# Central Queensland Coal Project

# Chapter 1 Proponent Response to IESC 2020-118 (EPBC 2016/7851) Advice to Decision Maker

Central Queensland Coal

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## Terms and Abbreviations

| | |
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| CQC | Central Queensland Coal Pty Ltd |
| DAWE | Australian Government Department of Agriculture, Water and the Environment |
| DES | Queensland Department of Environment and Science |
| EPBC Act | *Environment Protection and Biodiversity Conservation Act 1999* |
| FHA | Fish Habitat Area |
| GBR | Great Barrier Reef |
| GBRCMP | Great Barrier Reef Coast Marine Park |
| GBRMP | Great Barrier Reef Marine Park |
| GBRWHA | Great Barrier Reef World Heritage Area |
| GDE | Groundwater Dependent Ecosystem |
| GDEMMP | Groundwater Dependent Ecosystem Management and Monitoring Plan |
| IESC | the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development |
| MNES | Matters of National Environmental Significance |
| MSES | Matters of State Environmental Significance |
| QEOP | Queensland Environmental Offsets Policy |
| TARP | Trigger Action Response Plan |
| The Project | The Central Queensland Coal Project |
| REMP | Receiving Environment Monitoring Program |
| SEIS | Supplementary Environmental Impact Statement |
| SEIS v3 | Supplementary Environmental Impact Statement Version 3 |
| SSMP | Significant Species Management Plan |

# 1 Introduction and Purpose

On 27 October 2020, the Australian Government Department of Agriculture, Water and the Environment (DAWE) and the Queensland Department of Environment and Science (DES) (hereafter collectively referred to as the ‘requesting agencies’) requested that the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (the IESC) provide advice to them on the Central Queensland Coal Pty Ltd’s (CQC) and Fairway Coal Pty Ltd’s Central Queensland Coal Project in Queensland.

The requesting agencies had two specific questions as follows:

1. Question 1: Has the proponent considered and addressed the IESC’s previous advice and concerns (IESC 2018b-094 and IESC 2017-091):
   - Through the revised groundwater model and its predictions?
   - Relating to the risks and impacts to water resources and water-related assets, including Tooloombah Creek and Deep Creek, GDEs, fish habitat and the GBRWHA?
2. Question 2: Advice is sought on whether the measures and commitments proposed in the revised documentation are appropriate to effectively manage impacts to water resources and water related assets?

The IESC provides six responses to each of the aforementioned questions.

CQC considers that the 12 responses given demonstrate that the IESC have not given adequate, and in some cases no, regard to the documentation provided by CQC in the SEIS version 3.

As such, CQC have provided comments in response to the 12 responses given by the IESC in answer to the requesting agencies questions.

# 2 IESC comments and CQC responses

The 12 responses and corresponding CQC responses are detailed below.

### 2.1.1 IESC Response 1

1. The proponent has undertaken substantial further investigation and analyses in response to our previous advice (IESC 2018b). The IESC still has major concerns that the project presents very significant risks to nationally and internationally recognised assets with high ecological values, including the Great Barrier Reef World Heritage Area (GBRWHA) and the Broad Sound Fish Habitat Area downstream of the project. Other high-value environments which may be impacted by the project include Tooloombah Creek, Deep Creek, the Styx River estuary, and two state-listed wetlands.

#### 2.1.1.1 CQC Response

The SEIS v3 specifically investigated and further assessed potential risks to national and internationally recognised assets with high ecological values, specifically including the GBRWHA and Broad Sound FHA, as well as Tooloombah and Deep Creeks, the Styx River estuary and the two state-listed wetlands.

Based on detailed geochemical assessment (Appendix A3b, Chapter 8) which fed into water quality modelling work undertaken by WRM Water and Environment (Appendix 5b, Chapter 9), the water management system (designed by WRM Water and Environment from engineering design by CQC) was shown to *not* affect downstream water quality due to controlled and uncontrolled releases. Due to the proposed actions, sediment generation from the Project area will actually reduce due to various measures (including destocking, strengthening of riparian zones, and erosion and sediment controls on the site) (See Appendix 15b– Styx Catchment Sediment Budget). The geomorphological study conducted for the project (Appendix A5d) concluded that the overall risk of rapid and significant geomorphic change due to the proposed mining activity was negligible.

The assessment presented in the Flood Study and Water Balance in Appendix A5b and summarised in Section 9.6.2 of Chapter 9 – Surface Water has shown that there will be negligible reduction in flows within the creeks (and therefore the Styx River estuarine areas) as a result of the Project. The change in runoff volume in Tooloombah Creek is estimated at about 0.1% and in Deep Creek about 4%, with the number of flow days in these watercourses not impacted by the Project. Therefore, particularly considering the large tidal influence in the Styx River estuary, flow conditions in downstream estuarine areas will not change as a result of the Project.

In this regard, the ephemeral nature of the creeks and the current flow regimes will remain unchanged, and connectivity along the creek systems for aquatic fauna will not be affected. Downstream areas including the FHA will continue to be primarily influenced by the tidal regime of the Styx River estuary and the Broad Sound marine environment. Groundwater drawdown is not predicted to occur beneath the estuarine areas of the Styx River, and in fact does not extend to (or beyond) the Deep and Tooloombah Creek confluence, and therefore there will be no drawdown related impacts to downstream estuarine areas as a result of the Project (refer to Figure 10-66 and Section 10.5.1.2.2 in Chapter 10 – Groundwater).

> ***"The IESC still has major concerns that the project presents very significant risks to nationally and internationally recognised assets with high ecological values, including the***

***Great Barrier Reef World Heritage Area (GBRWHA) and the Broad Sound Fish Habitat Area downstream of the project."***

The SEIS specifically states that there will be no significant impact to any values in these areas. This is based on extensive work including in particular the water quality, streamflow, revised groundwater modelling (see further below), surface water – groundwater interactions, groundwater dependent ecosystem and aquatic ecology assessments within the SEIS, undertaken by reputable and experienced professionals in their fields. It is not clear upon which basis this assertion is made, as it does not reflect the impact assessment provided in the SEIS v3. The findings of the impact assessments in relation to these areas is summarised below. Given the findings of no significant impact to these areas, the IESC should state what their "major concerns" and the "very significant risks" are.

**Matters of National Environmental Significance (MNES)**

Significant impact assessments are required to be undertaken for MNES which may be impacted by the Project. The GBRWHA and the GBRMP are MNES. As such, significant impact assessments for the GBRWHA and GBRMP are provided in Section 16.10.4.5 of Chapter 16.

As described in Section 16.6.5 of Chapter 16, for any MNES considered known or likely to occur within the Project Site or Near Surrounds, or in the downstream environment, a significant impact assessment was undertaken in accordance with the following relevant guidelines:

- Matters of National Environmental Significance Significant Impact Guidelines 1.1 (DE 2013a)
- EPBC Act Policy Statement 3.21 – Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (DEE 2017)
- Significant impact guidelines 1.3: Coal seam gas and large coal mining developments – impacts on water resources (DE 2013b) and
- EPBC Act referral guidelines for the Outstanding Universal Value of the Great Barrier Reef World Heritage Area (DE 2014).

As outlined in the MNES Significant Impact Guidelines 1.1 (DE 2013a) an action is likely to have a significant impact on the World Heritage values of a declared World Heritage property if there is a real chance or possibility that it will cause:

- one or more of the World Heritage values to be lost
- one or more of the World Heritage values to be degraded or damaged or
- one or more of the World Heritage values to be notably altered, modified, obscured or diminished.

An assessment of the Project has been undertaken against the significant impact criteria applicable to the GBRWHA, and considering advice provided in EPBC Act referral guidelines for the Outstanding Universal Value of the Great Barrier Reef World Heritage Area (DE 2014). This assessment is presented in Table 16-71 of Chapter 16. The application of the Significant Impact Guidelines, consideration of the referral guidelines and the impact assessment presented in the preceding sections demonstrates that the Project will **not** result in a significant impact on the GBRWHA.

Significant impacts on the GBRMP are also assessed through the application of the MNES Significant Impact Guidelines 1.1 (DE 2013a). Assessment against the applicable criteria is provided in Table 16-72. As specified in Section 16.10.4.5, the Project is **not** expected to result in a significant impact to the GBRMP.

**Matters of State Environmental Significance (MSES)**

As specified in Section 15.6.3.5.1 of Chapter 15, the areas of the GBRCMP zoned Marine National Park or Conservation Park Zone are considered MSES. The entire Broad Sound FHA is also a MSES. As per the QEOP Significant Residual Impact Guidelines (DEHP 2014), works are considered to result in a significant residual impact to a highly protected zone of a marine park or a declared FHA if:

- the works are not for a specific purpose or structure as specified in the guidelines and
- the works will result in a residual disturbance footprint within the declared FHA and/or highly protected zone of a marine park of 40 $m^2$ or greater in area.

The Marine National Park zone is located approximately 33 km northeast of the Project (or 40 km downstream). The Broad Sound FHA boundary is located approximately 10 km downstream of the Project Site. The Project will **not** have a direct impact on a highly protected zone of the GBRCMP or Broad Sound FHA as it does **not** involve any direct disturbance within the boundary of these areas. The Project will **not** result in a residual disturbance footprint of 40 $m^2$ or greater, and the Project will **not** cause a significant residual impact on these MSES.

> ***"Other high-value environments which may be impacted by the project include Tooloombah Creek, Deep Creek, the Styx River estuary, and two state-listed wetlands."***

Substantial work has been undertaken to elucidate potential impacts to these areas and it is considered that the potential impacts to these area as a result of the project are well understood. These are discussed further blow with reference to each of the aforementioned areas.

> ***"Tooloombah Creek, Deep Creek"***

The assessments presented in the SEIS v3 have demonstrated that the environmental values associated with Tooloombah Creek will **not** be significantly impacted.

With reference to Deep Creek, groundwater drawdown could result in at least a 'Possible' likelihood of there being a 'Minor' impact on Terrestrial GDEs within three Deep Creek stream reaches. The area predicted to be potentially affected along Deep Creek consists of 165.23 ha of riparian vegetation. The effects are predicted to be a reduction in vegetation condition, and the vegetation is expected to remain in place to continue to provide for bank stability and other ecosystem services such as habitat connectivity, foraging and feeding resources for fauna species. However, due to the 'possible' 'minor' impact upon this vegetation, CQC has undertaken extensive work to provide an offsets package for the entire 165.23 ha.

**Water quality**

In both Tooloombah and Deep Creeks, changes to surface water quality as a result of Project releases are predicted to be negligible, with downstream water quality expected to remain within the range of natural variability (refer to Appendix A5b, as summarised in Section 9.6.1 of Chapter 9 – Surface Water and Section 9.6.5 of Chapter 9 – Surface Water). This is based on geochemistry, groundwater quality and surface water assessments, based on site specific data collected throughout the EIS process and substantially added to as part of the SEIS v3.

**Surface Water Hydrology**

Increases in flood levels in both creeks will generally be minor and flooding is mostly confined within the banks of Tooloombah and Deep creeks (as in the existing case).

