

EPBC Self Assessment Report

Ensham Life of Mine Extension Project

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Executive Summary

The Ensham Mine is owned by the Ensham Joint Venture (Ensham JV) which comprises Bligh Coal Limited, Idemitsu Australia Resources Limited and Bowen (Investments) Limited and is operated by Ensham Resources Pty Limited. The Ensham JV is proposing to extend the life of the mining operations.

Ensham Mine is an existing open-cut and underground bord and pillar coal mine located approximately 35 kilometres east of Emerald in Central Queensland. Ensham is proposing to extend the life of its existing bord and pillar underground operations by up to approximately nine years by developing a portion of Mineral Development Licence 217 as well as targeted areas within the existing mining leases.

Ensham JV is seeking approval for the Project under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in relation to impacts on a water resource by a large coal mining development. A groundwater impact assessment was carried out for the Project by SLR Consulting Australia Pty Ltd (SLR). A surface water assessment is currently being carried out for the Project by Hydro Engineering and Consulting Pty Ltd (HEC).

The EPBC Act provides a framework for the protection of the Australian environment, including its biodiversity, natural resources and culturally significant places. This report provides a self-assessment under the EPBC Act framework, based on the groundwater impact assessment prepared by SLR and surface water assessment being prepared by HEC, to assess if the EPBC Act water trigger applies for the proposed activity.

The results from the groundwater impact assessment were reviewed to assess if there are any potential significant impacts on a water resource under the EPBC Act criteria. A review of desktop information, existing assessments and workshop outputs has also been undertaken to assess the potential impacts on surface water resources.

Based on the assessment of surface water resources undertaken to date, the Project is not expected to result in changes in baseflow and water quality in the Nogoa River. Preliminary flood modelling undertaken for the Project indicates potential changes to flooding including instability and erosion of waterways are unlikely. The Project is unlikely to increase the frequency or volume of release events at Ensham Mine. Where absolutely required, controlled discharges to the Nogoa River will be undertaken in accordance with the current Environmental Authority which specifies the location, frequency and water quality limits of discharge events.

The groundwater impact assessment demonstrated that the Nogoa River is not well connected to the underlying alluvium. There is no predicted additional groundwater level drawdown within the alluvium in the Project Area as a result of the Project. No private landholder bores are predicted to have an additional decline beyond the existing drawdown in groundwater levels greater than 2 m at any point in time in the long term after the life of the Project. Groundwater drawdown of 2 m is the minimum reporting threshold for unconsolidated materials in the Underground Water Impact Report (UWIR) framework established under the *Water Act 2000*. The maximum additional drawdown (between existing operations and the Project) predicted in this assessment is 10cm at nearby private bores.

Therefore, the proposed action is determined to be unlikely to have a significant impact on a water resource for the purposes of the EPBC Act. Ensham may still wish to refer the action to the department as a precautionary measure.

1.0 Introduction

1.1 Scope

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is administered by the Commonwealth Department of Agriculture, Water and the Environment (DAWE, hereafter referred to as 'the Department'). The EPBC Act provides a framework for the protection of the Australian environment, including its biodiversity, natural resources and culturally significant places. Nine matters of national environmental significance (MNES) are identified under the Act including water resources in relation to large coal mining development (known as the water trigger). These are discussed in detail in **Section 1.3**.

Proposed activities that have the potential to have a "significant impact" on MNES require referral to the Department for approval. An EPBC referral document identifies the proponent undertaking the proposed action and a description of the proposal, including the project location, the nature and extent of any potential impacts and any proposed mitigation measures.

Prior to undertaking an activity, proponents are required to undertake a "self-assessment" to determine if an EPBC referral is required. The self-assessment is undertaken with reference to relevant guidelines and policies held by the Department. The Guideline that is applicable to this scope of work is the *Significant Impact Guidelines 1.3 - Coal seam gas and large coal mining developments – impacts on water resources* (DoE, 2013).

This self-assessment has been undertaken to determine whether the proposed extension of Ensham's underground mine and associated infrastructure (the Project) needs to be referred to the Minister under the EPBC Act relating to potential impacts of the Project on water resources.

This report provides an overview of the activities proposed by Ensham Joint Venture (Ensham JV) and an assessment as to whether the Project is likely to be considered a controlled action in relation to the water trigger under the EPBC Act.

1.2 Assessment approach

SLR Consulting Australia Pty Ltd (SLR) and Hydro Engineering and Consulting Pty Ltd (HEC) were engaged by AECOM Australia Pty Ltd (AECOM) on behalf of Ensham JV to provide advice regarding the applicability of the EPBC Act to activities and potential impacts associated with the Project. This assessment and advice was limited to impacts to groundwater resources. The detailed assessment is provided as **Appendix A**.

AECOM has undertaken a review of desktop information, existing assessments and workshop outputs to undertake the self-assessment of impacts on surface water resources. A detailed surface water investigation and report is currently being prepared for the Project to satisfy the assessment requirements set out under the *Environmental Protection Act 1994* (EP Act). The Project would continue to operate in compliance with the existing Ensham Mine Environmental Authority (EA) (EPML00732813, dated 9 August 2018) through the adoption of established site control and monitoring measures.

1.3 Legislative Context

1.3.1 Environment Protection Biodiversity Conservation Act 1999

The EPBC Act is the key piece of environmental legislation which is administered by the Australian Government. The EPBC Act provides a framework for the protection and management of nationally and internationally significant flora, fauna, ecological communities and heritage. MNES as defined in the EPBC Act are:

- World heritage properties
- National heritage places
- Wetlands of international importance

- Listed threatened species and ecological communities
- Migratory species
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mining)
- A water resource, in relation to coal seam gas (CSG) and large coal mining development (known as the water trigger).

Under the EPBC Act (section 528), the following definition is provided for a large coal mining development:

“any coal mining activity that has, or is likely to have, a significant impact on water resources (including any impacts of associated salt production and/or salinity):

- a. in its own right; or*
- b. when considered with other developments, whether past, present or reasonably foreseeable developments.”*

Under the EPBC Act an action will require approval from the Minister if the action has, will have, or is likely to have, a significant impact on a MNES. Under the EPBC Act, an “action” is defined broadly as: a project, a development, an undertaking, an activity or a series of activities of any of these things. Actions include mineral and petroleum resource exploration and extraction. This includes site preparation and construction, operation and maintenance and closure and completion stages of a project (including any modifications).

A person who proposes to undertake an action that will have, or is likely to have, a significant impact on MNES must refer the action to the Minister for a decision. A “significant impact” is an impact which is important, notable, or of consequence having regard to its context or intensity. When considering whether the action is significant, consideration must be given to the sensitivity, value and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impact(s).

