in the PMST (white-throated snapping turtle and Fitzroy River turtle) are unlikely to be impacted by the Project - the nearest known population of white-throated snapping turtle is approximately 80 km (straight-line distance) downstream from the Project Site, and the nearest known population of Fitzroy River turtle is approximately 90 km (straight-line distance) downstream from the Project Site. The nearest likely population of both of these MNES species is approximately 70 km (straight-line distance) downstream of the Project Site. Therefore, the Project is unlikely to impact on any aquatic MNES.

7.8 Summary and conclusion

The in-stream aquatic environmental value of watercourses in and surrounding the Project Site was assessed as moderate (significant short-term but reversible harm to sensitive components of the environment; minor environmental harm to protected components of the environment, such as protected wetlands or MNES). The watercourses provide favourable habitat for common species of fish, invertebrates and aquatic plants, noting that in-stream aquatic habitat is typically temporary and restricted to isolated pools. Aquatic MNES, threatened aquatic species and HEV waters are not reported to occur in or surrounding the Project Site, although regulated vegetation types occur in the riparian zone and watercourses of the Project Site are important corridors for fish passage.

All aquatic species recorded from watercourses in and surrounding the Project Site are tolerant of ephemeral flow and variable water quality, and all are common and widespread in the region. No sensitive aquatic environmental receptors are likely to occur in watercourses in or surrounding the Project Site.

The following potential sources of impact to aquatic environmental values associated with the Project were identified and include:

- subsidence
- unplanned discharge of MAW to watercourses
- watercourse crossings
- vegetation clearing and earthworks
- operation and maintenance of vehicles and other equipment.

The consequence of impact from each source of impact was assessed as moderate, but the likelihood of impact was low where the identified mitigations were applied. Therefore, there was low risk of adverse impact to the aquatic environmental values of watercourses in and surrounding the Project Site.