

Appendix D

Aquatic ecology technical memo



19 August 2022

Technical Memo: Meandu Mine Transmission Line Relocation, Aquatic Ecology Assessment

1 Introduction

The existing Feeder 831 is a 275kV transmission line between the Tarong and Middle Ridge substations owned and operated by Powerlink Queensland (Powerlink). It is located immediately to the east of Meandu Mine, which is owned and operated by TEC Coal Pty Ltd (TEC Coal), a wholly owned subsidiary of Stanwell Corporation Limited (Stanwell). A portion (approximately 5 km) of the Feeder 831 transmission line is proposed to be relocated (the Project). Relocation of this portion of Feeder 831 is required to safely accommodate proposed mining activities at the Meandu Mine, which requires that a section of land underneath this line is mined. Stanwell are also investigating an additional surface area to Meandu Mine within this locality, referred to as the King 2 East (K2E) Project. Planning for relocation of the portion of the transmission line has been undertaken with consideration of the K2E Project. The preferred alignment of the proposed Project is located within the Upper Brisbane River sub-basin and the Barker and Barambah Creeks sub-basin of the Burnett River Basin (Figure 1.1).

1.1 Scope of Works

This technical memo has been prepared by Ecological Service Professionals (ESP) for WSP Australia Pty Limited (WSP) on behalf of Powerlink. It provides an aquatic ecology constraints assessment for the Project.

A desktop review was completed to summarise the known environmental values (EVs), surface water quality and aquatic biological communities of waterways and wetlands in the vicinity of the Project. Baseline information available from the area was used to describe and assess the relevant waterways, specifically sources included:

- K2E Project: Surface Water Quality and Aquatic Ecology (ESP 2021), which includes comprehensive water quality and aquatic ecology surveys for waterways in the Brisbane River sub-basin and a summary of previous assessment and monitoring programs completed for Meandu Mine and Tarong and Tarong North power stations (Tarong power stations) in the Barker and Barambah Creeks sub-basin, as well as a stygofauna pilot study.

- Environmental Investigation Report – Meandu Mine (ESP 2018), including a water, sediment, aquatic habitat, macroinvertebrate, plant and fish survey in the Barker and Barambah Creeks sub-basin.

Sites previously surveyed for in these assessments for are shown in Figure 1.2.

A field survey was also completed by ESP in June 2019, at seven sites located on a sub-set of mapped waterway crossings and unmapped dams along the easement within the Brisbane River sub-basin. At each site, photographs were taken and habitat assessments were completed, including observations of:

- features of the water body, including bank height, estimate of flow, estimated width, and depth of any standing water present
- aquatic plants (cover, growth form and species)
- details of the riparian zone (e.g. width, canopy height and species present) and adjacent land use
- details of surrounding land use and disturbance, and how it may be impacting on aquatic habitat and communities
- aquatic habitat types present and their relative percent cover within the reach
- channel characteristics (e.g. description of beds and banks, channel width and gradient), and
- details of the types of sediment present (e.g. relative percent cover of different grain sizes, presence of anoxic sediments).

Aquatic habitat assessment site locations are detailed in Table 1 and shown in Figure 1.2.

Table 1 Aquatic habitat sites assessed during the field survey in June 2019

Site	Description	Latitude	Longitude
TL1	Located on a mapped tributary of Rocky Creek within the easement	-26.8079°	151.9323°
TLD1	Located on an unmapped dam in the Rocky Creek catchment immediately adjacent to the easement	-26.8142°	151.9320°
TL3	Located on a mapped tributary of Rocky Creek within the easement	-26.8156°	151.9319°
TL4	Located on a mapped tributary of Rocky Creek within the easement	-26.8221°	151.9313°
TLD2	Located on an unmapped dam in the Rocky Creek catchment within the easement, adjacent to site TL4	-26.8224°	151.9312°
TL5	Located on a mapped tributary of Rocky Creek 30 m north-west of the current easement (on the previous alignment)	-26.8268°	151.9303°
TL6	Located on a mapped tributary of Rocky Creek 80 m north-west of the current easement (on the previous alignment)	-26.8285°	151.9277°

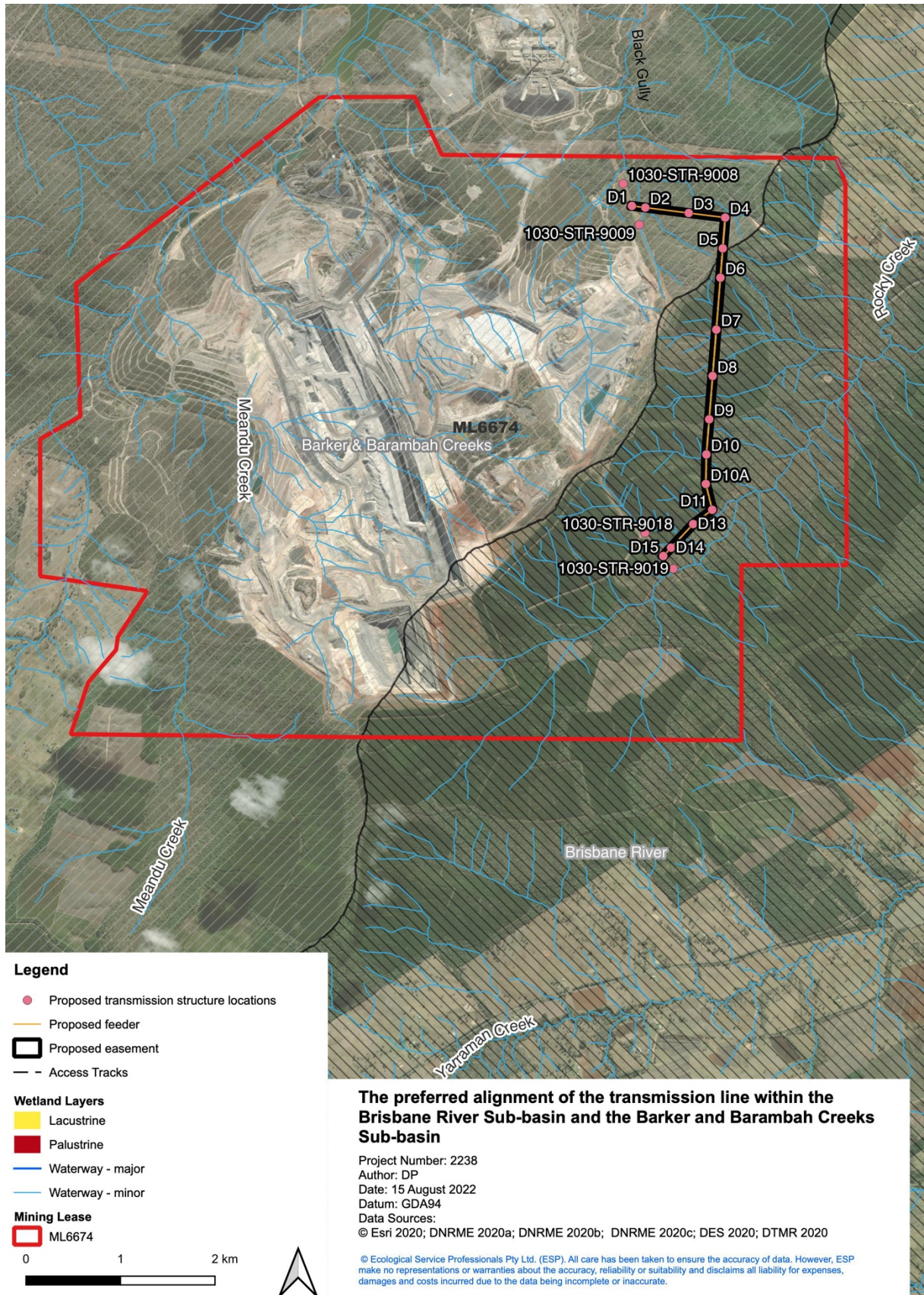


Figure 1.1 The preferred alignment of the transmission line showing the diversion between the Brisbane River sub-basin and the Barker and Barambah Creeks sub-basin