It is important to note that it is not necessary for a significant impact to have a greater than 50% chance of happening. Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DEWHA, 2013) states *“If there is a scientific uncertainty about the impacts of your action and potential impacts are serious or irreversible, the precautionary principle is applicable”*. Therefore, the lack of scientific certainty is not a justification for an action not to be referred.

1.3.2 EPBC Act Significant Impact Guidelines

In undertaking this self-assessment, the *Significant Impact Guidelines 1.3 - Coal seam gas and large coal mining developments – impacts on water resources* (DoE, 2013) were considered. In accordance with these guidelines the following matters should be considered:

- Are there any matters of national significance located in the area of the proposed action (action is be considered broader than the immediate area: e.g. any downstream or upstream impacts or areas immediate adjacent need to be considered)?
- Considering the project at its broadest scope, is there potential for impacts, including indirect impacts, on matters of national environmental significance?
- Are there any proposed measures to avoid or reduce impacts of national environmental significance (and if so, is the effectiveness of these measures certain enough to reduce the level of impact below the “significant impact” threshold)?
- Are any impacts of the proposed action on matters of national environmental significance likely to be significant impacts (important, notable, or of consequence, having regard to their content or intensity)?

Reference is also made to Information guidelines for proponents preparing coal seam gas and large coal mining development proposals, Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC), May 2018. The role of the IESC is to provide advice to the Commonwealth Environment Minister and relevant state ministers on CSG and large coal mine developments which are likely to have a significant impact on water resources. The Information Guidelines have been developed to inform proponents what information is required to enable a robust scientific assessment.

Section 3.0 of this report outlines the self-assessment for the Project in relation to the water trigger.

2.0 Project Description

2.1 Project Overview

Ensham Mine is an existing open-cut and underground bord and pillar coal mine located approximately 35 kilometres (km) east of Emerald in Queensland's Bowen Basin (see **Figure 1**). The existing bord and pillar operations are located on ML 7459 and ML 70365 which extracts a portion of the various combined Aries/Castor seam plies.

The Project proposes to extend the existing underground bord and pillar mine into an area identified as the Project Area (Mining Lease (ML) 700061, application submitted 25 March 2020) commencing from within ML 7459, ML 70326, ML 70365, and ML 70366 to an area west of ML 70365 within part of MDL 217 (see **Figure 1**).

The Project Area comprises three areas: an area on MDL 217 (Zone 1), and two areas across current MLs; Zone 2 partially includes ML 70326, ML 70365 and ML 7459 and, Zone 3 partially includes ML 7459 and ML 70366. The extension of the underground into the Project Area adjacent to the current approved mine plan will maintain a steady supply of coal to market and ongoing employment at Ensham Mine.

The Project will continue to produce at current production rates up to approximately 4.5 million tonnes per annum of run of mine (ROM) coal. This will extend the Ensham Life of Mine (LOM) by up to nine years to approximately 2037. The Project would not seek to change the current EA limit (condition A14) which authorises the mining of 12 million tonnes of ROM coal per annum. The Project is proposed to commence in 2021. The use of conventional underground mining equipment or similar forms of continuous miners is currently anticipated.

The Project proposes to utilise the existing mine infrastructure area (MIA) facilities which includes a coal handling plant (CHP).

2.2 Existing Ensham Mine Operations

The existing mining operations at Ensham Mine consist of open-cut and underground operations (**Figure 2**). The open-cut operation is scheduled to continue to approximately 2024, followed by further rehabilitation of the open-cut mine. Current approved underground operations are due to cease in 2028 (see **Figure 3**).

The underground operations currently use the bord and pillar mining method. This involves the use of a continuous miner to remove the ROM coal while leaving a series of coal pillars to support the roof.

The existing underground workings are accessed through portals located in Pit C. The portals are used for conveying ROM coal from the workings to the CHP and for personnel and materials access.

Extracted coal is transported by a system of underground conveyors to the surface. Coal is then transported by semitrailers to the CHP where it is crushed and sized. Product coal is transported via rail to Gladstone for the Gladstone Power Station and to the port for export.

The underground mine services are largely integrated wherever possible with those of the open-cut mine in aspects such as coal handling, transport, waste and water management.

2.3 Water Resources

As defined within the *Significant Impact Guidelines 1.3 - Coal seam gas and large coal mining developments – impacts on water resources* (DoE, 2013), a water resource means:

- a) Surface water or groundwater, or
- b) a watercourse, lake, wetland or aquifer (whether or not it currently has water in it),

and includes all aspects of the water resource (including water, organisms and other components and ecosystems that contribute to the physical state and environmental value of the water resource).

For the purposes of this report, watercourses, lakes and wetlands have been considered a surface water resource, and aquifers and groundwater-dependent ecosystems have been considered a groundwater resource.

The water resources that have been considered within the Project Area and wider Study Area under this assessment are listed below.

Surface Water

- Nogoia River and catchment including:
 - Boggy Creek
 - Winton Creek
 - Corkscrew Creek
- Nogoia River floodplain
- Lakes and dams
- Springs
- Wetlands.

Groundwater

- Alluvial Aquifers
- Porous Rock Aquifers
- Groundwater users, including:
 - Groundwater dependent ecosystems
 - Private bores
 - Great Artesian Basin Intake.

Their values are further detailed in **Sections 4.1** and **5.1**.