Surface water modelling (see Chapter 9 – Surface Water) found that creeks will continue to flow during construction and operation of the Project, in a similar manner to existing baseline conditions. Local waterways are in a state of flow for approximately 24% of the time under current conditions, and this will not be affected by the Project. As flow conditions under the Project will remain the same as baseline conditions, there will be no obstruction to fish passage from the Project-related surface water changes in Deep or Tooloombah Creeks, nor will there be any changes to water quality of a magnitude that would affect fish passage (see Chapter 9 – Surface Water).

Two unnamed tributaries of Deep Creek mapped as moderate and low risk waterways for fish passage will be permanently removed through the establishment of Dam 1 and the mine pits, resulting in the permanent loss of aquatic habitat and riparian vegetation. An offset has been proposed for the removal of this waterway area providing fish passage, by way of a financial settlement offset in accordance with the QEOP. However, removal of this waterway will not have the effect of blocking fish passage, which will continue to be provided by way of catchment diversions around the mine area. This drainage will be reinstated to suit the final landform on closure and rehabilitation of the site.

**Groundwater inflows**

As discussed in Section 9.6.2.1 of Chapter 9 – Surface Water, an assessment of changes to flow within the streams as a result of a reduction in baseflow found the impact to be negligible, and that there would be no impact on the number of days that flow occurs in the receiving watercourses. One of the key reasons for this is that the creeks are currently highly ephemeral, and baseflows only occur for short durations. Groundwater does not provide a significant baseflow component. This is discussed further below under 'Pools'.

The assessment specifically concluded that the Project would **not** result in any changes to low or no flow days in any of the creek systems.

**Pools**

As discussed in Section 9.3.4.5 of Chapter 9 – Surface Water, some of the pools within Tooloombah Creek, and possibly in the lower reaches of Deep Creek, are potentially supported by groundwater that may be reduced due to Project related groundwater drawdown.

Modelling work was undertaken by ELA to investigate the mechanisms of groundwater-surface water interactions (refer to the Surface Water / Groundwater Interactions Report in Appendix A6d). The work undertaken by ELA drew upon the revised groundwater modelling and impact assessment (Appendix 6b), the revised flood study and water balance (Appendix 5b) as well as additional work undertaken by ELA and CQC (see Appendix 6d) – this specifically investigated the actual geology/lithology, hydrogeology, measured water levels, aquifer porosity and transmissivity and the like to determine local interactions. The finding of the aforementioned studies with reference to aquatic ecosystems are summarised in Chapter 15 - Aquatic and Marine Ecology. ELA concluded that in some locations Tooloombah Creek is groundwater fed, but primarily from bank storage[1] and this

[1] In the context of the SEIS v3 assessment, bank storage is a temporary source of groundwater stored within the banks of creeks or rivers which is derived from infiltration associated with flooding or rainfall. Water held in bank storage may be released to the adjacent creek or river over varying timescales following the recession of surface water levels. Water can also be held in bank storage for prolonged periods, where it may be accessed by Terrestrial GDEs. Bank storage is not primarily fed by groundwater that can be affected by the Project, but instead by flooding and rainfall events associated with the creek systems.

is evident particularly in the stretch adjacent to the Project site (refer to Chapter 15, but also to Section 9.3.4.5 of Chapter 9 – Surface Water). Deep Creek also feeds wet season and flood flows into bank storage, but due to differing geology, this is much lower in magnitude, and bank storage return flow may not reach the creek in some areas. In particular, they conclude that pools are unlikely to be sustained during the dry season in this area of Deep Creek, which is confirmed by extensive observations of pool persistence in the creeks.

As summarised in Section 10.3.7 of Chapter 10 – Groundwater, the available data (observed pools persistence, water quality data particularly EC and water level changes over time, lithological descriptions and groundwater levels in alluvial and regolith cross sections across the creeks) supports increasing persistence of pools moving downstream (i.e. downstream of the Project site) in Tooloombah Creek; the lack of persistence in Deep Creek (other than potentially downstream near the confluence); the primary source of baseflow to pools being bank flow return rather than the dry season water table, which is typically lower than the creek bed, and saline water sourced from seasonally elevated water tables – the exception to this is some highly localised pools where the Styx Coal Measures outcrop (particularly the pool identified at the location of the stream flow gauge).

Essentially, the assessments and the data above show that while seasonally elevated water tables recharge bank storage, which feeds back to the pools during part of the dry season, the water table declines typically to below the creek bed during the dry season, and so an unsaturated zone exists underneath most sections of the creeks. Therefore, direct drawdown impacts on the pools within both creeks are unlikely – i.e. since water table aquifers do not supply the creeks in the dry season directly, and since an unsaturated zone exists underneath the creeks (the water table is already below the base of the creeks), any further drawdown within the water table would not change this, and seepage would remain limited by the existing rate of infiltration from the creeks. Bank storage is primarily fed by flood and rainfall events associated with the creek systems.

WRM undertook an assessment of the impact to the Tooloombah Creek stream gauge pool of reducing the modelled groundwater inflow. This showed that reducing the groundwater inflow to zero, the pool would continue to contain water about 96% of the time, only drying out during major drought conditions. Further modelling assuming an enhanced leakage from the pool (by 9 kL/day), would result in the pool drying out 30% of the time. However, this may be conservatively high, given the sediments in these locations have a low permeability (reducing the potential for enhanced leakage), and also given the importance of bank storage within these systems, which is not accounted for in the modelling. As such, the actual impacts of groundwater drawdown as a result of the Project are expected to be much lower than predicted, and the pool would either remain perennial, or become semi-permanent, drying out during particularly dry periods.

The primary mode of impact would therefore be the lowering of the water table in proximity to the Project in the wet season, by lowering the regional groundwater levels, and reducing the height that the water table reaches. This could have the effect of reducing the amount of water that is supplied by seasonal rise in the underlying water tables, and in effect some bank recharge flow that would otherwise be held in bank storage may be lost to the water table aquifer, rather than returned to the creek. However, since the processes of bank flow storage and return are very local to each reach of the creeks, and given the highly permeable alluvium is patchy and discontinuous and does not extend to the pits, the overall effect may be quite small.

A reduction or elimination of groundwater inputs to the creek systems during dry periods may have the resultant effect of reducing the time over which some of the pools persist, however, this depends on the level of connectivity a given pool has with groundwater, and it is known that not all pools have this connection. Changes to the water chemistry of pools is also likely to occur in pools which receive a saline groundwater inflow (whether directly, or as a result of seasonally elevated saline water table inputs to the alluvial bank store), resulting in a more consistent salinity profile in the absence of saline groundwater inputs, which have a more pronounced effect on pool salinity in the dry season. Pools that have a connection to groundwater can be expected to retain their freshwater chemistry <1,500 µS/cm while they persist during the dry season in the event that saline groundwater inflows are reduced or cease as a result of the Project. Each pool is likely to be affected in a different way, as a function of its size (length, width and depth), habitat features and types of fauna it supports, amount of groundwater drawdown predicted to occur in its location, and the degree to which groundwater currently supports the pool under baseline conditions.

**Aquatic GDEs**

Chapter 15 – Aquatic and Marine Ecology assesses the potential impacts of the changes to groundwater flow regime on Aquatic Groundwater Dependent Ecosystems (GDEs) (i.e. ecosystems dependent on the surface expression of groundwater). Section 15.3.4 describes the existing Aquatic GDEs, Section 15.4.2 discusses the potential impacts to Aquatic GDEs, and Section 15.6.2 provides the impact assessment.

The impact assessment found that the impacts of groundwater drawdown on Aquatic GDEs is expected to be relatively minor because:

- Drawdown at Tooloombah Creek is relatively small (<4 m) and the sediments in these locations have a low permeability (reducing the potential for enhanced leakage).
- Bank storage at Tooloombah Creek is unlikely to be significantly affected by groundwater drawdown. This is because any downward movement of water held in bank storage is restricted by the impermeable layer of weathered clay underlying the alluvium of Tooloombah Creek.
- The persistence of bank storage and associated return flows to Tooloombah Creek are likely to provide safeguards to mitigate impacts on pool persistence from drawdown of the water table underneath the creek. Flows from bank storage were predicted to reach the creek for a period of approximately 150 days, even after drawdown from the Project.
- Permanent pools are likely to still persist most of the time, even under the worst-case scenario, with improvements in water quality (i.e. less variation in salinity), and pools further downstream towards the Deep and Tooloombah Creek confluence will not be affected and so will remain permanent.
- Most pools at Deep Creek are ephemeral and notwithstanding that an unsaturated zone exists under the creek during the dry season (so further lowering of water tables would have no effect), it was considered in the assessment that ephemeral pools could dry up more quickly and for longer than under existing conditions, especially in the middle reaches of Deep Creek. However, these pools experience a natural cycle of drying under existing baseline conditions, and the aquatic ecosystem is adapted to these cycles.
- Recolonisation of pools will occur naturally as it currently does under existing conditions following rainfall, once the creeks begin flowing again. Flow currently occurs approximately 24% of the time and will not be affected by the Project. In addition, aquatic fauna recorded in pools during field surveys are all common species considered typical of a Central Queensland coast catchment, so there will not be any impacts on threatened aquatic fauna.

- Groundwater drawdown is not predicted to occur beneath the Styx River and therefore loss of potential baseflow to Aquatic GDEs in downstream areas is not considered to be a potential impact of the Project.

Note that water will likely always remain in proximity to the Deep and Tooloombah Creek confluence, as this area is affected by peak tides, and is not affected by drawdown (refer to Figure 10-66 and Section 10.5.1.2.2 in Chapter 10 – Groundwater).

**Terrestrial GDEs**

The risk assessment shows that for all areas of Tooloombah Creek, any changes in vegetation as a result of groundwater drawdown are expected to be insignificant.

With reference to terrestrial GDEs along Deep Creek, the SEIS v3 concluded that groundwater drawdown could result in at least a 'Possible' likelihood of there being a 'Minor' impact on Terrestrial GDEs within three stream reaches. The area predicted to be potentially affected consists of 165.23 ha of riparian vegetation, comprising RE 11.3.25, RE 11.3.27, RE 11.3.35, and RE 11.3.4. These areas are proposed to be offset in accordance with State and Commonwealth policies, and substantial work has been undertaken to demonstrate that offsets for these areas are feasible.

The assessment demonstrates that impacts on vegetation as a result of groundwater drawdown are likely to vary in scale along the different stream reaches. For the majority of the 165 ha expected to be affected, impacts are likely to manifest as a gradual reduction in BioCondition scores, canopy cover and canopy height. In some areas vegetation may no longer meet the Regional Ecosystem description, however, will continue to provide ecosystem services, including minimising erosion and some fauna habitat, but with elevated weed cover.

Impacts can be expected to commence over timeframes of 10 to 20 years after commencement of the Project. Based on this assessment, the complete loss of vegetation and ecosystem services, including bank stability, is considered *highly unlikely to occur* at either Tooloombah or Deep Creek.

CQC will implement an adaptive management and monitoring program in areas that may be affected, aimed at increasing resilience of the vegetation communities through improved management of weeds and pests. In addition, the riparian corridors will be subject to revegetation to increase their width and to replace any loss of major structural elements of the vegetation community with alternative species that are not groundwater dependent. A Groundwater Dependent Ecosystem Management and Monitoring Plan (GDEMMP) has been prepared to guide these remediation, enhancement and monitoring actions (see Appendix 10e).