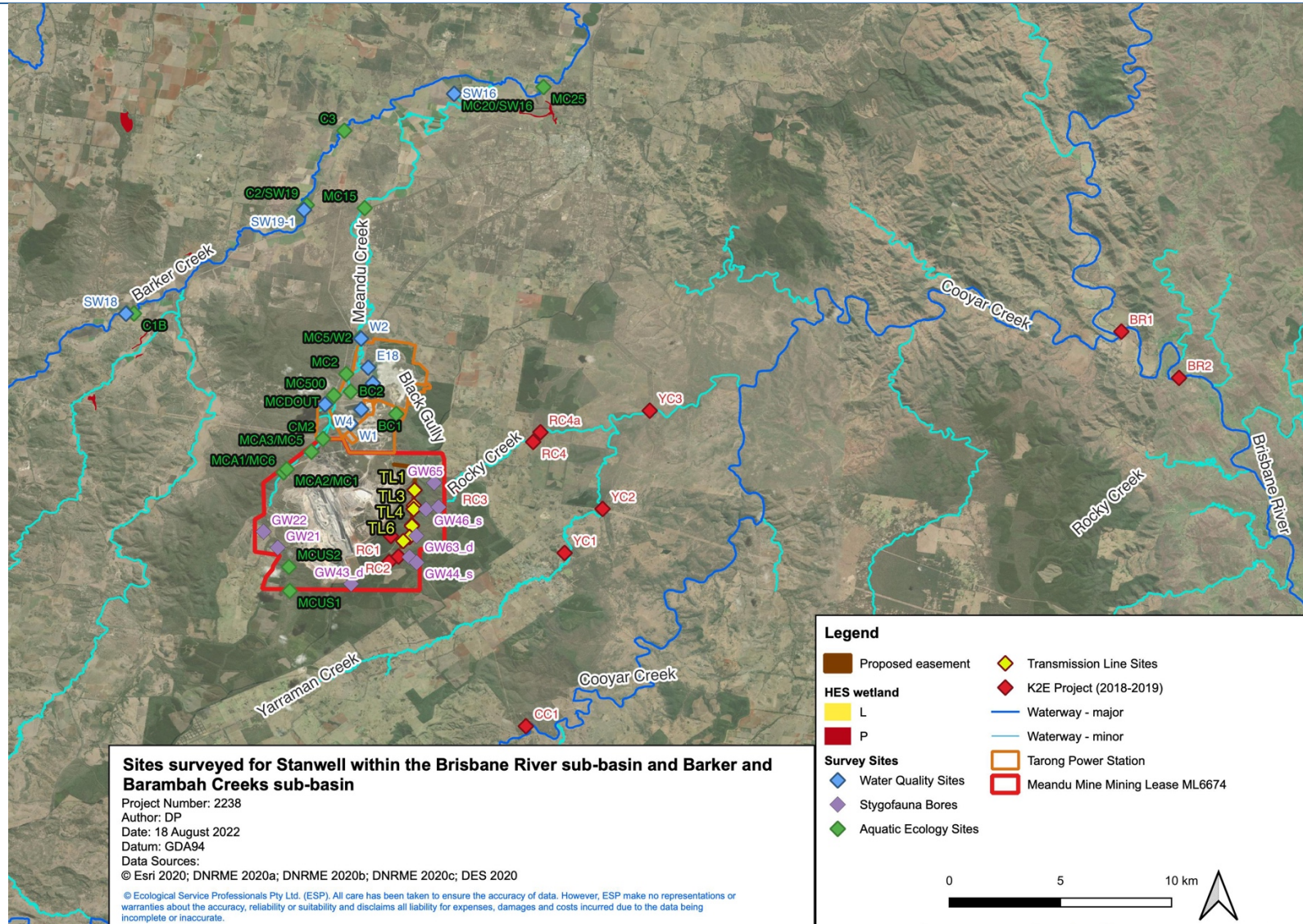


Figure 1.2 Sites surveyed for Stanwell within the Brisbane River sub-basin and the Barker and Barambah Creeks sub-basin

2 Existing Environment

2.1 Waterways and Wetlands

2.1.1 Brisbane River Sub-basin

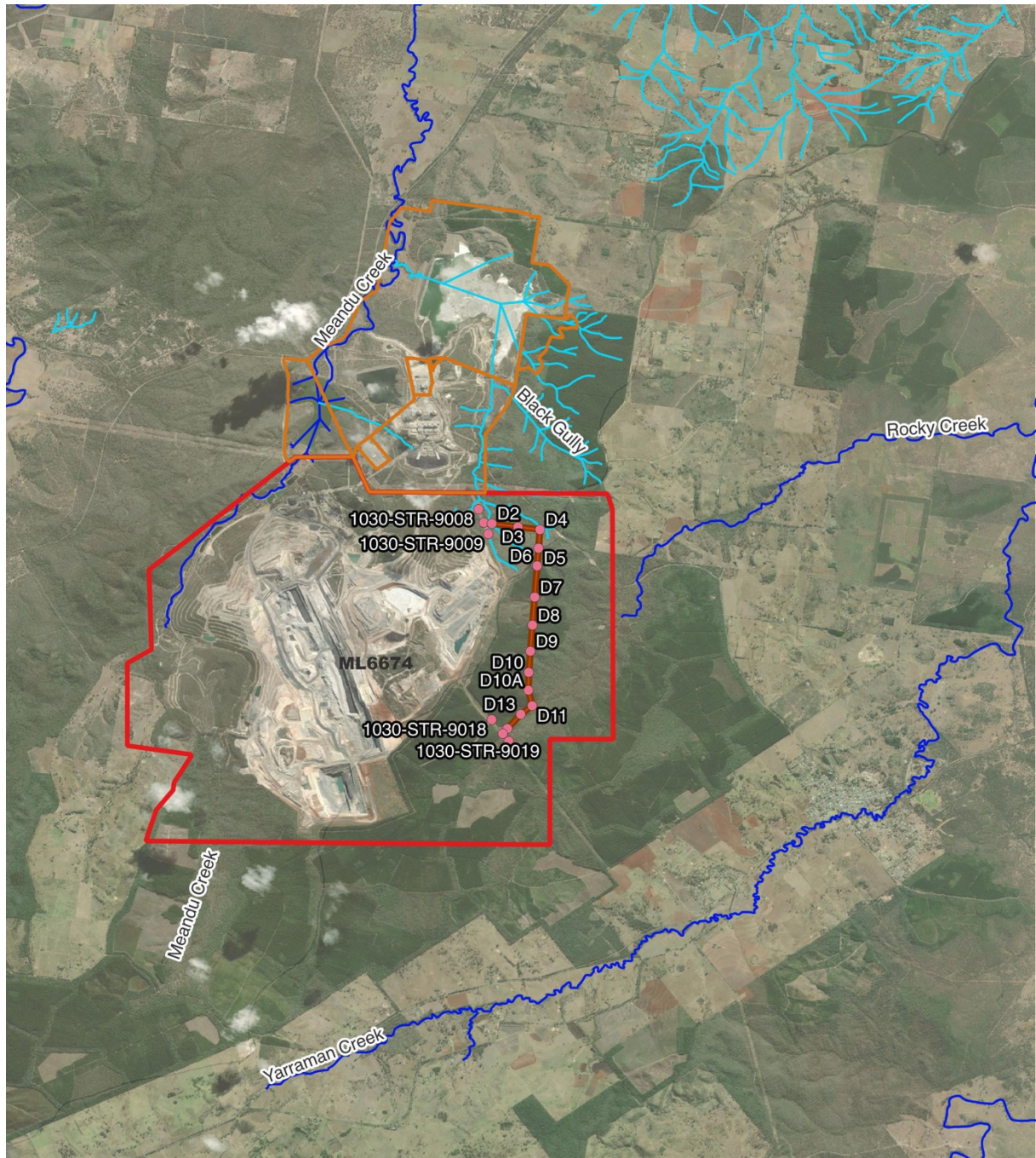
Structures D6 to D15 and the associated easement and access tracks are located within the Upper Brisbane River sub-basin, with the Project traversing headwaters of Rocky Creek, a tributary of Yarraman Creek and Cooyar Creek. These headwaters flow within the Yarraman State Forest, which is largely licenced for forestry use and utilised for hoop pine plantations. Land use downstream of the State Forest is dominated by agriculture.