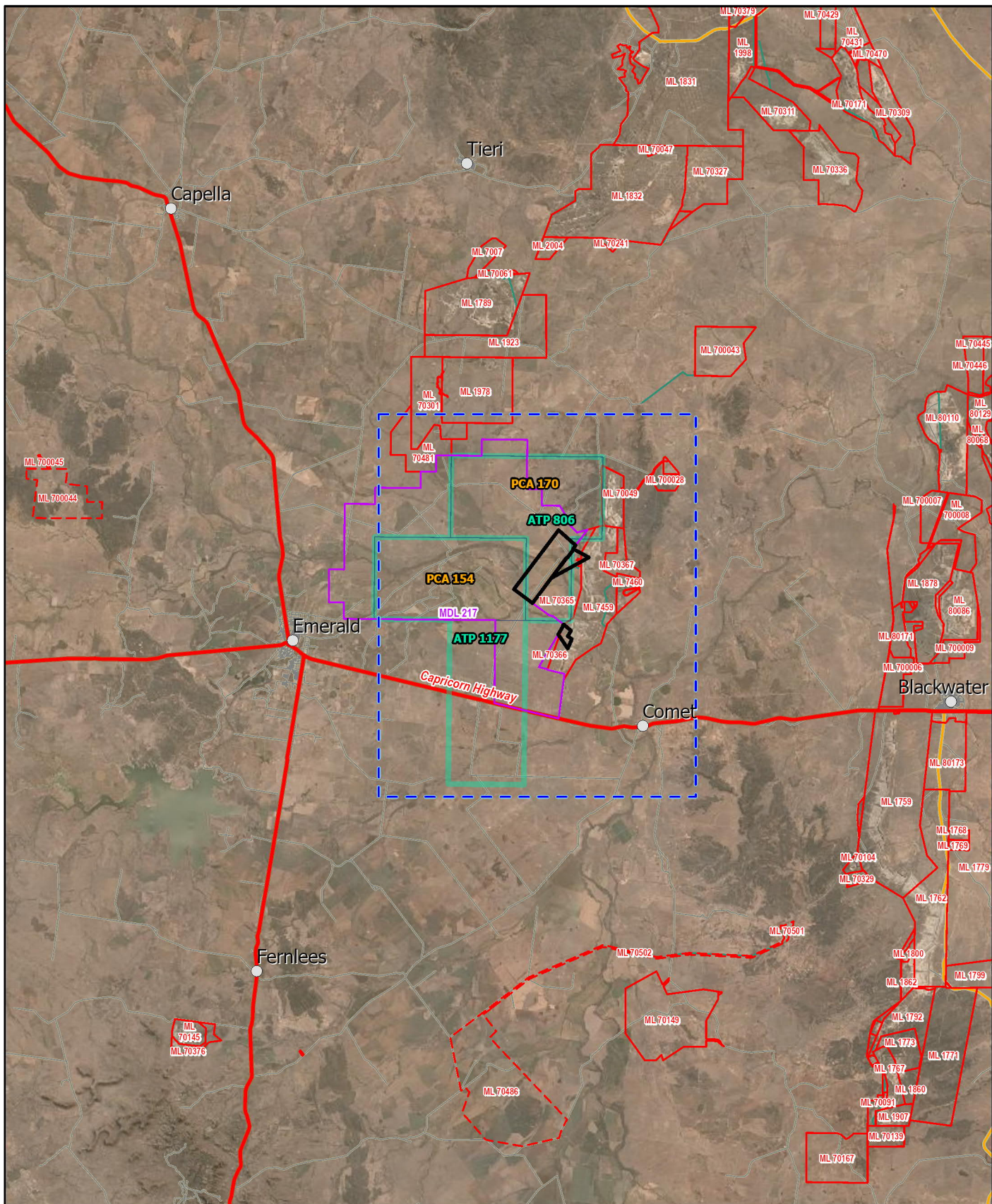


Figure 1
Project location and surrounding mine tenements



Legend

- | | | | | | |
|--|---------------------------|--|-------------------------------------------------------|--|-----------------------------------|
| | Project Area | | Mining leases | | Exploration permits for petroleum |
| | Main road | | Mineral development licence | | Potential commercial areas |
| | Public road | | Mining lease (application not related to the Project) | | |
| | Other road | | | | |
| | Model domain (study area) | | | | |

EPBC self-assessment
Ensham Life of Mine Extension Project

Projection: GDA 1994 MGA Zone 55 Scale: 1:600,000
Source: State of Queensland, 2019. Imagery: State of Queensland, 2017. Indemitsu RFI 2019. Model data AECOM 2020

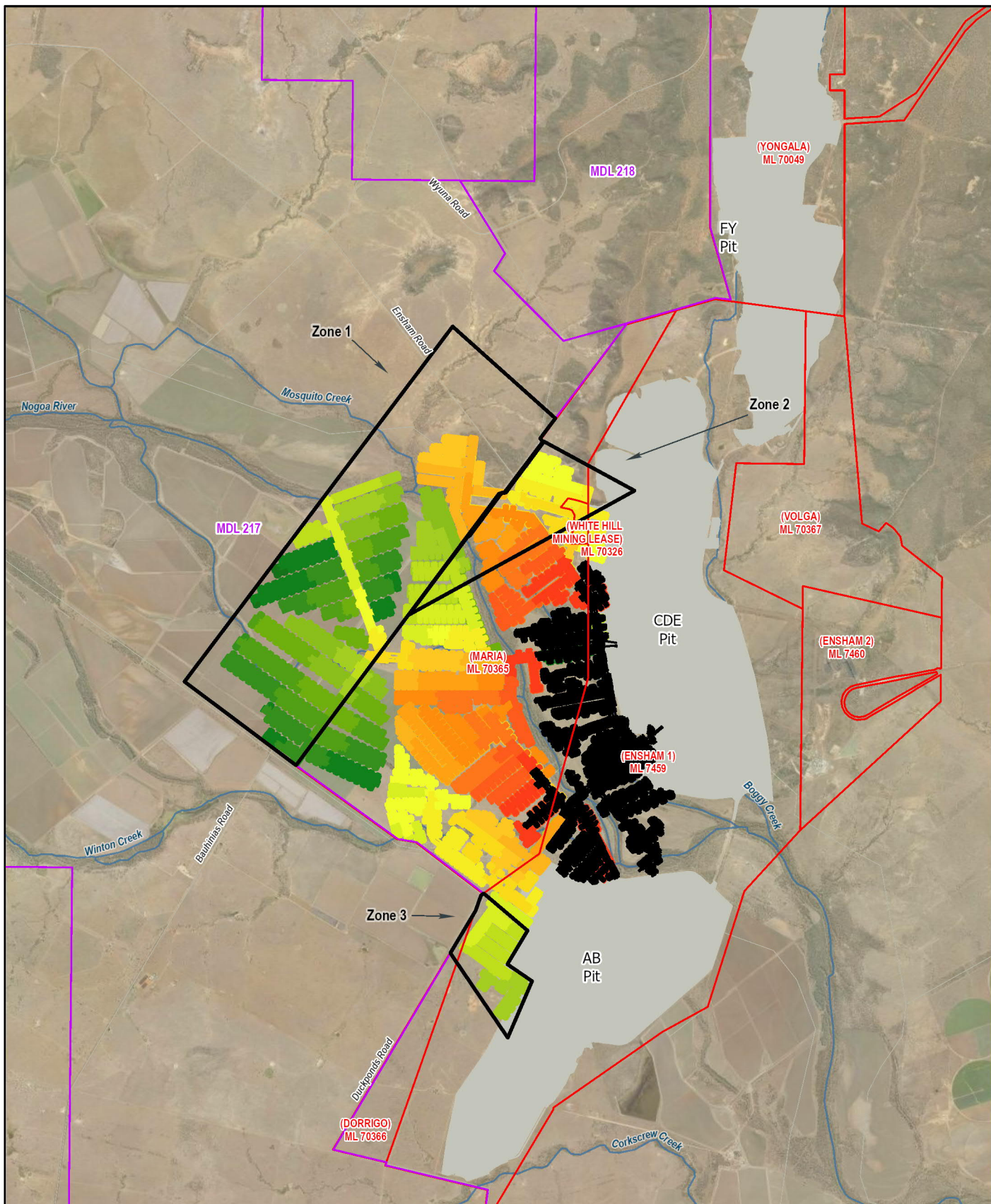







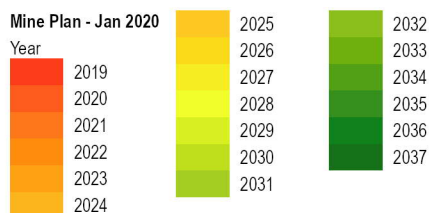


Figure 2
Project mine tenements pit shell boundaries and underground mining areas