It is also important to note that the impact assessment for Terrestrial GDEs is considered to be a worst- case assessment for the following reasons:

- In identifying potential groundwater dependent RE, only areas with a groundwater level deeper than 15 mbgl were excluded from the assessment. This approach is considered to be conservative, as known depths to water table in published sources are generally reported as a maximum of 10 m for the vegetation species present within the Project Site (IESC 2018).
- It was assumed that the maximum EC of groundwater that may sustain terrestrial vegetation at the site is 10,000 µS/cm. Whereas, the upper soil salinity tolerance of key vegetation species present in the Project Area is generally equivalent to an EC of 4,000 to 8,000 µS/cm (DoA 2020).

Based on these conservative assumptions, it is possible that the area to be affected may be substantially less than 165.23 ha.

Hence it is possible that there will be a minor impact upon up to 165.23 ha of riparian vegetation along Deep Creek. These potential impacts will be offset in their entirety (i.e. offsets have been proposed for the 165.23 ha of riparian vegetation). The offsets have been devised in accordance with the EPBC Act Environmental Offsets Policy (DSEWPC 2012) and the Queensland Environmental Offsets Policy (Version 1.8; DES 2020). A key premise of offsetting, is that a net gain can compensate for a local loss. It is a specific requirement of the EPBC Act Environmental Offsets Policy that direct offsets provide a measurable conservation gain for an impacted protected matter.

In accordance with the ToR for the Project, offsets for impacted protected matters have been tailored specifically to the attribute of the protected matter that is impacted in order to deliver a conservation gain.

***"Styx River Estuary"***

There is no expected impact to the Styx River Estuary.

A number of assessments have been undertaken to consider the risks to downstream environments, including the Styx River Estuary, Broad Sound and the GBR, from changes to water quality (see the Sediment Loads Assessment in Appendix A15b, and Aquatic and Marine Ecology, GDE and GBR Impact Assessment in Appendix A10a). These assessments indicate that the risks to downstream environments from sediments and/or high concentrations of water quality parameters contained in controlled or uncontrolled releases from the mine are low.

In fact, with regards to sediment, using average climatic conditions, the sediment load assessment (contained in Appendix 15b) indicates that the Project will reduce the estimated baseline sediment generation rate of 5,037 t/year to approximately 2,297 t/year. This is primarily due to the water management and sediment and erosion control systems for the Project being designed such that sediment-laden water is captured and treated on site. Based on this assessment the Project will reduce the sediment load to the downstream environment by approximately 2,740 t/year. This equates to a reduction in the total Styx Basin sediment load of 2.74 % and a reduction in the total Fitzroy Basin sediment load of 0.15%.

Groundwater drawdown is not predicted to occur beneath the estuarine areas in the Styx River, and in fact does not extend to (or beyond) the Deep and Tooloombah Creek confluence, and therefore there will be no drawdown related impacts to downstream estuarine areas as a result of the Project (refer to Figure 10-66 and Section 10.5.1.2.2 in Chapter 10 – Groundwater).

The assessment presented in the Flood Study and Water Balance in Appendix A5b and summarised in Section 9.6.2 of Chapter 9 – Surface Water has shown that there will be negligible reduction in flows within the creeks (and therefore the Styx River estuarine areas) as a result of the Project. The change in runoff volume in Tooloombah Creek is estimated at about 0.1% and in Deep Creek about 4%, with the number of flow days in these watercourses not impacted by the Project. Therefore, flow conditions in downstream estuarine areas will not changes as a result of the Project.

In this regard, the ephemeral nature of the creeks and the current flow regimes will remain unchanged, and connectivity along the creek systems for aquatic fauna will not be affected. Downstream areas including the FHA will continue to be primarily influenced by the tidal regime of the Styx River estuary and the Broad Sound marine environment.

***"two state-listed wetlands."***

It is assumed that the IESC is referring to Wetland 1 and Wetland 2.

Wetland 1, as *Melaleuca viridiflora* utilises sub-surface groundwater, in the form of a perched aquifer. As *Melaleuca viridiflora* is a key component of the wetland, and its associated RE 11.3.12, the entire wetland is considered a Terrestrial GDE.

Wetland 2 is not a Terrestrial GDE as any aquifer located beneath Wetland 2 is deeper than 15 mbgl and beyond the reach of tree roots. Vegetation within Wetland 2, and Wetland 2 itself, is not a Terrestrial GDE.

Wetland 1 and Wetland 2 are not supported by the surface expression of groundwater and are therefore not Aquatic GDEs. Water and associated soil moisture at Wetland 1 and Wetland 2 are derived from surface water, rather than the surface expression of groundwater.

Wetland 1 is a GBR wetland of High Ecological Significance located in a GBR Wetland Protection Area. Wetland 2 is a wetland of General Ecological Significance and mapped on the vegetation management wetlands map under the VM Act.

The impact assessment presented in Section 15.6.1 of Chapter 15 describes the potential impacts to these areas and explains that there will be no impact to these areas as a result of mining operations.

Wetland 1 is also a MSES because it is both a wetland of HES and a wetland in a WPA. As such, a significant impact assessment for Wetland 1 was undertaken in accordance with the QEOP Significant Residual Impact Guidelines (DEHP 2014). A project is likely to have a significant residual impact on wetlands listed as MSES if it is likely that it will result in environmental values being affected as per the criteria listed in Table 15-10 of Chapter 15. The assessment demonstrates that the Project will not result in a significant residual impact on Wetland 1.

## 2.2 Groundwater model and predictions

### 2.2.1 IESC Response 2

2. Despite improvements to groundwater and GDE data and modelling, inherent uncertainties limit the reliability of groundwater predictions for drawdown, intrusion of seawater into aquifers, and alterations of fresh groundwater discharge to Tooloombah Creek and to the Styx River estuary. The large and mostly irreducible uncertainties in the timing, magnitude and spatial extent of predicted groundwater- related impacts confound assessment of the likely environmental impacts. Furthermore, trigger action response plans (TARPs) will be hampered by the timelags, potentially of several decades, for groundwater-related impacts to be detected. Lack of mitigation options means that the recent changes in project design are likely to be inadequate.

#### 2.2.1.1 CQC Response

***"inherent uncertainties limit the reliability of groundwater predictions for drawdown"***

The groundwater model has been substantially improved, and while improvements were identified by the peer reviewers (Appendix A6e), their overall finding was that the assessment and modelling work has "been carried out in a professional and rigorous manner that meets current industry standards. The modelling work has generally been completed in line with the Guiding Principles included in the Australian Groundwater Modelling Guidelines and in the IESC Uncertainty Analysis Guidance Note and we have not identified any fundamental flaws in the work which are likely to significantly effect model predictions". Therefore, the peer reviewers consider that the revised model is suitable to be used to assess the potential groundwater related impacts of the Project and it is unclear why the IESC asserts that "inherent uncertainties limit the reliability of groundwater predictions for drawdown".

Note that no amount of modelling will *eliminate* all uncertainty, which is why uncertainty analysis is required to be undertaken, and was conducted for the Project, with additional sensitivity assessment conducted to satisfy comments made by the peer reviewers during the staged peer review process. This led to the conclusion of the peer review that the model is suitable for predicting groundwater drawdown due to the Project (no ' fundamental flaws in the work which are likely to significantly effect model predictions').

***"intrusion of seawater into aquifers"***

The Project will not cause a mobilisation of the groundwater-saltwater interface.

Despite the salinity evident in some of the groundwater samples collected at the Project Site and surrounding areas, it has been determined that the salinity in the groundwaters intersected by the Project is derived from regional geochemistry, and not an oceanic saltwater. If any interface between oceanic saltwater and freshwater does exist within the groundwater in the vicinity of the Project, it will be hundreds of meters below sea level at the location of the pits, or beyond the extent of any drawdown influence from the Project, and would therefore not result in any movement of any interface between seawater and groundwater.

A detailed explanation of the reasoning for the above is provided in Section 10.3.6.7 of Chapter 10 – Groundwater. As discussed in Section 10.5.3 to Chapter 10 – Groundwater, the numerical groundwater modelling has also demonstrated that Project influence on groundwater flow directions diminishes to effectively nil at the Tooloombah – Deep Creek confluence, which is only 2.2km downstream of the Project, where the theoretical seawater interface surface would be below -280 mAHD, which is well beneath the predicted extent of drawdown. At the Ogmore bridge and WMP29 bore locations, both well outside the drawdown extent, and approximately 4km downstream of the Project, the theoretical fresh-seawater interface is still at least -40 to -80 mAHD. Any fresh-seawater interface at a shallower depth closer to the coast is well beyond the influence of the drawdown zone and any influence of the Project on groundwater flow direction.

In assessing this issue, CQC has drawn upon a large number of sampling bores and events (21 sites at 30 rounds each, and a further 30 sites drilled in 2018 and sampled 8 times), covering the full spectrum of hydrostratigraphic units. However, the nested bores nearer to the coast discussed in more detail in Section 10.5.3 to Chapter 10 (WMP29A-E) provides sample data demonstrating the lack of a freshwater-seawater interface, from the surface alluvium down to the Permian Back Creek Group.

HydroAlgorithmics (Appendix A6c) undertook a review of available groundwater quality datasets, and found there is no idealistic freshwater-saline groundwater interface evident, which they concluded is not unexpected given the geological and geomorphological history of the region, confirming the above findings.

***"alterations of fresh groundwater discharge to Tooloombah Creek and to the Styx River estuary."***

As discussed in Section 9.6.2.1 of Chapter 9 – Surface Water, an assessment of changes to flow within the streams as a result of a reduction in baseflow found the impact to be negligible, and that there would be no impact on the number of days that flow occurs in the receiving watercourses.

Groundwater drawdown is not predicted to occur beneath the estuarine areas in the Styx River, and in fact does not extend to (or beyond) the Deep and Tooloombah Creek confluence, and therefore there will be no drawdown related impacts to downstream estuarine areas as a result of the Project (refer to Figure 10-66 and Section 10.5.1.2.2 in Chapter 10 – Groundwater).

As mentioned above, bank storage is a mechanism by which is delivered to the creeks, in some locations. Seasonally elevated water tables recharge bank storage, which feeds back to the pools during part of the dry season, the water table declines typically to below the creek bed during the dry season, and so an unsaturated zone exists underneath most sections of the creeks. Therefore, direct drawdown impacts on the pools within both creeks are unlikely – i.e. since water table aquifers do not supply the creeks in the dry season directly, and since an unsaturated zone exists underneath the creeks (the water table is already below the base of the creeks), any further drawdown within the water table would not change this, and seepage would remain limited by the existing rate of infiltration from the creeks.

WRM undertook an assessment of the impact to the Tooloombah Creek stream gauge pool of reducing the modelled groundwater inflow. This showed that reducing the groundwater inflow to zero, the pool would continue to contain water about 96% of the time, only drying out during major drought conditions. Further modelling assuming an enhanced leakage from the pool (by 9 kL/day), would result in the pool drying out 30% of the time. However, this may be conservatively high, given the sediments in these locations have a low permeability (reducing the potential for enhanced leakage), and also given the importance of bank storage within these systems, which is not accounted for in the modelling. As such, the actual impacts of groundwater drawdown as a result of the Project are expected to be much lower than predicted, and the pool would either remain perennial, or become semi-permanent, drying out during particularly dry periods.