Rocky Creek comprises stream order one, two, three and four waterways, all of which are ephemeral. The headwaters of the sub-catchment are amongst steep terrain, and as such waterways are mostly dry with flows that would likely occur only for short periods during and following rainfall.

The headwaters and upper tributaries of Rocky Creek are not mapped as watercourses under the *Water Act 2000* (Water Act), however, advice from the (former) Queensland Department of Natural Resources, Mine and Energy (DNRME; now Department of Resources) indicates the headwaters and tributaries of Rocky Creek would be considered unnamed drainage lines (WSP, pers. comm). Rocky Creek from downstream of the Meandu Mine mining lease is mapped as a watercourse (Figure 2.1). In addition, Rocky Creek proper and its tributaries are mapped as (low to moderate) potential surface expression Groundwater Dependant Ecosystems (GDEs) (Figure 2.2). The waterways and wetlands within the study area are ephemeral but may receive baseflow to the alluvium from the groundwater system (JBT 2021). There are also waterholes on Rocky Creek that have been assessed to receive some input from groundwater for at least some of the year (approximately 6 km downstream of the preferred alignment). These waterholes occur just upstream of the contact between the Maronghi Creek beds (in which the waterholes occur) and granite outcrop of the Boondooma Igneous Complex. It is likely that the low permeability granite unit is acting as a dam that impedes the downgradient flow of groundwater within the Maronghi Creek beds, resulting in drawing groundwater close to surface in the Rocky Creek waterholes (JBT 2021). There are two mapped lacustrine wetlands in the vicinity of the Project; one riverine wetland located within the small-order tributaries on the eastern boundary of the Project (though ground truthing during a site reconnaissance for the Project in March 2018 found that there was no wetland in this area), and the other (a farm dam) located on Rocky Creek proper approximately 6 km downstream of the Project (Figure 2.3). Several unmapped wetlands (constructed dams) are also located on reaches of Rocky Creek proper within the State Forest. There are no high ecological significance (HES) wetlands mapped within the Rocky Creek catchment, with the closest mapped HES wetland located approximately 90 km downstream adjacent to the Brisbane River.

Rocky Creek flows into Yarraman Creek approximately 9 km downstream of the Project. Yarraman Creek is ephemeral, with land use dominated by urban areas and agriculture (grazing and some cropping). Yarraman Creek from (and including) the impoundment of Yarraman Weir to its confluence with Cooyar Creek is a stream order four waterway, is mapped as a watercourse under the Water Act and is mapped as a potential surface

expression GDE. Yarraman Creek flows into Cooyar Creek approximately 16 km downstream of the Project, which flows into the Brisbane River, approximately 45 km downstream of the Project. The Brisbane River flows in a southerly direction, through Wivenhoe Dam (approximately 140 km downstream of the Project), and then flows east until it eventually discharges into Moreton Bay, which is a marine park and RAMSAR wetland (approximately 310 km downstream of the Project).



Legend

- Proposed transmission structure locations
- Meandu Mine Mining Lease ML6674
- Proposed feeder
- Watercourses - waterway feature
- Proposed easement
- Watercourses- drainage feature
- Tarong Power Station

Watercourses within the vicinity of the transmission line in the Brisbane River sub-basin and the Barker and Barambah Creeks Sub-basin

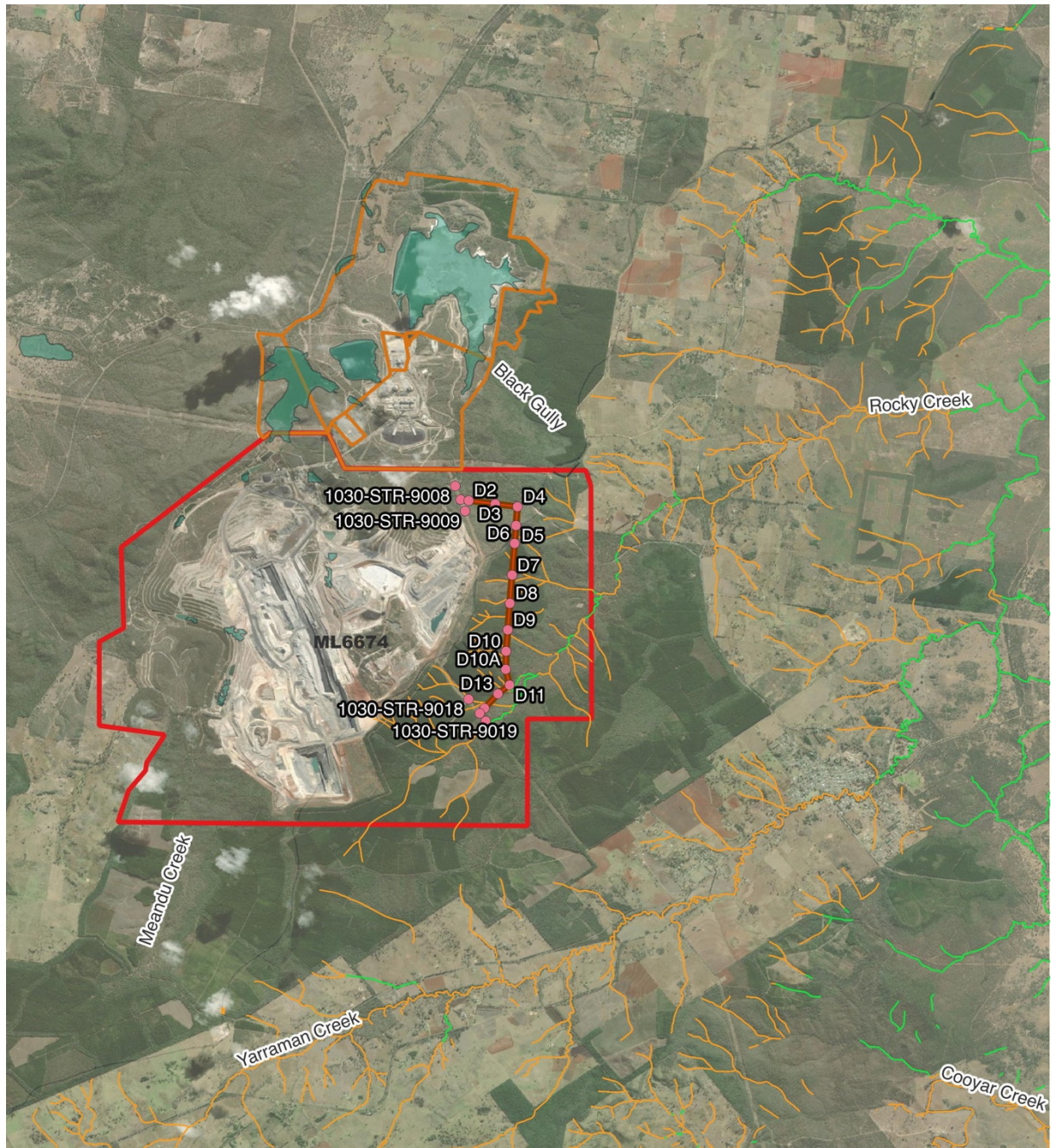
Project Number: 2238
 Author: DP
 Date: 18 August 2022
 Datum: GDA94
 Data Sources:
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0 1 2 km