Legend

-  Project Area
-  Coal conveyor transport system
-  Mineral development licence
-  Mining leases
-  Mine infrastructure footprint
-  Pit
-  Mined out areas



Ensham
RESOURCES



0 2 3 km

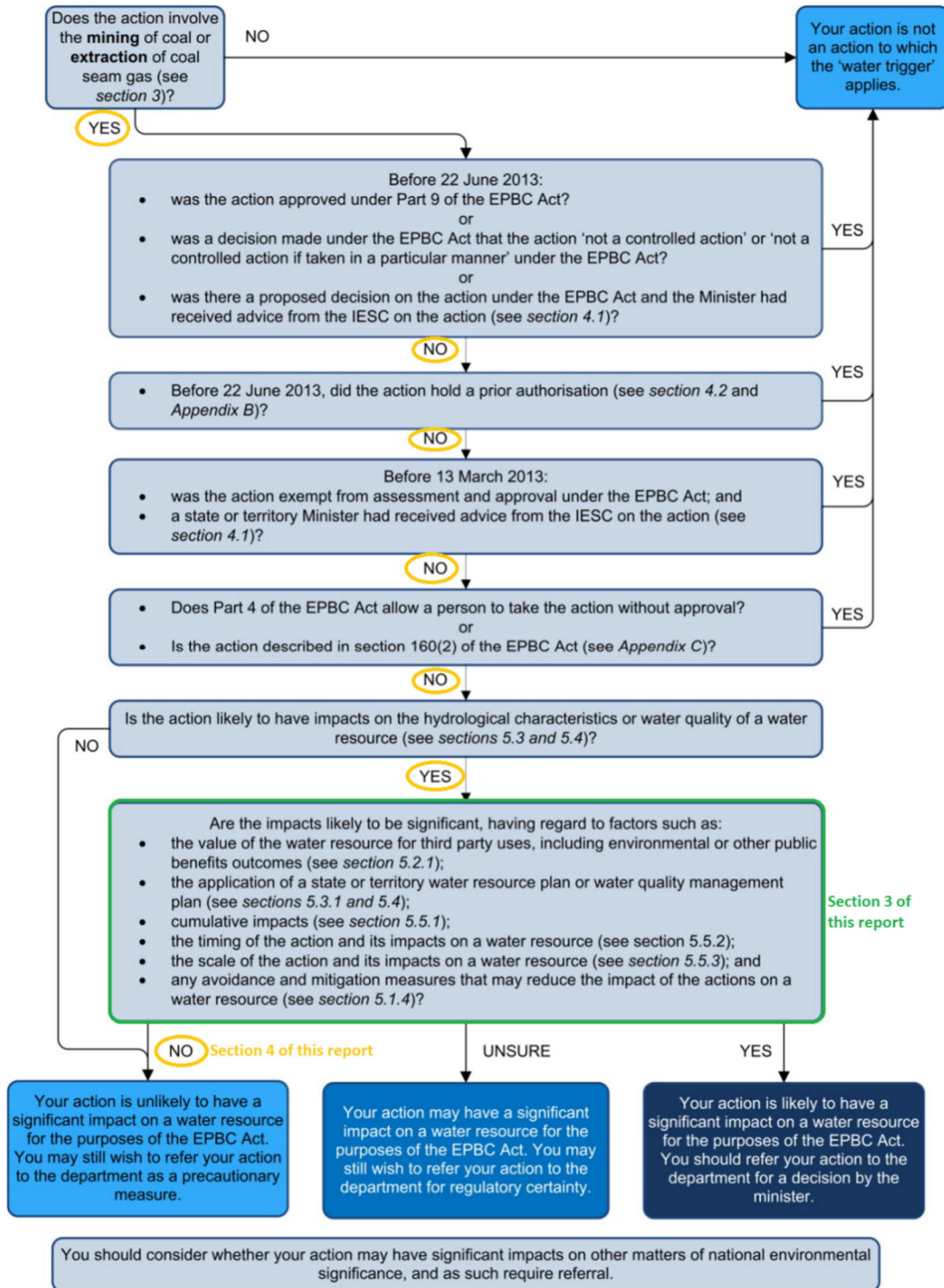
EPBC self-assessment
Ensham Life of Mine Extension Project

Projection: GDA 1994 MGA Zone 55 Scale: 1:100,000
Source: State of Queensland, 2019. Imagery: State of Queensland, 2017.
Indemitsu RFI 2019. Model data AECOM 2020

3.0 Assessment of the Water Trigger

The assessment of the water trigger was undertaken in accordance with the flowchart from the *Significant Impact Guidelines 1.3* (**Figure 4**). The Project will likely have some impact on the hydrological characteristics or quality of water; however, this assessment is to determine whether those impacts are likely to be significant.

Figure 4 Self assessment flow chart



SLR has previously undertaken a groundwater impact assessment (SLR, 2020; **Appendix A**) for the Project. The assessment included development of a numerical groundwater model, which predicted that there are likely no significant impacts to water resources from the Project, beyond the effects of already approved mining. The report findings are summarised in the following sections.

An assessment of the Project's impact on surface water resources is currently being undertaken. The assessment includes the development of a water balance for the Ensham Mine with the Project to identify any potential impacts to the existing hydrology and water quality of downstream watercourses. AECOM have undertaken a review of desktop information, existing assessments and workshop outputs to undertake the self-assessment of impacts on surface water.

4.0 Surface water

4.1 Value and Quality of the Surface Water Resource

4.1.1 Nogoia River and catchment

The dominant hydrological feature across the Project Area is the Nogoia River. The Project is located within the Nogoia River catchment, which is a sub-basin of the Fitzroy Basin. The Nogoia River is naturally ephemeral but generally has constant low flows due to controlled irrigation water supply releases from Fairbairn Dam which is located approximately 60 km upstream of the Project Area.

The main channel of the Nogoia River is relatively deep and well-defined, however, overbank flooding can occur after heavy rains in the catchment. Within the Project Area, the river has a secondary anabranch channel that flows intermittently. Smaller ephemeral tributaries such as Winton Creek and Boggy Creek also skirt the Project Area. Approximately 10 km downstream of Ensham Mine, the Nogoia and Comet Rivers meet to form the Mackenzie River.