The primary mode of impact would therefore be the lowering of the water table in proximity to the Project in the wet season, by lowering the regional groundwater levels, and reducing the height that the water table reaches. This could have the effect of reducing the amount of water that is supplied by seasonal rise in the underlying water tables, and in effect some bank recharge flow that would otherwise be held in bank storage may be lost to the water table aquifer, rather than returned to the creek. However, since the processes of bank flow storage and return are very local to each reach of the creeks, and the highly permeable alluvium patchy and discontinuous, the overall effect may be quite small.

A reduction or elimination of groundwater inputs to the creek systems during dry periods may have the resultant effect of reducing the time over which some of the pools persist, however, this depends on the level of connectivity a given pool has with groundwater, and it is known that not all pools have this connection. Changes to the water chemistry of pools is also likely to occur in pools which receive a saline groundwater inflow (whether directly, or as a result of seasonally elevated saline water table inputs to the alluvial bank store), resulting in a more consistent salinity profile in the absence of saline groundwater inputs, which have a more pronounced effect on pool salinity in the dry season. Pools that have a connection to groundwater can be expected to retain their freshwater chemistry <1,500 µS/cm while they persist during the dry season in the event that saline groundwater inflows are reduced or cease as a result of the Project. Each pool is likely to be affected in a different way, as a function of its size (length, width and depth), habitat features and types of fauna it supports, amount of groundwater drawdown predicted to occur in its location, and the degree to which groundwater currently supports the pool under baseline conditions.

Therefore, there may be some alteration of discharge via bank storage to some areas of the creeks during the dry season. However, the impact assessment found that the impacts of groundwater drawdown on the environmental values and Aquatic GDEs within the creeks is expected to be relatively minor because:

- Drawdown at Tooloombah Creek is relatively small (<4 m) and the sediments in these locations have a low permeability (reducing the potential for enhanced leakage).
- Bank storage at Tooloombah Creek is unlikely to be significantly affected by groundwater drawdown. This is because any downward movement of water held in bank storage is restricted by the impermeable layer of weathered clay underlying the alluvium of Tooloombah Creek.
- The persistence of bank storage and associated return flows to Tooloombah Creek are likely to provide safeguards to mitigate impacts on pool persistence from drawdown of the water table underneath the creek. Flows from bank storage were predicted to reach the creek for a period of approximately 150 days, even after drawdown from the Project.
- Permanent pools are likely to still persist most of the time, even under the worst-case scenario, with improvements in water quality (i.e. less variation in salinity), and pools further downstream towards the Deep and Tooloombah Creek confluence will not be affected and so will remain permanent.
- Most pools at Deep Creek are ephemeral and notwithstanding that an unsaturated zone exists under the creek during the dry season (so further lowering of water tables would have no effect), it was considered in the assessment that ephemeral pools could dry up more quickly and for longer than under existing conditions, especially in the middle reaches of Deep Creek. However, these pools experience a natural cycle of drying under existing baseline conditions, and the aquatic ecosystem is adapted to these cycles.
- Recolonisation of pools will occur naturally as it currently does under existing conditions following rainfall, once the creeks begin flowing again. Flow currently occurs approximately 24% of the time and will not be affected by the Project. In addition, aquatic fauna recorded in pools during field surveys are all common species considered typical of a Central Queensland coast catchment, so there will not be any impacts on threatened aquatic fauna.
- Groundwater drawdown is not predicted to occur beneath the Styx River and therefore loss of potential baseflow to Aquatic GDEs in downstream areas is not considered to be a potential impact of the Project.

Note that water will likely always remain in proximity to the Deep and Tooloombah Creek confluence, as this area is affected by peak tides, and is not affected by drawdown (refer to Figure 10-66 and Section 10.5.1.2.2 in Chapter 10 – Groundwater).

> ***"The large and mostly irreducible uncertainties in the timing, magnitude and spatial extent of predicted groundwater- related impacts confound assessment of the likely environmental impacts."***

A stated above, it is unclear what the basis of this assertion by the IESC is, as the peer reviewer has concluded that the revised model is suitable to be used to assess the potential groundwater related impacts of the Project. The overall finding of the peer review was that the assessment and modelling work has "been carried out in a professional and rigorous manner that meets current industry standards. The modelling work has generally been completed in line with the Guiding Principles included in the Australian Groundwater Modelling Guidelines and in the IESC Uncertainty Analysis

Guidance Note and we have not identified any fundamental flaws in the work which are likely to significantly effect model predictions".

The conclusion of the peer review was that the model is suitable for predicting groundwater drawdown due to the Project (no 'fundamental flaws in the work which are likely to significantly effect model predictions'). This provides for entirely appropriate predictions of the timing, magnitude and spatial extent of predicted groundwater-related impacts.

The additional work particularly associated with surface water – groundwater interactions and groundwater dependent ecosystems (refer to comments in above sections) allow for a good understanding of potential impacts.

> ***"Furthermore, trigger action response plans (TARPs) will be hampered by the timelags, potentially of several decades, for groundwater-related impacts to be detected. Lack of mitigation options means that the recent changes in project design are likely to be inadequate."***

Unless the IESC is referring to the possible changes to Terrestrial GDEs along three stream reaches of Deep Creek (which can be expected to commence 10 to 20 years after commencement of the Project), it is not understood why the IESC believes timelags of several decades would result between any detection of change and mitigation measures being undertaken. TARPs provided in the SEIS v3 allow for an adaptive approach to monitoring and responses, and the Before-After-Control-Impact (BACI) style monitoring program coupled with the multiple lines of evidence and weight of evidence approach (after the Australian and New Zealand Guidelines for Fresh and Marine Water Quality framework, ANZG 2018) has been specifically developed to detect change as a result of the project, with changes detected as they occur.

Given the frequency and timeframes of monitoring, changes would be expected to be detectable immediately for groundwater drawdown and water management system releases, with larger changes in ecological processes and water quality detectable over perhaps a year (in order to have confidence in measured trends – refer ANZG 2018). Smaller changes may take longer to detect, but the causative impacting processes will be detectable as they occur, and so mitigation measures will be employable immediately. As noted in the SEIS however, impacts to downstream environments are not anticipated (refer to all above responses).

Regarding the abovementioned 'possible' 'minor' changes to Terrestrial GDEs along Deep Creek, ongoing management and monitoring of vegetation health, weed presence and riparian zone integrity will ensure that this system retains its fundamental ecosystem processes. Any changes would be gradual, detectable and able to be managed and mitigated before any substantial deleterious changes occur. As noted in earlier sections of this response, CQC will implement an adaptive management and monitoring program in areas that may be affected, aimed at increasing the resilience of the vegetation communities through improved management of weeds and pests. In addition, the riparian corridors will be subject to revegetation to increase their width and to replace any loss of major structural elements of the vegetation community with alternative species that are not groundwater dependent. A Groundwater Dependent Ecosystem Management and Monitoring Plan (GDEMMP) has been prepared to guide these remediation, enhancement and monitoring actions (see Appendix 10e).

### 2.2.2 IESC Response 3

3. The independent peer review of the groundwater model recommended revisiting the history matching and uncertainty quantification of the groundwater model. The IESC agrees with the model shortcomings identified by the reviewer (AGE 2020, Appendix 6E), and also notes:
   a. inadequacies in the improved model, both in terms of the inability to fit all historical measurements (e.g. Figures 7-10a-c, Hydro Algorithmics 2020), and of the high levels of parameter non-uniqueness (e.g. Attachment 16, Hydro Algorithmics 2020);
   b. the lack of observed head differences in nested monitoring facilities and estimated baseflows at the Tooloombah Creek and Deep Creek gauges within the history matching dataset which exacerbates the uncertainty of some simulated predictions;
   c. the incomplete representation of all uncertain model parameters and boundary conditions within the uncertainty analysis such as the riverbed conductance parameters and the coastal boundary conditions, including along the Styx River mouth. This is likely to underestimate prediction uncertainties, hampering reliable risk assessment of the project;
   d. the incomplete representation of potential model prediction structural error in the uncertainty analysis;
   e. the lack of long-term pump testing to provide a more laterally extensive estimate of the integrated hydraulic properties of the aquifer (Central Queensland Coal 2020, Chapter 11, p. 47);
   f. that the risk of aquifer seawater intrusion has not been quantified or characterised to a sufficiently high resolution, given the six delineated hydrolithologic units at the coastal boundary;
   g. the uncertainty of the simulated potential impact of climate change which also does not account for the model parameter and boundary condition uncertainties listed above;
   h. the hydraulic conductivity of the backfilled material was modelled (using time-varying material properties) with a higher hydraulic conductivity compared to the undisturbed material (Hydro Algorithmics 2020, Table 8-2, p. 164). However, it is not clear if the modelled hydraulic conductivity of the emplaced spoil decreases over time (due to consolidation) and how this compaction will affect the predicted long-term groundwater mounding of the final landform; and,
   i. no information was provided on the reinjection methods and quality of the mine-affected water reinjected into groundwater.

#### 2.2.2.1 Proponent Response

This is misleading as it focusses on the negative aspects of the staged review process but fails to acknowledge that these issues were raised during the model development process, and considered during the staged peer review process undertaken by the Australasian Groundwater and Environmental Consultants' (AGE) principal hydrogeologist and principal groundwater modeller. The concluding statement of the peer review taking all of this into account is that the assessment and modelling work has **"been carried out in a professional and rigorous manner that meets current industry standards. The modelling work has generally been completed in line with the Guiding Principles included in the Australian Groundwater Modelling Guidelines and in the IESC Uncertainty Analysis Guidance Note and we have not identified any fundamental flaws in the work which are likely to significantly effect model predictions".**

While the peer reviewers did find issues with various elements of the model, those mentioned above were either worked through successfully as part of the staged approach to the model development (resulting in peer reviews conducted over four stages), or were determined to be improvements recommended to be adopted in the first model review – i.e. no fundamental flaws were identified, and model outputs are considered suitable to predict timing and extent of drawdown.

Moreover, the peer review identified that the modelling met the requirements as laid out in the IESC Uncertainty Analysis Guidance Note, other than the following two items:

- Checklist Item 3 – development of models commensurate with the overall risk context
  - This relates to the development of integrated surface and groundwater models; however, these were developed and extensive assessment was conducted by EcoLogical Australia (refer Appendices A6d, A10a, A10d) with the data and assessments summarised in Section 10.3.7 of Chapter 10 – Groundwater. The peer review related to the numerical groundwater model and the determination of extent and timing of drawdown as a result of the Project and did not consider the Surface Water / Ground Water Interactions modelling.
- Checklist Item 5 – has the calibration minimised non-uniqueness
  - The peer reviewers note this limitation, and that this has been addressed to some extent through completion of additional sensitivity analysis runs. They concluded that the model was suitable to provide predictions for the SEIS, and recommended refinement of the model in the first model review, 3 years after mining commences. However, CQC have committed to refining the model *prior* to mining commencing (following approval), including updating and refining the surface-groundwater interactions modelling and overall conceptual modelling.