Figure 2.1 Mapped watercourses within the vicinity of the transmission line



Legend

- Proposed transmission structure locations
- Proposed feeder
- Proposed easement
- Tarong Power Station
- Meandu Mine Mining Lease ML6674
- GDE Watercourses (Queensland)
- GDE (Barker & Barambah - Federal)
- Aquatic GDE (Brisbane - Federal)**
- Low potential GDE - from regional studies
- Moderate potential GDE - from regional studies

Groundwater dependent ecosystems within the vicinity of the transmission line in the Brisbane River sub-basin and the Barker and Barambah Creeks Sub-basin

Project Number: 2238
 Author: DP
 Date: 18 August 2022
 Datum: GDA94
 Data Sources:
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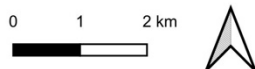
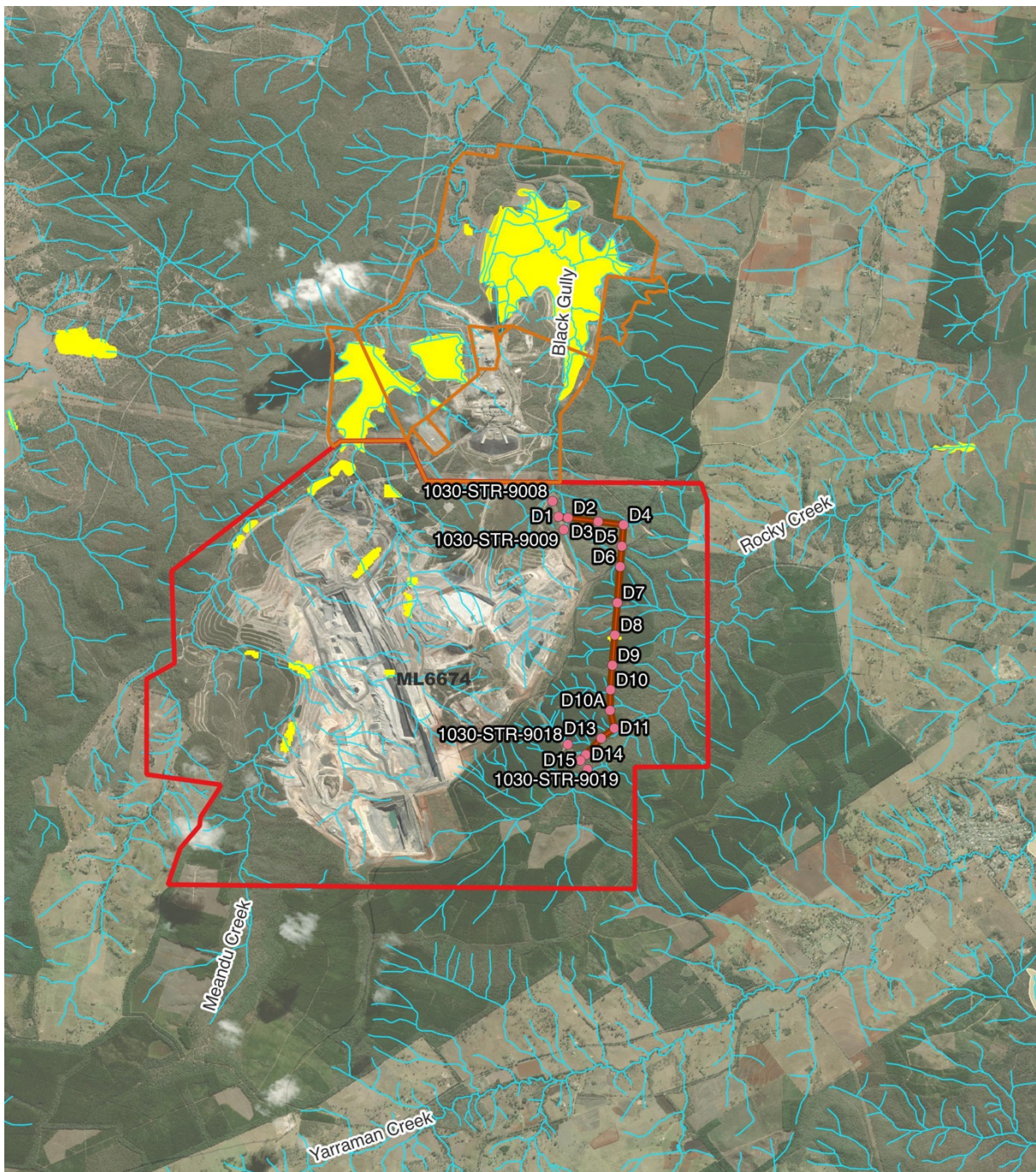
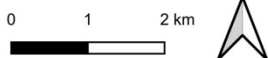


Figure 2.2 Mapped Groundwater Dependent Ecosystems (GDEs) in the vicinity of the transmission line



Legend

- Proposed transmission structure locations
 - Proposed feeder
 - Proposed easement
 - Tarong Power Station
 - Meandu Mine Mining Lease ML6674
- | | |
|-----------------|--|
| Wetlands | Lacustrine |
| | Palustrine |
| | Waterway - major |
| | Waterway - minor |



Waterways and wetlands within the vicinity of the transmission line in the Brisbane River sub-basin and the Barker and Barambah Creeks Sub-basin

Project Number: 2238
 Author: DP
 Date: 18 August 2022
 Datum: GDA94
 Data Sources:
 © Esri 2020; DNRME 2020a; DNRME 2020b; DNRME2020c;
 DES 2020

© Ecological Service Professionals Pty Ltd. (ESP). All care has been taken to ensure the accuracy of data. However, ESP make no representations or warranties about the accuracy, reliability or suitability and disclaims all liability for expenses, damages and costs incurred due to the data being incomplete or inaccurate.

Figure 2.3 Mapped waterways and wetlands in the vicinity of the transmission line

2.1.2 Barker and Barambah Creeks Sub-basin

Structures D1 to D5 and the associated easement and infrastructure are located in the Barker and Barambah creeks sub-basin, with the Project traversing the headwaters of Black Creek. Black Creek has been substantially modified from its natural state through construction of the Tarong Ash Dam, Black Creek Dam and the Black Creek Dam overflow diversion channel (which are located on the site of the Tarong power stations).