4.1.2 Floodplains

The Project is located on the Nogoia River floodplain, with a series of well-defined braided channels of the Nogoia River intersecting the Project Area from the west to the east. The low-lying area includes floodplains and riparian zones along the Nogoia River and an anabranch which runs to the north of the Nogoia River. Other watercourses within the Project Area are typically well-defined channels that follow an irregular sinuous pattern. There are no high ecological value waters or surface expression groundwater dependent ecosystems in, or surrounding, the Project Area.

4.1.3 Lakes and dams

Nogoia River's flow is maintained by upstream irrigation water supply releases from Fairbairn Dam, south of Emerald.

4.1.4 Springs

A search with Queensland's WetlandInfo Portal (WetlandInfo, 2019) showed that there are no registered springs in a 50 km radius of the Project Area (**Appendix A, Section 5.5.2**).

4.1.5 Wetlands

A search within Queensland Globe showed a wetland of high significance located 2.6 km south of the existing open-cut mine (**Figure 5**). The wetland is surrounded by agriculturally used land, as indicated by farm dams and irrigation pivots in the area (**Appendix A, Section 5.5.3**). The wetland has not been confirmed by a site visit.

4.2 Potential Changes to the Hydrology of Surface Water Resources

The *Significant Impact Guidelines 1.3 - Coal seam gas and large coal mining developments – impacts on water resources* define a significant impact to the hydrology of water resources as:

"...a change that is of sufficient scale or intensity as to reduce the current or future utility of the water resource for third party users, including environmental and other public benefit outcomes, or create a material risk of such reduction in utility occurring."

The potential impacts relating to hydrology of surface water resources that have been identified from the desktop review are summarised below:

- The Project is not expected to result in a change in baseflow of the Nogoia River
- No changes in the water quantity are predicted for the Nogoia River
- The surface topography will not be altered so there will be no changes to the area or extent of the Nogoia River or other creeks within the vicinity
- Due to the nature of the proposed mining method, no large-scale subsidence is predicted
- Based on flood modelling undertaken for the Project, potential changes to flooding including instability and erosion of waterways are unlikely.

A detailed assessment against the *Significant Impact Guidelines 1.3 - Coal seam gas and large coal mining developments* – impacts on surface water resources is provided in **Table 1**.

The assessment of potential impacts to surface water resources is ongoing. Assessment undertaken to date indicates that potential impacts to surface water resources as a result of the Project are likely to be comparable to Ensham Mine's existing operations.

The Nogoia River and its upstream and downstream catchment, associated floodplain, and tributaries have previously been considered as part of the assessment of the existing mine. The existing EA (EPML00732813) imposes conditions on current operations to manage the risk of releases to the Nogoia River catchment and associated surface waters. It is expected that the Project will continue to comply with current EA conditions.

Therefore, it is considered unlikely that the Project would result directly or indirectly in a substantial change in the hydrology of surface water resources.

Table 1 Assessment of Surface Water Resources - Hydrology

Guideline Section 5.3 An impact on the hydrological characteristics of a water resource may occur where there are, as a result of the action:	Assessment
Change in water quantity, including the timing of variations	<p>No changes in water quantity are predicted for the Nogoia River (Appendix A, Section 6.4.4.2) and the Nogoia River alluvium (Appendix A, Section 6.4.4.1).</p> <p>Mine water will continue to be managed using the existing water management system for the Project. Assessment undertaken to date indicates that the existing water management system will contain water generated in the Project area.</p> <p>Third party users of surface water resources (including environmental and public users) will not be impacted by the Project.</p>
Changes in the integrity of hydrological or hydrogeological connections, including substantial structural damage (e.g. large-scale subsidence)	<p>The surface topography will not be altered so there will be no changes to the area or extent of the Nogoia River or other creeks within the vicinity.</p> <p>Due to the nature of the proposed mining method, no large-scale subsidence is predicted, refer to Appendix A, Section 8.2.</p>
Changes in the area or extent of a water resource	<p>No changes in the area or extent of a water resource are predicted.</p> <p>Preliminary flood modelling undertaken for the Project indicates potential changes to flooding including instability and erosion of waterways are unlikely.</p>

4.3 Potential Changes in Water Quality of Surface Water Resources

The *Significant Impact Guidelines 1.3 - Coal seam gas and large coal mining developments – impacts on water resources* define a ‘substantial change’ in water quality as a change that:

“...would be sufficient to create a risk that, as a result of the action, the ability to achieve relevant local or regional water quality objectives would be materially compromised.”

The potential impacts relating to water quality of surface water resources are summarised below:

- The Project is not expected to impact on stream baseflows and as such there is unlikely to be a negative impact on water quality in the Nogoia River or other creeks within the vicinity
- As the Project is an extension of existing underground operations, the current EA conditions are considered adequate to manage potential impacts on water quality in receiving environment.

A detailed assessment against the *Significant Impact Guidelines 1.3 - Coal seam gas and large coal mining developments – impacts on surface water resources* is provided in **Table 2**.

Therefore, it is considered unlikely that the Project would result directly or indirectly in a substantial change in the water quality of surface water resources.

Table 2 Assessment of Surface Water Resources - Water Quality

Guideline Section 5.4 A significant impact on a water resource may occur where, as a result of the action:	Assessment
There is a risk that the ability to achieve relevant local and regional water quality objectives would be materially compromised.	<p>Mine water will continue to be managed using the existing water management system for the Project. Assessment undertaken to date indicates that the existing water management system will contain water generated in the Project area.</p> <p>Discharge to Nogoia River (which is only undertaken when absolutely necessary for continuity of mining operations) will be undertaken in accordance with the current EA (EPML00732813). The current EA imposes conditions on the location of releases (condition C2), water quality limits of discharge events (condition C4), and monitoring requirements at the release points (condition C5). These EA conditions manage the risk of releases to the Nogoia River catchment and associated surface waters.</p> <p>As the Project is an extension of existing underground operations, the current EA conditions are considered adequate to manage potential impacts on water quality in receiving environment.</p> <p>As the Project would have no discernible impact on stream baseflows (Appendix A, Section 6.4.4.2), it is unlikely to have an impact on water quality in the Nogoia River.</p>
There is a significant worsening of local water quality (where current local water quality is superior to local or regional water quality objectives)	Not applicable. The water quality is not superior to local or regional water quality objectives. Both the alluvium and the coal seams show high salinity (Appendix A, Section 5.4.1).
High quality water is released into an ecosystem which is adapted to a lower quality of water	Not applicable. Any water from mining would be released into Nogoia River, which has fresher water quality than the groundwater (Appendix A, Section 5.4.2 and Figure 22)

5.0 Groundwater

5.1 Value and Quality of the Groundwater Resource

The Project is located in the western part of the geological Bowen Basin, which is one of five major foreland sedimentary basins formed along the eastern side of Australia during the Permian period. The Bowen Basin is the largest productive coal basin in Australia. The Bowen Basin stretches from Townsville to south of the Queensland-New South Wales border in a north to south direction.