A summary of the model development process is provided in Chapter 10 – Groundwater of the SEIS v3, particularly Section 10.2.4, with surface water – groundwater interactions work described in Section 10.2.5. Further summary of the uncertainty analysis is provided in Section 10.5.5 of Chapter 10, and is detailed within the Numerical Groundwater Model and Groundwater Assessment Report in Appendix A6b.

A short response to the other items listed by the IESC is provided below:

- In relation to the lack of long term pump testing, representative site-specific data for hydraulic properties has been collected through aquifer testing conducted for the previous EIS and SEIS's and core permeability testwork (see Appendix A6g) as described in Section 5.6 of the Groundwater Model and Assessment Report in Appendix A6b. This data, combined with literature review and prior modelling work, has been tested as part of the Uncertainty Analysis.
- Different stage heights (i.e. water depths) within Tooloombah Creek and enhanced and reduced riverbed conductance values were explicitly explored in the sensitivity testing
- The risk of seawater intrusion has been described in the above sections of this response and is detailed in Section 10.3.6.7 of Chapter 10 – Groundwater (none likely).
- Climate change has been explicitly included in the uncertainty analysis, by way of reduced and increased rainfall (±20%), and the downstream tidal boundary condition range (sensitivity range of 2 – 4.5 mAHD) (refer to summary in Section 10.5.5 of Chapter 10 – Groundwater, and Sections 8.11.5, particularly page 185 below the table and page 186 (Sea Level Rise Predictions), and 8.11.3 of the HydroAlgorithmics 2020 report).
- Uncertainty in coastal boundary conditions were incorporated into this sensitivity testing.

- The Time-varying Material (TVM) approach was used to represent a change from pre-mining conditions to backfill conditions, but with the effect of changed properties accounted for – a key weakness identified in the previous modelling (for the SEIS v2). Ongoing consolidation is not accounted for, however this is consistent with common modelling approaches and meets the peer review suggestion for its use (as well as being accepted by the peer review).
- No reinjection of mine affected water is proposed.

## 2.3 Risks and impacts to water resources and water-related assets

### 2.3.1 IESC Response 4

4. The proponent predicts that reductions in surface water hydrology and water quality are expected to result in negligible to minor impacts to ecological values. However, the IESC has limited confidence in these predictions (refer to Paragraph 2 and 6) because changes to surface water hydrology and water quality are likely to affect the persistence of GDEs in the areas where additional mitigation measures are likely to be required (refer to Paragraph 12). This concern was also highlighted in the previous IESC advice (IESC 2018b, Paragraph 19).

#### 2.3.1.1 Proponent Response

It is unclear why the IESC has “limited confidence in these predictions” and it does not follow that because changes could affect GDE persistence, that the predictions themselves therefore have limited confidence. It is also erroneous to state that the SEIS v3 predicted reductions in water quality as a result of the Project.

The predictions set out in the SEIS v3 are derived from extensive assessments that have found negligible changes to both the hydrology and water quality of receiving waters, undertaken by WRM Water and Environment (Appendix A5b) and EcoLogical Australia (Appendices A6d, A10a, A10d) with the data and assessments summarised in Section 10.3.7 of Chapter 10 – Groundwater. WRM stated that there would be no impact on the number of days that flow occurs in the receiving watercourses, and that downstream water quality will remain within the range of natural variability even with the addition of the modelled Project releases.

Changes in surface water hydrology and water quality are related to persistence of some pools during extreme dry conditions, where some existing permanent pools (one in particular near the stream gauge) could possibly change from permanent to semi-permanent, and with removal of saline groundwater inflows, water quality could be expected to become fresher. However, it was not predicted that this would have significant impacts on the persistence of GDEs nor on aquatic ecosystems, due to the existing highly ephemeral nature of these systems, which will not change as a result of the Project, and the fact that tidally affected waters nearer to the Deep and Tooloombah Creek confluence will remain unimpacted by the Project.

Impacts to Aquatic and Terrestrial GDEs are discussed in the response to IESC Response 1 (Section 2.1.1.1), which states that impacts are related to groundwater drawdown rather than surface water processes, but that regardless, impacts are relatively minor to insignificant.

The key findings in relation to surface water hydrology and water quality are summarised below.

Tooloombah and Deep Creek are ephemeral and only flow for 24% of the time. Therefore, for 76% of the time there is no influence of Tooloombah or Deep Creek which could affect the tidal limit of the downstream environment. The amount of flow days will not change as a result of Project operations (see Section 9.6.2.1 of Chapter 9 – Surface Water). Downstream areas will continue to be primarily influenced by the tidal regime of the Styx River estuary and Broad Sound marine environment.

Furthermore, minimum dilution ratio for controlled releases, for low flows in the receiving watercourse, is 5 (i.e. receiving water flow is 5 times release flow), increasing to a range of 30 to 80 for higher receiving water flow rates. The impacts of mine water releases on receiving water quality have been assessed in detail (see section 8.4.10 of the Flood Study and Water Balance in Appendix A5b), concluding that downstream water quality will remain within the range of natural variability with the modelled Project releases. The assessment of water quality impacts and management measures includes the impacts of uncontrolled spills that may occur during significant wet weather events.

As such, there are no predictions of any significant changes to surface water hydrology or water quality, which in turn are not expected to affect the persistence of GDEs, so the IESC should explain why they believe that "changes to surface water hydrology and water quality are likely to affect the persistence of GDEs in the areas where additional mitigation measures are likely to be required".

## 2.4 Coal Conveyor

### 2.4.1 IESC Response 5

5. The coal conveyor near Deep Creek will be a constant source of coal dust into the waterway, posing serious risks to water quality and other water-related assets. These risks are particularly severe during the low-flow period in the dry season when dilution effects are minimal.

#### 2.4.1.1 Proponent Response

This statement is incorrect as it fails to recognise that the coal conveyor has been relocated specifically to avoid any impact or interaction with Deep Creek. The relocation of the conveyor is described in Section 16.4.8 of Chapter 16, and Section 3.6.4.3.10 of Chapter 3 (in response to the DAWE comments on SEIS v2). Specifically, the conveyor is now located at least 550 m west along the Bruce Highway from Deep Creek (at its closest extent) – See Figure 2-1 below. The relocation arose to address comments from DAWE in regards to potential flooding of the conveyor. Concerns about coal dust from the conveyor entering Deep Creek have not previously been raised by DAWE or DES.

Section 3.6.4.3.10 of Chapter 3 states:

"The proposed coal conveyor is located outside the Deep Creek main channel flood extent for the 0.1% AEP flood event. An excavated underpass will be required to cross the Bruce Highway. The design of the underpass will ensure no interaction with floodwaters. The conveyor will traverse some areas of the Deep Creek floodplain that are subject to shallow inundation (up to about 1 m) during major flood events. The conveyor can be designed to avoid interaction with floodwaters by elevating the conveyor above flood level.'

The portion of the conveyor on the northern side of the Bruce Highway has been repositioned out of the extent of the 0.1% AEP flood event as can be seen in Figure 9-40 Chapter 9 – Surface Water. This flooding is the worst case scenario. The portion of conveyor in the shallow inundation of the floodplain will be raised above the level of the flooding and will be enclosed as shown in Figure 16-16 of Chapter 16 - Matters of National Environmental Significance."

As such, given that the conveyor will be immune to a flood event with an average recurrence interval of 1000 years (i.e. 0.1% AEP) and the life of the conveyor will be less than 15 years, it is considered highly unlikely that the conveyor would be flooded during mine operation. Therefore the risks to the downstream environment from flooding of the conveyor are negligible. In any event, the operations of the conveyor will not occur during flood event of equal to or greater than Q10 (10%).

With reference to the potential for coal dust from the conveyor, CQC make the following points:

- The conveyor is at least 550 m distant from Deep Creek.
- As specified in section 16.4.8, as the conveyor will not be required until 2030, the design of the culvert and conveyor arrangement has not been finalised. As such, how can the IESC assert that the conveyor "will be a constant source of coal dust into the waterway, posing serious risks to water quality and other water-related assets" when the design is unknown?
- Furthermore, it is anticipated that the conveyor will be constructed and maintained to the same standards as those that exist at ship loadout facilities at coal export terminals such as RG Tanna, Dalrymple Bay Coal Terminal, Hay Point Coal Terminal and Abbott Point, all of which are located close to water sources and contiguous with the GBRWHA. In line with practices at these coal export facilities, the water content of the coal on the conveyor will be between 11 and 16% and, as such, will not emit coal dust.
- If emissions of coal dust from conveyors to Deep Creek is a concern CQC suggests that this can be addressed via conditions requiring the conveyor to be designed, constructed and maintained to the standards required at the aforementioned coal terminals.

It is also worth noting that coal does naturally occur in the waterways around the Project area, due to the (naturally occurring) outcropping of the coal seam within Tooloombah Creek as evidenced by Appendix 6d – Surface Water/Groundwater Interactions Report particularly Figure 17 and section 4.4.2. A photo is included below as Figure 2-2 showing the outcrop during a period when the creek is dry. Given that the conveyor will be well away from interaction with Deep Creek and will not be running in flood events, it is considered that it poses a minimal threat to water quality as compared with the naturally occurring outcropping of the coal seam within Tooloombah Creek.