Black Creek was de-gazetted as a watercourse in 2000 under the Water Act by the former DNRME. It is now mapped as a drainage feature (Figure 2.1). The unnamed tributaries of Black Creek crossed by the preferred alignment are mapped as stream order one and two waterways. Approximately 320 m downstream of the transmission line, Black Creek is an order three waterway, and approximately 450 m downstream, it is an order four waterway, which extends to Black Creek Dam. The upper tributaries of Black Creek are not mapped as GDEs, with the closest mapped (moderate) potential GDE located approximately 1.6 km downstream (Figure 2.2). Shallow groundwater flow within the Black Creek catchment is likely to occur within the shallow Tertiary Regolith, where discharge to surface may occur towards Black Creek Dam. Although there are two mapped lacustrine wetlands within Black Creek catchment, these are artificial dams that form part of the water management system for Meandu Mine and the Tarong power stations (Figure 2.3). There are no HES wetlands within the Black Creek catchment, with the closest located approximately 16 km downstream of the Project.

The section of Black Creek that traverses the preferred alignment is on the boundary of Meandu Mine surface rights area. Approximately 450 m downstream of the preferred alignment, this section of Black Creek joins with another tributary of Black Creek, which contains mine affected water (MAW) from Meandu Mine retention dam RD17B. MAW from retention dam RD17B is released downstream via the CP2 spillway or release valve in accordance with the Meandu Mine Environmental Authority. Black Creek then flows into Black Creek Dam approximately 2 km downstream of the preferred alignment. Black Creek Dam is a 1,350 ML water storage constructed in 1987 to intercept runoff from the upstream catchment, including MAW, and surface water draining from remnant forest/bush land and forestry/pine plantation as well as a small area of Tarong power station. Water (including MAW) in Black Creek Dam can be used at the Tarong power stations, pumped to the adjacent Meandu Creek Dam or overflow to the Black Creek Diversion Channel, which was constructed in 2015. Black Creek Dam only overflows during extreme rain events, with water from the Black Creek Diversion Channel entering Meandu Creek approximately 2 km downstream of Meandu Creek Dam.

Meandu Creek downstream of Meandu Creek Dam is a stream order five waterway, is mapped as a watercourse under the Water Act and as moderate confidence derived surface-expression GDEs from approximately 2.5 km downstream of Meandu Creek Dam. Meandu Creek flows into the Bjelke-Peterson Dam, approximately 100 km downstream of Meandu Creek Dam. Meandu Creek and Barambah Creek generally have perennial flows, due to consistent releases from Meandu Creek Dam and Bjelke-Peterson Dam. Downstream of Bjelke-Petersen Dam, Barker Creek turns into Barambah Creek, which eventually flows into the Burnett River, which discharges into the Coral Sea at Bundaberg.

2.2 Environmental Values

The quality of natural waters in Queensland is protected under the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (EPP (Water and Wetland Biodiversity)). Section 6 of the EPP (Water and Wetland Biodiversity) lists the categories into which waters can be classified and their associated EVs. The EVs and water quality objectives (WQOs) assigned to maintain the identified EVs, are progressively being determined for each water basin in Queensland. Queensland waters with defined EVs and WQOs are listed in Schedule 1 of the EPP (Water and Wetland Biodiversity).

The EPP (Water and Wetland Biodiversity) for the Upper Brisbane River (DERM 2010; EHP 2017) assigns EVs to freshwaters within the Cooyar Creek sub-catchment (which comprises the waterways of Rocky, Yarraman and Cooyar creeks). While listed as an EV for the Upper Brisbane River, review of the current water licences issued for surface water users indicated that the EV of aquaculture is not relevant to waterways in the vicinity of the Project. The draft update to EVs for the Upper Brisbane River (EHP 2017) indicates the headwaters of Rocky Creek and tributaries that flow within the Yarraman State Forest are mapped as slightly disturbed aquatic ecosystem values. However, tributaries of Rocky Creek within the hoop pine plantations (including those relevant to the Project) have been adversely affected to a relatively small but measurable degree by human activity, and as such are moderately disturbed. The headwaters of Rocky Creek proper within Yarraman State Forest but outside the hoop pine plantations have relatively good coverage of riparian vegetation and natural flow pathways, and as such remain slightly disturbed.

Waters in the vicinity of the Project in the Burnett River Basin are not listed in Schedule 1 of the EPP (Water and Wetland Biodiversity). Relevant EVs and associated WQOs have been assigned in the Meandu Creek Receiving Environment Monitoring Program (REMP) with reference to the Burnett Mary River Water Quality Improvement Plan (WQIP) (Burnett Mary Regional Group 2015), findings from available literature, previous technical reports and the results of monitoring assessments. Based on this, Black Creek has been assigned the industrial use EV only, but given the direct connectivity, should also be managed to protect the downstream EVs of Meandu Creek. While the Burnett Mary WQIP also identifies drinking water as an EV for Barker Creek from Nanango Weir to the Bjelke-Peterson Dam storage and Barambah Creek, this was not considered relevant to Meandu Creek given the distance downstream.

The EVs assigned to waterways surrounding the Project are outlined in Table 2. No high ecological value (HEV) waters are mapped in the vicinity of the Project.

Table 2 Environmental values assigned for waterways within the study area

Environmental Value	Brisbane River Sub-basin	Barker and Barambah Creeks Sub-basin	
	Cooyar Creek sub-catchment (Rocky, Yarraman and Cooyar creeks) ^a	Black Creek and Black Creek Dam ^a	Meandu Creek downstream of Meandu Creek Dam ^a
Aquatic ecosystems	Y, slightly to moderately disturbed	–	Y, moderately disturbed
Irrigation	Y	–	Y
Farm supply / use	Y	–	Y
Stock watering	Y	–	Y
Aquaculture	Y*	–	–
Human consumer	Y	–	Y
Primary recreation	Y	–	Y
Secondary recreation	Y	–	Y
Visual appreciation	Y	–	Y
Drinking water	Y	–	–
Industrial use	Y	Y	Y
Cultural and spiritual values	Y	–	–

^a Source: DERM 2010

Y Indicates applicable EV

– Indicates EV not applicable

* Not relevant to the waters within the study area; this EV was not considered in the derivation of WQOs

2.3 Water and Sediment Quality

2.3.1 Brisbane River Sub-basin

Twelve monthly water quality sampling events between April 2018 and March 2019 as well as sediment quality sampling in April and September 2018 were completed for the Meandu Mine K2E Project (ESP 2021). During these surveys, the upstream waterway sites on Rocky Creek (sites RC1, RCT1 and RC3 on Figure 1.2) were dry during all sampling events. These sites are likely to flow for a very short time and are unlikely to hold water following rainfall.

Dams located on Rocky Creek (sites RC2 and RC4) had slightly alkaline, turbid water, with elevated concentrations of nutrients (specifically ammonia, organic nitrogen, total nitrogen and total phosphorus) and some metals and metalloids (manganese and iron at both sites and aluminium at site RC2), likely due to local geology and the surrounding land use (hoop pine plantation and agriculture). Water quality was particularly poor at the dam site within the Meandu Mine mining lease (site RC2), likely due to the very limited flushing given it was a small, isolated dam with poor connectivity to other waterways.