Table 3 lists the stratigraphy in the study area (see **Figure 1** for the extent and location of the study area). The two relevant formations considered aquifers are the alluvium and the Rangal Coal Measures. These are further discussed in **Section 5.1.1** and **Section 5.1.2** respectively. These two aquifers are separated by the Rewan Group, which is considered a regional scale aquitard in the Bowen Basin. Below the Rangal Coal Measures, older Permian formation are present, but are not considered relevant as a groundwater resource in the context of this assessment.

Table 3 Summary of the stratigraphy in the study area

Age	Unit	Description
Quaternary	Alluvium	Silt, clay, sand and gravel
Tertiary	Undifferentiated deposits	Duricrusted palaeosols at the top of deep weathering profiles, including ferricrete and silcrete; duricrusted old land surfaces
	Emerald Formation	Fluviatile and lacustrine claystone and siltstone, quartzose sandstone, pebbly sandstone, gravel, lignite, oil shale, interbedded basalt; all deeply weathered in outcrop
	Basalt	Tertiary volcanics (basalt) mapped as being present over 10 km west of the site
Triassic	Rewan Group	Lithic sandstone, pebbly lithic sandstone, green to reddish brown mudstone and minor volcanilithic pebble conglomerate (at base); deposited in a fluvial-lacustrine environment.
Permian	Rangal Coal Measures	Feldspathic and lithic sandstone, carbonaceous mudstone, siltstone, tuff and coal seams. Coal seams include the Aries, Castor, Pollux and Orion seams. The main economic seams at Ensham are the Aries 2 and Castor seams.
	Burngrove Formation	Sandstones, siltstones and mudstones, and banded coal seams frequently interbedded with tuff and tuffaceous mudstones - coal seams include the Virgo and Leo seams.
	Fair Hill Formation	Lithic and feldspathic labile sandstone, siltstone, mudstone and conglomerate
	Macmillan Formation	Lithic and feldspathic sublabile mudstone, siltstone and sandstone

5.1.1 Alluvial Aquifers

Alluvial deposits are associated with Nogoia River and its anabranch and are between two and four kilometres wide (see **Figure 5** for the extent of the alluvium). The alluvial sequence varies in thickness, with a maximum observed depth of 25 m. The alluvium crosses the open-cut area of Ensham Mine. Within the Nogoia River floodplain, the alluvial sequence comprises silt and clay underlain by a basal unit of sand and gravel. The alluvium is itself overlain by a deep clay-rich black soil, which tends to be highly absorbent during rainfall events.

The groundwater in the alluvium shows high salinity with a median of 13,100 $\mu\text{S}/\text{cm}$, which makes it unsuitable for groundwater uses such as stock watering and irrigation. The alluvium is not well connected with Nogoia River, which can be concluded by the difference in salinity between the more saline alluvial groundwater and the fresher river water. Furthermore, some bores installed in the alluvium are sporadically dry, also indicating that there is no continuous recharge from Nogoia River.

5.1.2 Porous Rock Aquifers

The Rangal Coal Measures consist of interbedded sandstone, siltstone, mudstone, and coal with tuff (towards the base) and have a thickness of up to 100 m in the study area. The coal seams outcrop / subcrop over a strike length of about 80 km in north-south direction at the Ensham Mine to the east of the Project Area. To the north of Project Area, the outcrop / subcrop changes direction and is showing east to west. It forms part of the syncline basin plunging to the south-west.

The Rangal Coal Measures comprise economic coal seams interbedded with low permeability siltstone, sandstone and shale. The most permeable lithological units at the Ensham Mine are the coal seams within the Rangal Coal Measures. The coal seams form aquifers that generally exhibit low transmissivities and are confined by overlying and underlying shales and mudstones. Groundwater storage and movement largely occurs within the coal seams, along cleats and occasionally within minor fault zones that intercept the seams. The other lithologies present in the overburden and interburden sequence are considered to form aquitards.

The data indicate that the coal seams contain groundwater that is generally saline with a median of 7,700 $\mu\text{S}/\text{cm}$ and not suitable for stock water supply or irrigation.

5.1.3 Groundwater Users

5.1.3.1 Groundwater dependent ecosystems

Ecosystems (aquatic and terrestrial) that are dependent on groundwater or that may be affected by change in groundwater quantity (levels) and quality are referred to as groundwater dependant ecosystems (GDEs). GDE mapping is available from the Department of Science (DES). The GDEs relevant to the Project are summarised as follows (**Figure 5**):

- potential GDE aquifer: unconsolidated sedimentary (alluvium) aquifer along the reaches of the Nogoia River and a small consolidated sedimentary aquifer on the southern end of the Project Area
- surface expression GDE: derived GDE with low confidence along the Nogoia River and Winton Creek
- terrestrial GDE areas: derived GDE with low confidence along the Nogoia River and parts of Winton Creek.

There were no high confidence GDEs identified in the study area.