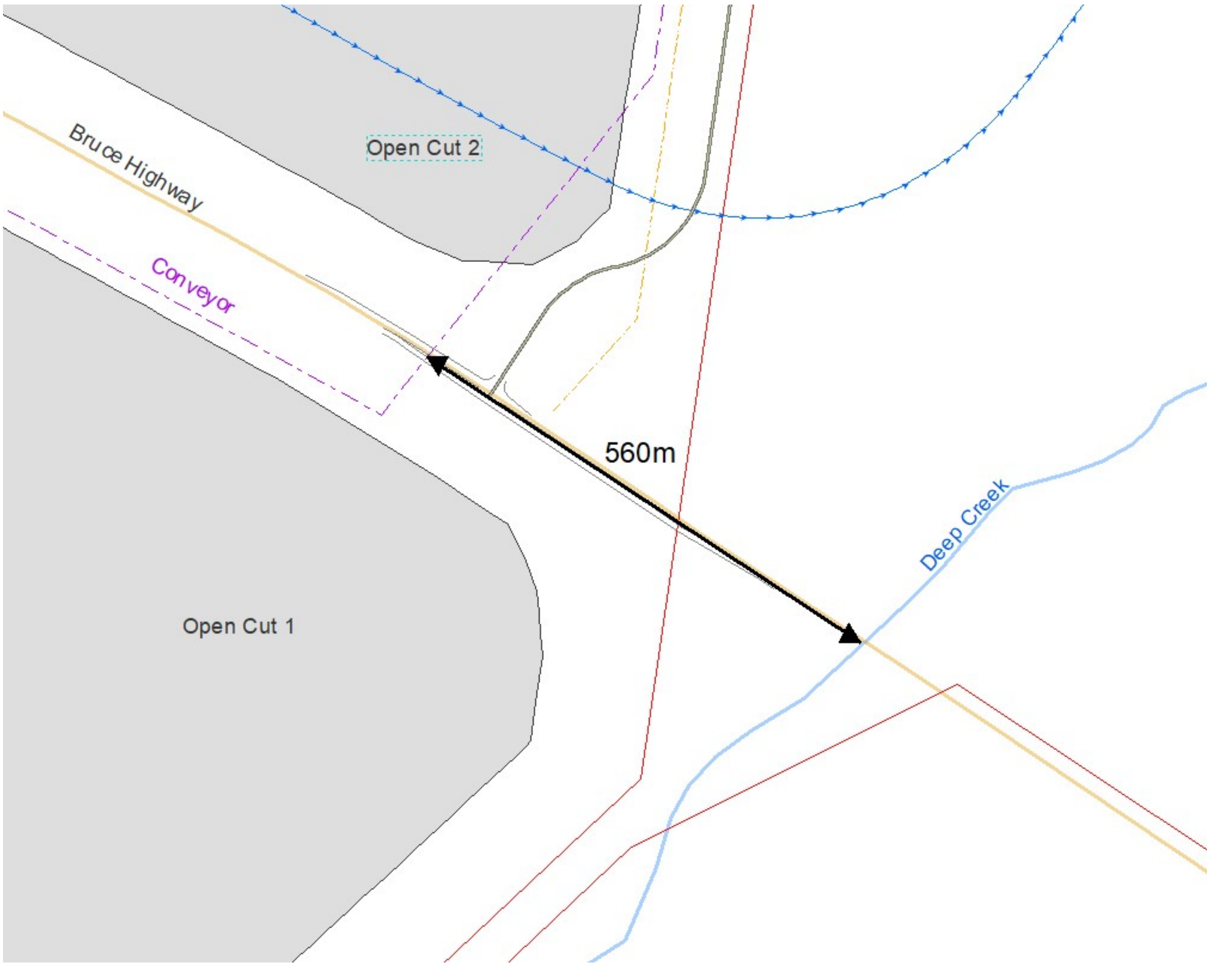


**Figure 2-1: Distance between coal conveyor and Deep Creek**

**Figure 2-2: Naturally occurring coal seam outcrop in Tooloombah Creek**

### 2.4.2 IESC Response 6

6. Assessment of groundwater dependence (3d Environmental 2020) indicated that some vegetation at Wetland 1, Forest Red Gums (*Eucalyptus tereticornis*) along Tooloombah Creek, and Forest Red Gums and Weeping Paperbarks (*Melaleuca fluviatilis*) along Deep Creek are GDEs. Drawdown, enhanced leakage and decreases in bank storage are predicted to increase the numbers of low-flow and no-flow days in several pools along Tooloombah and Deep creeks, and impact on the condition of vegetation, particularly along Deep Creek (Eco Logical Australia 2020, pp. 21, 40, 59–61, 93–96). Site surveys recorded Greater Gliders (*Petauroides volans*) and Koalas (*Phascolarctos cinereus*), particularly in areas containing Forest Red Gums, taller trees or trees with hollows. Damage to or loss of this vegetation due to groundwater drawdown is likely to impact these two species, both listed by the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) as Vulnerable, as well as other arboreal native wildlife. Other

predicted impacts of mine-associated drawdown on the three types of GDEs in the project area include:

a. loss of stygofauna habitat from the Styx River alluvium around the mine, and isolation of stygofaunal communities upslope of the mine from downstream ones;
b. complete drying or declines in volumes of permanent pools along Tooloombah and Deep creeks during the dry season, compromising their ecological roles as aquatic refuges (Paragraph 10) and overall aquatic habitat connectivity;
c. reductions in baseflow, potentially affecting ecologically important components of the streamflow regime (e.g. number of low-flow days) which may adversely affect stream and riparian biota; and,
d. impacts on the water quality of surface water and groundwater associated with drawdown of up to 60 m beneath Deep Creek.

#### 2.4.2.1 Proponent Response

> ***Assessment of groundwater dependence (3d Environmental 2020) indicated that some vegetation at Wetland 1, Forest Red Gums (Eucalyptus tereticornis) along Tooloombah Creek, and Forest Red Gums and Weeping Paperbarks (Melaleuca fluviatilis) along Deep Creek are GDEs. Drawdown, enhanced leakage and decreases in bank storage are predicted to increase the numbers of low-flow and no-flow days in several pools along Tooloombah and Deep creeks, and impact on the condition of vegetation, particularly along Deep Creek (Eco Logical Australia 2020, pp. 21, 40, 59–61, 93–96).***

The assessment specifically concluded that the Project would **not** result in any changes to low flow or no flow days in any of the creek systems. Instead, the assessment has found that some specific pools may reduce their persistence as a result of the project, although the predictions indicate that removal of groundwater bank inflows to pools completely would have the effect of the pool drying out only during major drought conditions (a reduction of permanent to containing water 96% of the time – refer to Appendix A5b).

ELAs work on aquatic ecological systems found that recolonisation of pools will occur naturally as it currently does under existing conditions following rainfall, once the creeks begin flowing again. Flow currently occurs approximately 24% of the time and will not be affected by the Project. Aquatic fauna recorded in pools during field surveys are all common species considered typical of a Central Queensland coast catchment.

> ***Site surveys recorded Greater Gliders (*****Petauroides volans*****) and Koalas (*****Phascolarctos cinereus*****), particularly in areas containing Forest Red Gums, taller trees or trees with hollows. Damage to or loss of this vegetation due to groundwater drawdown is likely to impact these two species, both listed by the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) as Vulnerable, as well as other arboreal native wildlife.***

It is unclear what point the IESC is trying to make with this statement. These impacts are assessed and specified in the SEIS v3. The IESC fails to mention that, in accordance with the EPBC Act Environmental Offsets Policy, environmental offsets have been proposed to compensate for the residual adverse impacts of the Project. These have been proposed for both of the aforementioned fauna species, as well as for the squatter pigeon (southern) (*Geophaps scripta scripta*) and the vegetation communities predicted to be affected along Deep Creek.

It is important to note that the impact assessment for Terrestrial GDEs, which concludes that there is a 'possible' 'minor' impact to the GDE vegetation communities along three stream reaches of Deep Creek, is considered to be a worst- case assessment for the following reasons:

- In identifying potential groundwater dependent RE, only areas with a groundwater level deeper than 15 mbgl were excluded from the assessment. This approach is considered to be conservative, as known depths to water table in published sources are generally reported as a maximum of 10 m for the vegetation species present within the Project Site (IESC 2018).
- It was assumed that the maximum EC of groundwater that may sustain terrestrial vegetation at the site is 10,000 µS/cm. Whereas, the upper soil salinity tolerance of key vegetation species present in the Project Area is generally equivalent to an EC of 4,000 to 8,000 µS/cm (DoA 2020).

Based on these conservative assumptions, it is possible that the area to be affected may be substantially less than 165.23 ha. In addition, the vegetation is not anticipated to be completely lost, and will continue to provide ecosystem services, including minimising erosion and some fauna habitat, however, microhabitat features for fauna, such as hollows, may become limited. However, the entire 165.23 ha is proposed to be offset.

CQC has prepared a Biodiversity Offset Strategy to provide a detailed account of how the Project's anticipated offset requirements will be acquitted and CQC's approach to delivering these offsets. The Biodiversity Offset Strategy is included in Appendix 11a. Details of the proposed offsets for the unavoidable significant residual impacts on greater glider, koala and squatter pigeon habitat are also summarised in Section 16.13 of Chapter 16.

Section 6.5 of the Biodiversity Offset Strategy (Appendix 11a) demonstrates how the offsets meets the key overarching requirements of the EPBC Act Environmental Offsets Policy (DSEWPC 2012)) and the Queensland Environmental Offsets Policy (Version 1.8; DES 2020).

Furthermore, these potential impacts will be mitigated and managed through the implementation of a range of actions outlined in the Project's EMP and relevant sub-plans. The plans of particular importance for impacts of the Project on greater glider, squatter pigeon and koala habitat are the Draft Significant Species Management Plan (SSMP, see Appendix 9e) and the Draft Groundwater Dependent Ecosystem Management and Monitoring Plan (GDEMMP) (see Appendix 10e).

The purpose of the Draft SSMP is to reduce the environmental impacts of the Project on listed species and their habitat, through the development of mitigation and monitoring measures for implementation prior to construction, during construction, during operations and as part of the decommissioning process.

The Draft GDEMMP describes the mitigation and monitoring measures that will be implemented to manage the impacts of the Project on GDEs. A series of triggers and corrective actions have been developed for each GDE, including Terrestrial GDEs, to facilitate an assessment of the impacts of the Project during various development stages, and to inform an assessment of the suitability of mitigation measures to manage impacts. An adaptive management approach will be implemented, with the results of monitoring relevant indicators for each GDE informing the ongoing re-evaluation of Project impacts and associated mitigation measures.

As part of the GDEMMP, the potential impacts of groundwater drawdown on riparian vegetation along Deep Creek will be mitigated through the implementation of a revegetation program with the aim of building ecological resilience. Revegetation will include expansion of the existing riparian corridor by a width of 10 m. A revegetation program will be designed to ensure the planting of drought tolerant species of similar ecological function as those with the potential to be impacted. This will ensure that existing habitat for terrestrial species is maintained, as well as reducing the potential for consequential impacts such as erosion and sedimentation which may be associated with vegetation loss. The revegetation program will be implemented from Project commencement ensuring sufficient timeframes for establishment of vegetation, given potential impacts are not expected to commence until at least 10 years after Project commencement.

### 2.4.3 IESC Response 7

7. The proponent's measures and commitments to monitor impacts to water resources and water related assets are generally appropriate, although several deficiencies are noted (Paragraph 8). However, the IESC remains extremely concerned that residual impacts (after amendments to the mine layout to minimise direct disturbance, the proposed destocking to reduce sediment inputs, and the riparian zone revegetation to partially compensate for impacts to groundwater-dependent vegetation) can only be mitigated by offsetting and/or financial remuneration. The IESC believes that these mitigation options are very unlikely to adequately compensate for the predicted impacts of the project on many highly valued water resources in this greenfield context, including downstream assets such as the Broad Sound Fish Habitat Area and Great Barrier Reef World Heritage Area. As noted previously, the IESC cannot envisage feasible mitigation measures, including offsets, that could safeguard these irreplaceable and internationally significant ecological assets and their associated water resources.

#### 2.4.3.1 Proponent Response

> ***"The proponent's measures and commitments to monitor impacts to water resources and water related assets are generally appropriate, although several deficiencies are noted (Paragraph 8)."***

Refer to the proponent response to IESC response 8, below.

> ***"However, the IESC remains extremely concerned that residual impacts (after amendments to the mine layout to minimise direct disturbance, the proposed destocking to reduce sediment inputs, and the riparian zone revegetation to partially compensate for impacts to groundwater-dependent vegetation) can only be mitigated by offsetting and/or financial remuneration."***

This comment implies that this is an unacceptable proposition, however, it is entirely acceptable, and in accordance with State and Commonwealth Government policies for a proponent to propose offsets for unavoidable significant residual impacts.