Prior to the confluence of Yarraman Creek, Rocky Creek consists of isolated pools that connect during periods of high flow. Water quality in this area (site RC4a) was characterised

by very high electrical conductivity, total dissolved solids, total suspended solids and concentrations of ions (dominated by sodium). The concentrations of nutrients (ammonia, organic nitrogen, total nitrogen and total phosphorus) and some metals (manganese and uranium) were also slightly elevated. This site is likely influenced by local geology and environmental conditions, with potential for groundwater interaction. High concentrations of total petroleum hydrocarbons at some sites in Rocky Creek may have been from vehicles and machinery using access tracks adjacent to Rocky Creek. Sediment quality in Rocky Creek was typically good, with occasionally high concentrations of some metals (including exceeding default guideline values for the concentrations of nickel, cadmium and chromium) in some areas at times. Total petroleum hydrocarbons were also detected and high at times at some sites.

Water quality of waterways of Yarraman and Cooyar creeks were characterised by very high electrical conductivity, total dissolved solids and concentrations of sodium, which were likely a result of the local geology of these waterways. Water quality of the upper Brisbane River was in the best condition, with lower electrical conductivity and concentrations of ions as well as lower concentrations of nitrogen, metals and hydrocarbons, however water quality was still influenced by surrounding activities to a measurable degree. Sediment quality was typically good, and only exceeded default guideline values for the concentration of nickel at one site on Yarraman Weir. Total petroleum hydrocarbons were also detected and high at times at some sites.

2.3.2 Barker and Barambah Creeks Sub-basin

Water quality at the release point CP2 on Black Creek is released in accordance with the Meandu Mine EA, including water contaminant limits for pH (5.5 – 9.0 pH units), turbidity (<1000 NTU) and electrical conductivity (<2,500 $\mu\text{S}/\text{cm}$). Regular compliance monitoring of these parameters is undertaken during release to confirm compliance.

Other than compliance monitoring, there is limited data for Black Creek as it is not considered a waterway and is only managed for industrial use (for which no WQOs apply). However, two sites on Black Creek, one in Black Creek Dam and the other before the confluence with Meandu Creek were surveyed in 2017 for water and sediment quality. Water quality in Black Creek Dam during this survey was characterised by very high electrical conductivity, total dissolved solids, ions, nutrients and some metals (although metals were typically below default guideline values). Water quality was typically better further downstream prior to the confluence of Meandu Creek Dam. The concentrations of metals in the sediment of Black Creek were below default sediment quality guideline values and as such were considered to have a low risk of toxicity to aquatic flora and fauna.

Surface water of Meandu Creek (assessed between 1978 and 2017) was generally characterised by high electrical conductivity and concentrations of ions (primarily sodium), as well as high concentrations of nutrients (inorganic forms of nitrogen and phosphorus) and certain metals. Concentrations of these parameters were likely influenced by discharges from Meandu Creek Dam but were considered typical of moderately disturbed ecosystems and suitable for supporting the relevant EVs. Sediments were also characterised by higher concentrations of several metals when compared to comparative areas (including: arsenic, chromium, cobalt, copper, lead, manganese, nickel and zinc). However, additional testing indicated that they were unlikely to be bioavailable to aquatic flora and fauna.

2.4 Aquatic Habitat

2.4.1 Brisbane River Sub-basin

Within the transmission line easement, mapped tributaries of Rocky Creek assessed during the field survey in June 2019 (i.e. sites TL1, TL3, TL4, TL5 and TL6) did not have defined bed and banks, and no aquatic habitat was evident. These sites were not considered waterways and would likely only convey overland flows during periods of high rainfall. Most sites were highly disturbed by hoop pine plantations, with an understorey of lantana (Figure 2.4d). Two sites were located on unmapped dams that consisted of small, shallow depressions that were dry during the field survey (i.e. sites TLD1 and TLD2; Figure 2.4e). A summary of field observations completed at each site is provided in Appendix A.

Rocky Creek and its tributaries within the Yarraman State Forest consisted of narrow drainage channels that were generally dry during the K2E surveys (ESP 2021). The only water present was within small, isolated farm dams. These dams were highly disconnected from surrounding waterways and contained very limited aquatic habitat, restricted to shallow pools with some woody debris and isolated aquatic plants growing high along the banks (typically not submerged, except when the water level was high following rainfall) (Figure 2.4a).

The dry channels of Rocky Creek and its tributaries were disturbed by surrounding land-uses, primarily the presence of hoop pine plantations, which impeded the riparian zone at some sites (Figure 2.4b). There was a high abundance of exotic terrestrial weeds (e.g. Lantana, *Lantana camara*) in the dry channel (Figure 2.4c). These channels are mapped as low to moderate confidence surface expression GDEs (State of Queensland 2022, BOM 2022), but would very rarely hold water, only acting as drainage channels to convey flows during significant rainfall events. Instream sediments were dominated by silt / clay, with small portions of sand.

Further downstream, where the channel widened, Rocky Creek contained isolated small pools that are fed mostly by groundwater. There was also a large mapped modified lacustrine wetland located on Rocky Creek approximately 6 km downstream of the Project that provided a dry season refuge for aquatic flora and fauna (Figure 2.4f). This wetland was a farm dam and was disconnected from downstream habitats and crossed the entire creek channel, and as such fish passage was restricted except during periods of high flow. The dam was highly disturbed by cattle access (which had trampled the banks causing erosion in some areas) and riparian vegetation had been largely cleared for grazing (therefore in-stream shading was limited). However, it provided shallow and deep pool habitats and contained a high abundance and diversity of aquatic plants and a small amount of woody debris. Although aquatic habitat condition at this site was low to moderate, it provided a dry season refuge for aquatic flora and fauna. This included refuge for large-bodied fish, for which the smaller pools within the creek channel did not provide adequate habitat.

Yarraman Creek, Cooyar Creek and the Brisbane River had a good variety and availability of in-stream habitat, a variety of flow regimes, good bank stability and, although the adjacent lands were disturbed, a reduced but mainly intact riparian zone remained along sections of the waterways.

a)



b)



c)



d)



e)



f)



Figure 2.4 Photographs of (a) shallow pool habitat with limited instream habitat diversity at site RC2 on Rocky Creek; (b) poor riparian zone impacted by terrestrial weeds and hoop pine plantation at site RCT1 on a tributary of Rocky Creek; (c) dry channel with good riparian cover but a high proportion of Lantana at site RC1 on Rocky Creek; (d) hoop pines and lantana with no evidence of aquatic habitat at site TL1 on a tributary of Rocky Creek within the easement; (e) dry unmapped dam with some emergent aquatic plants at site TLD2 in the Rocky Creek catchment within the easement; and (f) large mapped lacustrine wetland with abundant aquatic plants at site RC4 on Rocky Creek

2.4.2 Barker and Barambah Creeks Sub-basin

Black Creek has been substantially modified from its natural state along most of the waterway. There are large persistent pools in some areas (particularly dams and in the constructed channel), but Black Creek has very poor connectivity to downstream waterways of Meandu Creek (Figure 2.5). The riparian vegetation is impacted by vegetation clearing associated with the adjacent land uses and the construction of the Black Creek Dam and Black Creek diversion channel. While Black Creek Dam provides some habitat for aquatic flora and fauna, the habitat is entirely engineered in the constructed channel downstream of Black Creek Dam. Black Creek Dam and the constructed channel have limited features, with little bank vegetation (except for some scattered aquatic plants around the dam) or in stream habitat features providing structural complexity and shelter for aquatic fauna (although boulders, cobbles, pebbles and gravel in some areas of the waterway provide some structural complexity: Figure 2.5d). Waterways and riparian vegetation within Meandu Creek were generally impacted by industrial land use, agricultural land use, hydrological change, riparian degradation, and / or weed infestation. Regardless of these impacts, instream habitat availability and diversity were typically good downstream of Meandu Creek Dam (including trailing bank vegetation, a variety of instream aquatic plants and woody debris).