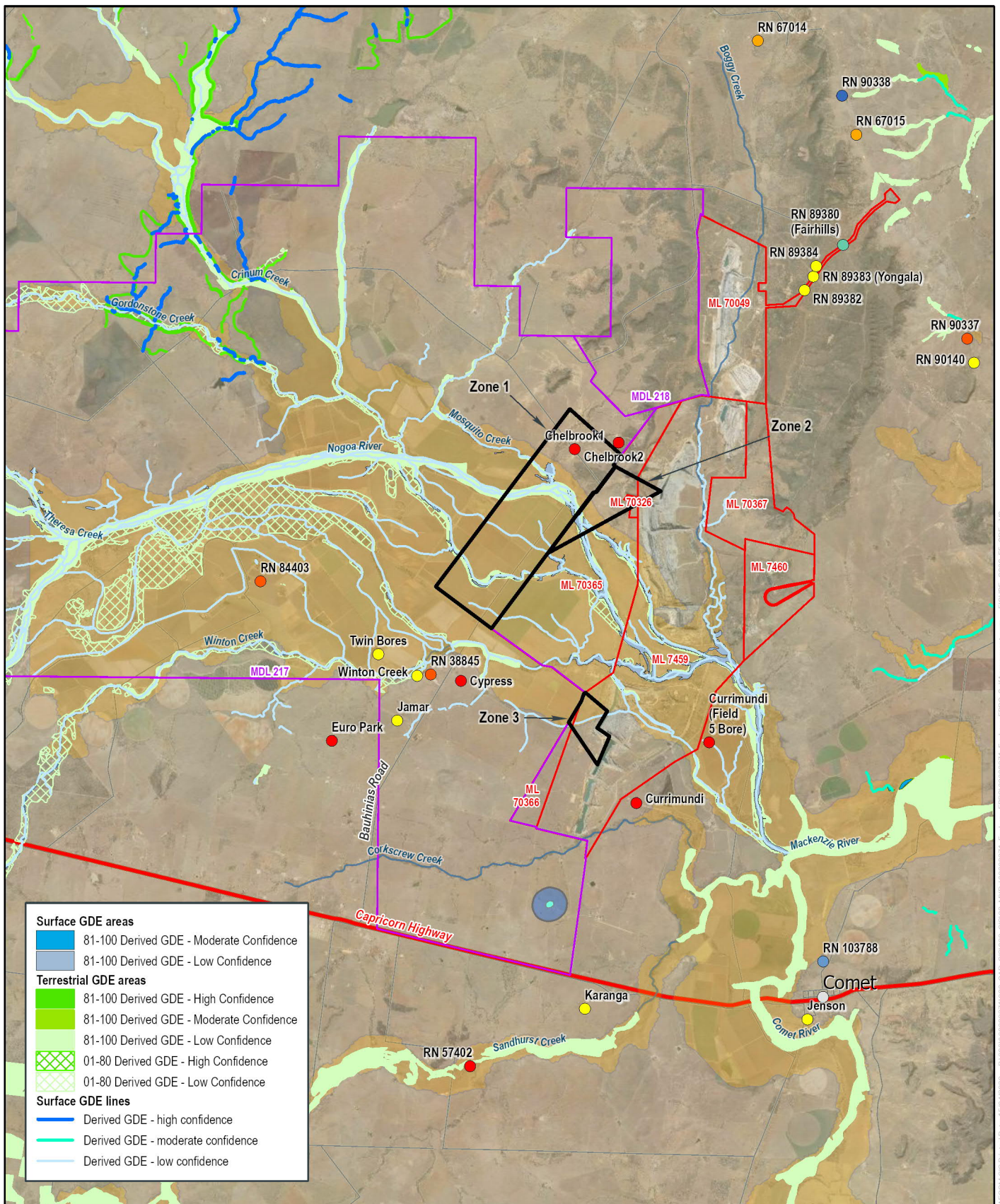


Figure 5
Groundwater Dependent Ecosystems and Private bores and alluvial extent



Legend

- | | | |
|--------------------|-------------------------------------|------------------------------|
| Project Area | Wetland | Irrigation, stock & domestic |
| Watercourse | Wetland protection area | Stock & domestic |
| Main road | Modelled Alluvial extent | Stock |
| Other road | | Unlikely used (very saline) |
| Ensham mine leases | Registered and Private bores | Unknown |
| Mining leases | Farm supply (potable) | Not in use |

EPBC self-assessment
Ensham Life of Mine Extension Project

Projection: GDA 1994 MGA Zone 55 Scale: 1:200,000
Source: State of Queensland, 2019. Imagery: State of Queensland, 2017. Indemitsu RFI 2019. Model data AECOM 2020

5.1.3.2 Private bores

The groundwater assessment (**Appendix A, Section 5.5.4**) identified 19 private groundwater bores in a 15 km radius from the Project (**Figure 5**). Of these bores, 11 are currently in use. The bores use water sources from different formations, namely the alluvium, undifferentiated Tertiary, the Rewan Group, the Fairhill Formation, Burngrove formation, and MacMillan Formation. None of the identified private bores are accessing water from the Rangal Coal Measures. Overall, groundwater usage is limited in the district, given access to better quality water from the perennial Nogoia River.

5.1.3.3 Great Artesian Basin Intake

The closest intake of the Great Artesian Basin (GAB) is located 50 km south-west of the Project and, therefore, the GAB is not considered relevant to the Project (**Appendix A, Section 4**).

5.2 Potential Changes to the Hydrology of Groundwater Resources

The *Significant Impact Guidelines 1.3 - Coal seam gas and large coal mining developments – impacts on water resources* define a significant impact to the hydrology of water resources as:

“...a change that is of sufficient scale or intensity as to reduce the current or future utility of the water resource for third party users, including environmental and other public benefit outcomes, or create a material risk of such reduction in utility occurring.”

The key findings of the groundwater impact assessment relating to hydrogeology are:

- The Nogoia River is not well connected to the underlying alluvium (**Appendix A, Section 5.2.1**).
- No private landholder bores are predicted to have an additional decline in groundwater levels greater than 2 m at any point in time in the long term after the life of the Project. Groundwater drawdown of 2 m is the minimum reporting threshold for unconsolidated materials in the Underground Water Impact Report (UWIR) framework established under the *Water Act 2000*. The largest predicted drawdowns in landholder bores were 10 cm (**Appendix A, Section 7.4**).
- There is no predicted additional groundwater level drawdown within the alluvium in the Project Area as a result of the Project. However, some additional drawdown is observed in the wider study area, specifically east of the open-cut voids (**Appendix A, Figure 43**).
- Impacts on any identified GDEs are predicted to be negligible. No maximum additional drawdown larger than 0.5 m was predicted in the alluvium in the Project Area (**Appendix A, Figure 53**).
- The additional net indirect loss of groundwater from the Nogoia River alluvium within the study area to underlying strata due to the Project is considered negligible (**Appendix A, Section 6.4.4.1**).
- There is no leakage from the coal measures predicted to flow into the alluvium, for both the Approved Case and the Project (**Appendix A, Section 9**).
- Post mining, the groundwater levels will recover slowly based on 200-year recovery simulations. Some permanent reduction in water levels is predicted in the target coal seams (**Appendix A, Figure J-20**). However, as these are not used by any third-party user, this is not considered a significant impact.

A detailed assessment against the *Significant Impact Guidelines 1.3 - Coal seam gas and large coal mining developments – impacts on water resources* is provided in **Table 4**.

Therefore, it is considered unlikely that the Project would result directly or indirectly in a substantial change in the hydrology of groundwater resources.

Table 4 Assessment of Groundwater Resources - Hydrology

Guideline Section 5.3 An impact on the hydrological characteristics of a water resource may occur where there are, as a result of the action:	Assessment
Change in water quantity, including the timing of variations	No changes in the water quantity are predicted for the Nogoia River (Appendix A, Section 6.4.4.2) and the Nogoia River alluvium (Appendix A, Section 6.4.4.1). The water quantity in the coal seams is predicted to be impacted by dewatering for mining (Appendix A, Section 6.4.2). However, this water resource is not used by any third party as the alluvium and the coal seams have high salinity. Water use in the area, including environmental and other public outcomes, is mainly based on surface water supply.
Changes in the integrity of hydrological or hydrogeological connections, including substantial structural damage (e.g. large-scale subsidence)	Due to the nature of the proposed mining method, no large-scale subsidence is predicted, refer to Appendix A, Section 8.2 .
Changes in the area or extent of a water resource	No changes in the area or extent of a water resource are predicted. Specifically, there are no changes to the Nogoia River (Appendix A, Section 6.4.4.2) and the Nogoia River alluvium (Appendix A, Section 6.4.4.1)

5.3 Potential Changes in Water Quality of Groundwater Resources

The *Significant Impact Guidelines 1.3 - Coal seam gas and large coal mining developments – impacts on water resources* define a ‘substantial change’ in water quality as a change that:

“...would be sufficient to create a risk that, as a result of the action, the ability to achieve relevant local or regional water quality objectives would be materially compromised.”