Considerable work has been undertaken on offsets and CQC has prepared a Biodiversity Offset Strategy to provide a detailed account of how the Project's anticipated offset requirements will be acquitted and CQC's approach to delivering these offsets. The Biodiversity Offset Strategy is included in Appendix 11a.

Section 6.5 of the Biodiversity Offset Strategy (Appendix 11a) demonstrates how the offsets meets the key overarching requirements of the EPBC Act Environmental Offsets Policy (DSEWPC 2012) and the Queensland Environmental Offsets Policy (Version 1.8; DES 2020).

Note also that the improvement to riparian zones is not proposed solely to provide 'partial compensation' for impacts to GDEs, but to maintain ongoing and long term stability and integrity of the riparian zone in proximity to the Project, providing a number of key improvements to the currently degraded nature of the existing riparian zone.

> ***"The IESC believes that these mitigation options are very unlikely to adequately compensate for the predicted impacts of the project on many highly valued water resources in this greenfield context, including downstream assets such as the Broad Sound Fish Habitat Area and Great Barrier Reef World Heritage Area. As noted previously, the IESC cannot envisage feasible mitigation measures, including offsets, that could safeguard these irreplaceable and internationally significant ecological assets and their associated water resources."***

It is unclear what the IESC are referring to here as there are **not** "predicted impacts of the project on **many** highly valued water resources in this greenfield context, including downstream assets such as the Broad Sound Fish Habitat Area and Great Barrier Reef World Heritage Area". The IESC should state what they believe the impacts to these areas are and why they believe they will occur.

While 'possible' minor' impacts are predicted to up to 165 ha of riparian vegetation along Deep Creek (which, it must be noted, is based upon conservative assumptions and is proposed to be offset in its entirely), there are **no** predicted significant impacts to **any** area downstream of the Styx River confluence, including the Broad Sound Fish Habitat Area and the Great Barrier Reef World Heritage Area. This assertion in based on impact assessments of these areas in accordance with State and Commonwealth guidelines (see Proponent response to EISC response 1, above for more information), based on substantial works by WRM Water and Environment (Appendix A5b) and EcoLogical Australia (Appendices A6d, A10a, A10d).

Hence, given there is no impact to any area downstream of the Project area, and that offsets, in accordance with State and Commonwealth offset policies, are proposed for significant residual impacts that may occur within and immediately adjacent to the project area, there is no need to "safeguard these irreplaceable and internationally significant ecological assets and their associated water resources" above and beyond what is already proposed within the SEIS v3.

### 2.4.4 IESC Response 8

8. The proposed monitoring has the following deficiencies:
    a. inadequate description of post-closure monitoring;
    b. lack of clear differentiation in the draft GDEMMP between reference or impacted sites for proposed monitoring of groundwater; and,
    c. lack of monitoring bores between the mine and the mapped fault.

#### 2.4.4.1 Proponent Response

These items are not considered fundamental flaws and further monitoring requirements can be adopted as required to address perceived deficiencies – these are easily rectifiable and conditionable.

> ***a. "inadequate description of post-closure monitoring;"***

Post-closure monitoring will be specified and approved under the Progressive Rehabilitation and Closure Plan (PRCP) required for the Project prior to works commencing on-site, and are described within Chapter 11 – Rehabilitation – of the SEIS v3. Indicators and success / completion criteria are described in Section 11.11 and monitoring and measurement in Section 11.12 of Chapter 11. CQC considers this an acceptable approach to finalising the post-closure monitoring requirements in line with the rehabilitation and closure requirements under the Queensland *Environmental Protection Act 1994.*

**b.** ***"lack of clear differentiation in the draft GDEMMP between reference or impacted sites for proposed monitoring of groundwater;"***

While an explicit listing and grouping of sites into control / reference sites and impact sites is not provided within the GDEMMP (other than for surface water sites), the monitoring describes sampling of groundwater bores for stygofauna; and water and sediment quality, aquatic ecology assessments and pool surveys at existing surface water sites. These sites reference the programs within the groundwater monitoring program (Appendix C10 within the draft EMP, which is Appendix 12 of the SEIS v3) and the draft REMP (Appendix A10f to the SEIS v3). Groundwater bores are potentially impacted within the zone of drawdown, but are considered along a gradient from impact (near pits) to unimpacted (far from the pits). Surface water sites are described in the REMP in terms of control / reference sites and potentially impacted sites.

Selection of control and impact sites are described in the GDEMMP for GDE vegetation (refer Section 5.4.3), with the specific locations to be defined during the pre-impact period, but based on existing baseline sites, with locations within, on the fringe of, and outside of predicted impact areas. It is envisaged that additional control sites would be sought during the post approvals baseline monitoring period to provide for control sites outside the predicted drawdown area.

To make this clear, Figure 5-4 from the GDEMMP has been annotated to show the predicted groundwater drawdown extent, and reference surface water sites are circled red, shown in Figure 2-3.

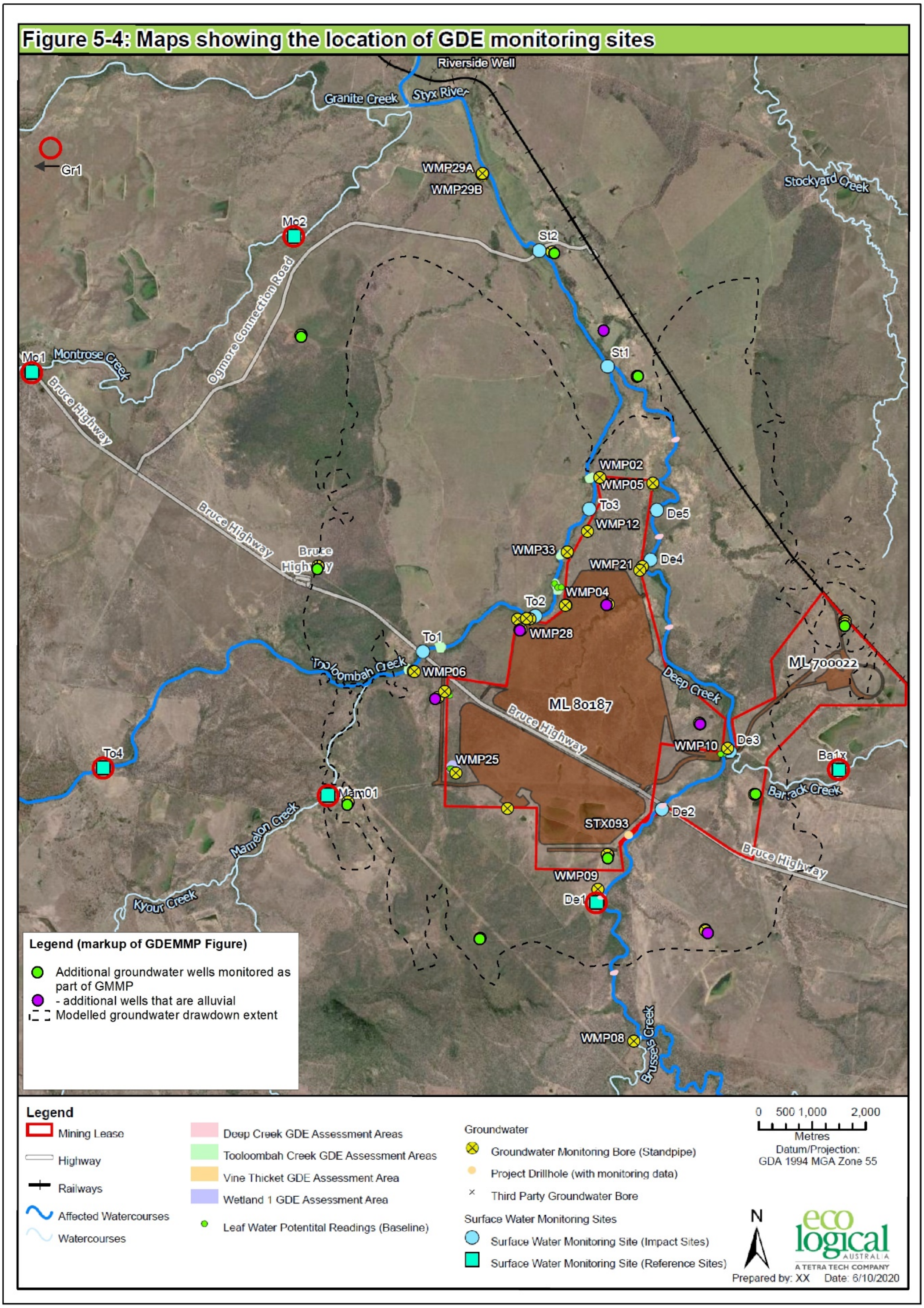


**Figure 2-3. Annotated GDEMMP Figure 5-4**

c. ***"lack of monitoring bores between the mine and the mapped fault."***

As mentioned in Chapter 5 – Land, Section 5.3.3.2, recent drilling demonstrated that the post-depositional high angle reverse fault located to the East of the CQC project, in which sediments of Styx Coal Measures (on the west) are faulted against the Permian Boomer Formation (on the east) coincides in part with Deep Creek channel.

Moreover, the Surface Water/Groundwater Interactions Report (Appendix 6d) states that Permian sedimentary rocks of the Back Creek Group were intersected in shallow drill holes located on the eastern side of Deep Creek, while Styx Coal Measures were intersected a short distance away in shallow drill holes near the western bank (Figure 15 – Appendix 6d).

Water monitoring bores WMP18, WMP18D, WMP10, WMP10D, and WMP32 intersected sediments of Styx Coal Measures – this means that they are located on the western side of the fault. Whereas WMP31 and WMP31B intersected the Permian Boomer Formation on the east side of the fault.

Based on the above facts, CQC concludes that the fault delineated by DNRME (Geological Mappping, Marlborough 1:100.000, DNRME, 2018) needs to be extended further to the south of its current boundary on a south-eastern direction.

Consequently, water monitoring bores WMP18, WMP18D, WMP10, WMP10D, and WMP32 have been located between the mine and the fault, even though that the fault is not mapped in that specific area by the current official geological map.

### 2.4.5 IESC Response 9

9. The proponent's modification of the mine plan to backfill both final voids has reduced but not eliminated potential environmental impacts post-closure. However, the physical and geochemical characteristics of the materials that are placed in the final voids could provide a long-term source of contaminants that could gradually leach and mobilise through groundwater flow. The risks posed by potential contaminant transport from the final landform have not been assessed. In particular, the impact of redox cycling on the long-term mobility and bioavailability of arsenic, selenium and aluminium (elevated in the spoil) to sensitive receptors has not been considered.

#### 2.4.5.1 Proponent Response

The risks of long term mobilisation of contaminants has been addressed through the geochemical assessment which included static and dynamic leachate testing, as well as whole element minerology. The geochemistry of the spoil was assessed by RGS Environmental (Appendix A3b), who determined that leachate from bulk mine waste materials exposed to oxidising conditions would have a pH in the range 8.5 to 9.5; a low to moderate salinity; very low acidity (with net positive alkalinity); be dominated by sodium, chloride and sulfate ions, with very low calcium, magnesium and potassium; low sulfate (compared to ANZG default guideline values); and low metal / metalloid concentrations, with the exception of aluminium, arsenic, molybdenum and selenium, and to a lesser extent zinc and vanadium, in some of the samples. The Groundwater Model and Assessment Report in Appendix A6b, as summarised in Section 10.5.2 of Chapter 10 – Groundwater, concludes that no deleterious effect in terms of water quality from waste rock and rejects would occur to groundwater.