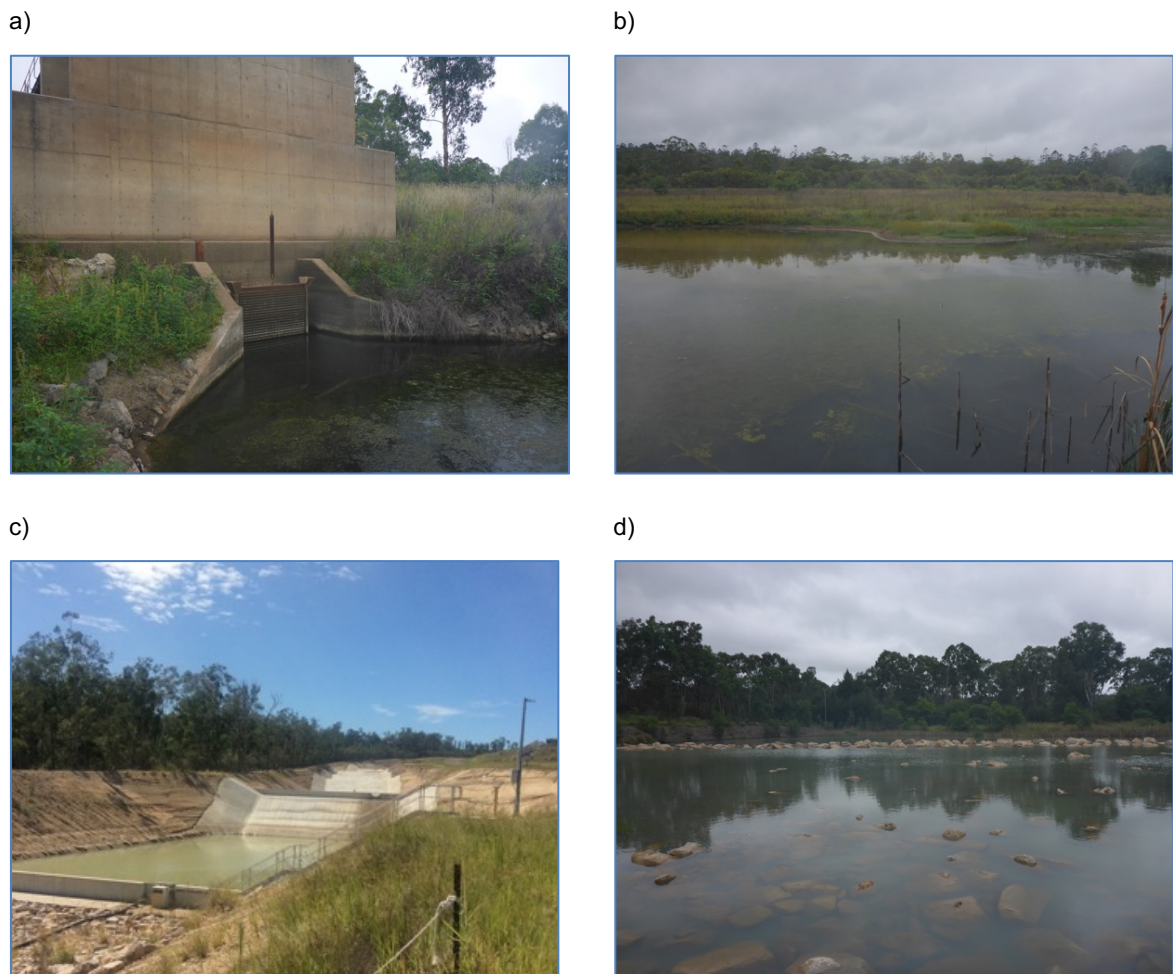


Figure 2.5 Photographs of (a) Black Creek Dam inlet; (b) Black Creek Dam facing south (c) concrete section in Black Creek diversion channel (d) constructed pool in Black Creek diversion channel.

2.5 Biological Communities

2.5.1 Brisbane River Sub-basin

Seasonal biological surveys (including aquatic plants, macroinvertebrates, macrocrustaceans, fish and turtles) have previously been completed in April and September 2018. Biological communities previously recorded at sites in the vicinity of the Project were generally typical of the broader region. No aquatic plants or fish were recorded within the upper Rocky Creek headwaters and there was limited habitat available for these species. Waterways and dams further downstream in Rocky and Yarraman creeks and the Brisbane River, as well as the adjacent Cooyar Creek, provide more suitable habitat for aquatic plants and fish, and contained a range of native species. Macroinvertebrate communities were in moderate to good condition relative to those expected in the broader region, and results indicated that high levels of nutrients and salinity may be influencing communities at most sites. A higher range of sensitive taxa were recorded in the larger waterways downstream of the Project, such as the Brisbane River. Turtles were only caught in dams / weirs and waterways with larger stream orders where pools held water throughout the year. They were not caught in Rocky Creek or its tributaries (except in artificial dams). This is likely a reflection of the ephemeral nature of these tributaries, which typically contained small shallow pools that did not provide adequate permanent habitat for turtles. One platypus (*Ornithorhynchus anatinus*; listed as 'Special Least Concern' under the *Nature Conservation Act 1994*) was observed in Yarraman Creek at the weir, and they are known to occur in the broader region. It is possible that platypus may temporarily inhabit sections of Rocky Creek (i.e. at least 5 km downstream of the Project) at certain times of year.

No listed threatened species of aquatic plants, invertebrates or turtles were recorded during the field surveys or are considered likely to occur in the region. Australian lungfish (*Neoceratodus forsteri*; listed as vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* [EPBC Act]) were caught in the Brisbane River, approximately 47 km downstream of the Project. This species may also inhabit the lower reaches of Cooyar Creek downstream of its confluence with Yarraman Creek during the wet season when habitat is suitable. Three other listed threatened species of fish are known from the freshwater reaches of the Brisbane River sub-basin: Mary River cod (*Maccullochella mariensis*), Murray cod (*Maccullochella peelii*); and silver perch (*Bidyanus bidyanus*). One threatened cod (species identification not confirmed) was observed in the Brisbane River, approximately 55 km downstream of the Project. Cod may also sporadically occur in the lower reaches of Cooyar and Yarraman creeks, as well as the Brisbane River, but are highly unlikely to occur in the small, ephemeral waterways of Rocky Creek in the vicinity of the Project due to lack of suitable habitat. No silver perch were recorded during the field surveys; this species has previously been stocked in Cooyar Creek and Wivenhoe Dam, but no self-sustaining populations are known from the sub-basin outside of stocked impoundments and any occurrences in Cooyar or Yarraman creeks would be unlikely and incidental.

Several invasive species are known to occur in the study area. One native species recorded during both surveys (cumbungi, *Typha domingensis*), is a recognised water weed; however, it is not a prohibited or restricted invasive plant under the *Biosecurity Act 2014*. Five pest species of fish were also recorded, two of which are listed as restricted biosecurity matters

and noxious under the *Biosecurity Act 2014*, namely mosquitofish (*Gambusia holbrooki*) and Mozambique tilapia (*Oreochromis mossambicus*).