The groundwater impact assessment (**Appendix A, Section 5.4.1**) found that groundwater quality is generally poor with salinity levels generally elevated above the relevant Guideline values for stock watering (ANZECC, 2000), for groundwater in the alluvium and coal seams.

The Project does not include any additional open voids or spoil emplacements, which could potentially impact the groundwater quality beyond the effects of approved mining. The Project is exclusively underground bord and pillar mining, leaving the excavated and dewatered underground voids in the coal body to recharge naturally over time. The inflowing water will have the same quality than the water previously stored in the coal.

As the Project would have no discernible impact on stream baseflows beyond the effects of approved mining (**Appendix A, Section 6.4.4.2**), it is unlikely to have an impact on water quality in the Nogoa River.

A detailed assessment against the *Significant Impact Guidelines 1.3 - Coal seam gas and large coal mining developments – impacts on water resources* is provided in **Table 5**.

Therefore, the Project could not be considered to have a significant impact on groundwater quality, beyond the effects of already approved mining.

Table 5 Assessment of Groundwater Resources - Water Quality

Guideline Section 5.4 A significant impact on a water resource may occur where, as a result of the action:	Assessment
There is a risk that the ability to achieve relevant local and regional water quality objectives would be materially compromised.	The Project does not include any additional open voids or spoil emplacements, which could potentially impact the groundwater quality beyond the effects of approved mining. The Project is exclusively underground bord and pillar mining, leaving the excavated and dewatered underground voids in the coal body to recharge naturally over time. The inflowing water will have the same quality than the water previously stored in the coal. As the Project would have no discernible impact on stream baseflows (Appendix A, Section 6.4.4.2), it is unlikely to have an impact on water quality in the Nogoa River.
There is a significant worsening of local water quality (where current local water quality is superior to local or regional water quality objectives.	Not applicable. The water quality is not superior to local or regional water quality objectives. Both the alluvium and the coal seams show high salinity (Appendix A, Section 5.4.1).
High quality water is released into an ecosystem which is adapted to a lower quality of water	Not applicable. Any water from mining would be released into Nogoa River, which has fresher water quality than the groundwater (Appendix A, Section 5.4.2 and Figure 22)

6.0 Other important considerations

6.1 Cumulative Impacts

The *Significant Impact Guidelines 1.3 - Coal seam gas and large coal mining developments – impacts on water resources* require the action to be “considered with other developments, whether past, present or reasonably foreseeable developments”.

The predictive numerical groundwater model for the Project (**Appendix A, Section 6**) included the approved Ensham open-cut mine, the approved underground mining and the Project. The impacts from the Project were calculated as incremental impacts from approved mining operations (open-cut and underground), refer to **Appendix A, Section 6.4**.

The cumulative impacts of other current or foreseeable developments that may have cumulative impacts with the Project were assessed qualitatively. There are several mines within a 50 km radius of the Project, none of them have been included in the groundwater model. However, a review of the combination of the target seams and distance concluded that there aren't any likely cumulative impacts expected from those mines (**Appendix A, Section 3.3.2**).

The impacts to surface water resources from the Project are negligible and are unlikely to have a greater impact on protected matters when considered together with other developments in the local and regional area.

6.2 Timing

The *Significant Impact Guidelines 1.3 - Coal seam gas and large coal mining developments – impacts on water resources* require an action to be assessed in the short-term and long-term, where long-term may be beyond the life of the action.

The groundwater model that was used to quantify the impacts of the action was set up to capture both short-term and long-term impacts. **Appendix A, Section 6.3.4** shows the temporal discretisation of the model. The active mining is modelled between 2020 and 2040, followed by a 220 year recovery period.

For surface water impacts, the potential for impacts occurs when there is likely to be a controlled discharge which may include during times of flooding and/or large rainfall events. The Project is unlikely to increase the frequency or volume of release events at Ensham Mine. Where absolutely required, controlled discharges to the Nogoia River are undertaken in accordance with the current EA which specifies the location, frequency and water quality limits of discharge events.

6.3 Scale

The *Significant Impact Guidelines 1.3 - Coal seam gas and large coal mining developments – impacts on water resources* require an action to be assessed on a local and regional scale.

The groundwater model that was used to quantify the impact of the action was set up large enough to capture regional processes (**Appendix A, Section 6.3.1**), such as the outcrop area of the coal seams. The model used an unstructured grid, which allowed to refine the modelling cells on a local scale.

The Nogoia River, its upstream and downstream catchment, its associated floodplain, and its tributaries have been considered as part of the existing mine assessments that have been reviewed as part of this self-assessment. Potential impacts at the local and regional scale must be managed to an acceptable level to meet compliance under the existing EA.

7.0 Conclusions

The Project is an extension of the previously approved underground mining operations at Ensham Mine. The additional impacts from the Project can be calculated by comparing the impacts from the approved mining operations and the Project. Only those additional impacts from the Project were considered when assessing the requirement for a referral.

It has been determined that there is no realistic possibility that the Project would directly or indirectly result in:

- a substantial change to the hydrology of a water resource; or
- a substantial change in water quality of a water resource.

The action is determined to be unlikely to have a significant impact on a water resource for the purposes of the EPBC Act beyond impacts from the currently approved operations. Ensham may still wish to refer the action to the department as a precautionary measure.

8.0 References

AECOM, 2020 - Ensham Life of Mine Extension Project – Matters of National Environmental Significance, 5 March 2020, Job No.: 60603371

ANZECC/ARMCANZ (2000) Australian and New Zealand guidelines for fresh and marine water quality. Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, 314 pp

DEWHA, 2013: Significant Impact Guidelines 1.1 – Matters of National Environmental Significance

DoE, 2013: Significant Impact Guidelines 1.3 - Coal seam gas and large coal mining developments – impacts on water resources

SLR, 2020: Ensham Life Of Mine Extension Project – Groundwater Impact Assessment, 27 February 2020, Ref: 665.ENS02.10000-R01 Rev A.

Appendix A

Groundwater Impact Assessment Report

Appendix A Groundwater Impact Assessment Report