### 2.4.6 IESC Response 10

10. The current proposed commitment to the monitoring and mitigation does not adequately consider:
    a. sediment monitoring to establish baseline data prior to clearing of the site and mine development, followed by ongoing sediment monitoring at the Dam 1 release point or if any uncontrolled releases occur;
    b. seasonal sampling of sediment-laden flows and characterisation of the entrained sediments (e.g. particle size and chemical composition) to assess impacts to ecological processes; and
    c. geomorphic monitoring which also targets areas that are listed as high-risk instability.

#### 2.4.6.1 Proponent Response

Apart from suspended solids (which was an oversight that can be easily rectified), the monitoring approach to all the aforementioned items has been summarised in Section 9.7.7 of Chapter 9 – Surface Water.

> ***"sediment monitoring to establish baseline data prior to clearing of the site and mine development, followed by ongoing sediment monitoring at the Dam 1 release point or if any uncontrolled releases occur"***

Sediment monitoring was explicitly included in the monitoring program – both monitoring of turbidity in dams and creek and river sediments up and downstream from the Project, including pre-operations to set a baseline. Geomorphic monitoring has also been explicitly included that focuses on areas listed as high-risk instability.

> ***"seasonal sampling of sediment-laden flows and characterisation of the entrained sediments (e.g. particle size and chemical composition) to assess impacts to ecological processes"***

The physico-chemical suite identified in Table 9-19 however did not include suspended solids – this was an oversight and will be included (and regardless can be conditioned as part of the approval).

> ***"geomorphic monitoring which also targets areas that are listed as high-risk instability."***

Geomorphic monitoring has also been explicitly included that focuses on areas listed as high-risk instability.

The IESC should specify which aspects of the aforementioned work they considered inadequate.

### 2.4.7 IESC Response 11

11. The proponent acknowledges that there will be a 'high' risk that stygofauna will be lost from the area of impact around the mine, and that communities upslope of the mine will be isolated from downstream communities (Central Queensland Coal 2020, App. A10a, p. 47). The proposed mitigation measure is to 'apply an adaptive monitoring approach through the GDEMMP, involving the monitoring of groundwater and stygofauna in the alluvium'. However, this monitoring approach will not mitigate the impacts, nor will it ensure post-mining recovery.

#### 2.4.7.1 Proponent Response

Page 47 of Appendix 10a is reproduced below. As can be seen, the full context reads "Stygofauna will be lost from the area of impact around the mine, and communities upslope of the mine will be isolated from downstream communities. It is the lower reaches of the Styx alluvium, and areas adjacent to the main creeks where stygofauna diversity is likely to be highest. Any taxa living in the area modelled for drawdown are likely to also occur in the downstream reaches."

Subterranean fauna are an important issue in Environmental Impact Assessment because a high proportion of subterranean species have geographically restricted ranges (short range endemism).

Context regarding this is given in Section 15.3.4.3 of Chapter 15 which reads:

"Stygofauna were collected from bores intersecting the alluvium near the Styx River during baseline studies, but are likely to occur more broadly than the points of collection. The Styx River alluvium extends south from the collection bores, through ML 80187, and further south for another 12 km. This makes it unlikely that the stygofauna taxa sampled as part of the Project investigations are short range endemics."

The significant impact assessment for stygofauna (Section 15.6.2.1 of Chapter 15) concludes that:

"Overall, impacts on stygofauna are considered to be acceptable, as they will result in the localised loss of assemblages that are likely to be well represented in adjacent areas. Extensive monitoring of GDEs including stygofauna will be undertaken as part of the adaptive management approach outlined in the GDEMMP. Stygofauna sampling will occur ahead of groundwater drawdown occurring, targeting the upper freshwater sections of aquifers. Samples will also be collected from locations outside of groundwater drawdown areas to understand stygofauna distribution patterns across the broader Styx River basin."

As such, overall, the impacts on stygofauna are considered to be acceptable, as they will result in the localised loss of assemblages that are likely to be well represented in adjacent areas and are unlikely to be short range endemics.

Table 6-2: Risk assessment for Subterranean GDEs

| Mechanism of change | Potential impacts | Likelihood of occurrence | Consequence rating | Risk assessment rating | Proposed mitigation measures | Residual risk |
|---|---|---|---|---|---|---|
| Drawdown in alluvium from aquifer dewatering, resulting in direct disturbance to stygofauna habitat | Stygofauna will be lost from the area of impact around the mine, and communities upslope of the mine will be isolated from downstream communities. It is the lower reaches of the Styx alluvium, and areas adjacent to the main creeks where stygofauna diversity is likely to be highest. Any taxa living in the area modelled for drawdown are likely to also occur in the downstream reaches. | Likely | Moderate | High | Project design to minimise the area of water table aquifer drawdown.<br>Apply an adaptive monitoring approach through the GDEMMP, involving the monitoring of groundwater and stygofauna in the alluvium. Target shallow bores that sample fresh groundwater overlying saline deeper water. | Medium |
| Depressurisation of lower aquifers causing change in groundwater flux and direction | Changes in the volume and quality of alluvium groundwater caused by depressurisation of deeper aquifers, which could impact stygofauna communities | Unlikely | Minor | Low | As above for aquifer ecosystems | Low |
| Alteration of recharge patterns for water table aquifers | Reduced infiltration from rainfall at impermeable surfaces such as roads, and an increase in infiltration along creeks during periods of drawdown. | Possible | Minor | Medium | Project design to minimise the area where water will be captured and not infiltrate to the creeks.<br>Minimal enhanced leakage estimated from the regional groundwater model (HydroAlgorithmics 2020). | Low |
| Leachate from waste rock stockpiles percolating into aquifers | Leachates could percolate into aquifer, then into creeks. Change to water quality post-mining. | Possible | Moderate | High | Proper sealing of stockpile base and bunding | Low |
| Seepage from storage dams | Local changes to groundwater quality around dam | Unlikely | Minor | Low | Dam design to reduce the risk of seepage, including use of low permeability clay as a | Low |

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**Figure 2-4: Page 47 of Appendix 10a**

### 2.4.8 IESC Response 12

12. Potential impacts of the mine, especially via mine-affected water, on ecological processes and species downstream, including within the Styx River estuary, the Broad Sound Fish Habitat Area and the GBRWHA are poorly understood. Consequently, mitigation and rehabilitation options have not been outlined in detail should environmental impacts occur (including catastrophic events such as the unintentional release of mine-affected water during severe weather events). Mitigation measures proposed as part of trigger action response plans to protect these sensitive environments are inadequate and are unlikely to protect these values because of the timelags (at least several decades) between detection of impacts and responses.

#### 2.4.8.1 Proponent Response

> ***"Potential impacts of the mine, especially via mine-affected water, on ecological processes and species downstream, including within the Styx River estuary, the Broad Sound Fish Habitat Area and the GBRWHA are poorly understood. "***

A substantial body of work has been completed relating to potential impacts of the mine especially via mine-affected water, on ecological processes and species downstream of the Project, finding that the Project would not result in any changes to low or no flow days in any of the creek systems and would result in negligible changes to downstream water quality. The water management system was designed and assessed based on 100 years of climatic conditions, including extreme events. As such, it is unclear why the IESC believes the "potential impacts of the mine, especially via mine-affected water, on ecological processes and species downstream, including within the Styx River estuary, the

Broad Sound Fish Habitat Area and the GBRWHA are poorly understood". The IESC should specify which elements they believe are "poorly understood" and why.

> ***"Consequently, mitigation and rehabilitation options have not been outlined in detail should environmental impacts occur (including catastrophic events such as the unintentional release of mine-affected water during severe weather events). Mitigation measures proposed as part of trigger action response plans to protect these sensitive environments are inadequate and are unlikely to protect these values because of the timelags (at least several decades) between detection of impacts and responses."***

The monitoring programs have been designed to assess and detect changes throughout the life of the Project, including tracking the development of groundwater drawdown in real-time (both through sampling visits to bores and loggers, monitoring water quality within dams, receiving waters and for any and all releases (large and small), and vegetation health assessments, including of GDEs. The slowest responses will be related to vegetation changes, however the causative impacting processes will be understood as they occur. Where they meet the predictions outlined in the SEIS v3, the impacts would be as expected in the SEIS v3. Where they do not, mitigation measures can be implemented quickly rather than waiting 'at least several decades'.

Mitigation measures outlined in the TARPs and the SEIS v3 more generally include (but are not limited to):

- Inter-dam transfers to manage water on the site (including containment of mine affected water)
- Changes to operating conditions, to reduce inflows (e.g. reduction in groundwater pumping from pits, changes to pumping capacity if required)
- Changes to water management operating rules and infrastructure
- Erosion and sediment control, including the draft ESCP and updates committed to in the SEIS, which includes an adaptive management strategy
- Spill control measures and procedures
- Rectification of leaks where identified
- Cessation of works causing potential high-risk contamination
- Development of remedial action plans – this may include for impacts to pools persistence engineering controls such as impermeable barriers to protect bank storage pathways from alluvial aquifers
- Make good arrangements
- Emergency Response Plan including pre-wet season and pre-storm preparedness.

In addition to the above, CQC has committed to a detailed waste rock characterisation process to plan, design and implement a stable landform both during and post-mining, using existing data and augmented with additional sampling and testwork. Substantial work has been completed to ensure that waste rock and the water management system can function without causing environmental harm.

Unless the IESC is referring to the abovementioned changes to riparian Terrestrial GDEs (for which changes are not predicted to commence until 10 years after commencement of mining), it is not understood why the IESC believes timelags of several decades would result between any detection of change and mitigation measures being undertaken. The TARPs provided in the SEIS, particularly those in the Draft Water Management Plan (Appendix A5c), allow for an adaptive approach to monitoring and responses, and the Before-After-Control-Impact (BACI) style monitoring program coupled with the multiple lines of evidence and weight of evidence approach after the Australian and New Zealand Guidelines for Fresh and Marine Water Quality framework (ANZG 2018) has been specifically developed to detect change as a result of the project, with changes detected as they occur (refer to Chapter 9 – Surface Water, and the Draft Receiving Environment Monitoring Program (REMP) in Appendix A10f).

Given the frequency and timeframes of monitoring, changes would be expected to be detectable immediately for groundwater drawdown and water management system releases, with larger changes in ecological processes and water quality detectable over perhaps a year (in order to have confidence in measured trends – refer ANZG 2018). Smaller changes may take longer to detect, but the causative impacting processes will be detectable as they occur, and so mitigation measures will be employable immediately. As noted in the SEIS however, impacts to downstream environments are not anticipated (refer to all above responses).

# 3 References

[excludes references contained in the IESC response comments which can be found in the IESC 2020-118 (EPBC 2016/7851) Advice to Decision Maker]

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