2.5.2 Barker and Barambah Creeks Sub-basin

Biological data (i.e. aquatic plant, macroinvertebrate, fish and turtle data) for Black Creek is not available likely due to this waterway not being managed for the aquatic ecosystem EV. However, based on habitat assessments and water and sediment quality available, any fish and turtles in the pools are likely to be common to the region given the environmental conditions and poor connectivity. Aquatic plants are generally limited in Black Creek Dam and further downstream in the constructed channel. No listed threatened species of aquatic plants, invertebrates or vertebrates are considered likely to occur given waterways are high in the catchment, have poor connectivity and are highly impacted by the surrounding industrial land use.

Further downstream, the majority of aquatic flora and fauna recorded in Meandu Creek were common and widespread, with communities downstream of Meandu Creek Dam in a similar or better condition than would be expected in the broader catchment. The perennial flow regime, resulting from the consistent releases from Meandu Creek Dam, allows for stable and diverse aquatic habitats to occur, which in turn are colonised by a diverse range of macroinvertebrates, along with aquatic plants, fish and turtles, where habitat is suitable. Although not previously recorded, platypus habitat is present in Meandu and Barker creeks, and they are considered likely to occur.

Silver perch is listed as critically endangered under the EPBC Act and have been historically stocked in the Tarong power stations cooling water dam. The Burnett Basin is outside the natural distribution for this species and annual fish surveys in Meandu Creek Dam since 2013 have not recorded silver perch. Three additional listed threatened aquatic species are known from the Barker and Barambah Creeks sub basin, including Australian lungfish, Mary River cod and white-throated snapping turtle (*Elseya albagula*). These species were not recorded during the field surveys and were considered unlikely to occur in Meandu Creek due to lack of suitable habitat, although Mary River cod may sporadically occur in the lower reaches of Meandu Creek during the wet season when water levels are high. Several invasive species are known to occur, including one water weed previously recorded (curled dock, *Rumex crispus*), which is not a prohibited or restricted invasive plant under the *Biosecurity Act 2014*). Two introduced pest species of fish have been recorded from the Barker and Barambah Creeks sub basin: mosquitofish (listed as restricted noxious fish under the *Biosecurity Act 2014*) and goldfish (non-indigenous to Australia).

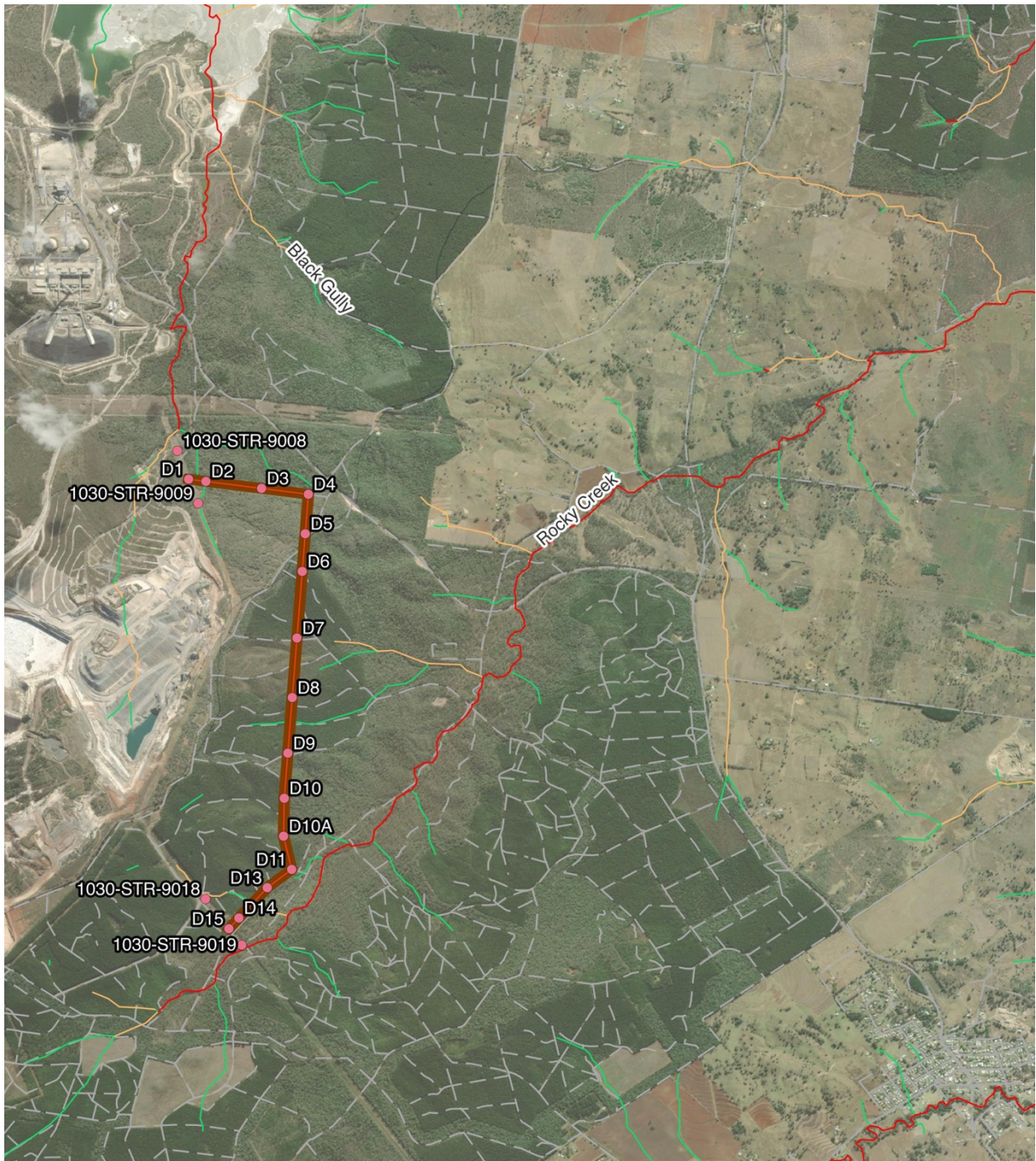
2.6 Fauna Passage

Many species of the native fish known from the Brisbane River sub-basin and Barker and Barambah creeks sub-basin in the vicinity of the Project migrate upstream and downstream, and between different aquatic habitats, at different stages of their life cycle (Marsden & Power 2007). Stimuli for movement include small and large flow events and increases in water temperature. Spring and summer are generally the most important months for migration; however, maintaining fish passage is important throughout the year (Marsden & Power 2007). The waterway in the vicinity of the Project are high in the catchment would act

as drainage channels, conveying water during periods of high rainfall. They would rarely provide habitat or connectivity for fish passage.

The waterways in the vicinity of the Project are mapped as the following risk of adverse impact to fish movement from waterways barrier works in the DAF Queensland Waterways for Waterway Barrier Works spatial layer (Figure 2.6):

- Tributaries of Rocky Creek in the vicinity of the Project are mapped as low (green) and moderate (amber) risk, whereas Rocky Creek downstream of the Project is mapped as a high (red) risk.
- Tributaries of Black Creek are in the vicinity of the Project are mapped as low (green), whereas downstream of the Meandu Mine mining lease boundary Black Creek to Meandu Creek is mapped as moderate (amber) risk and high (red) risk.



Legend

- Proposed transmission structure locations
- Access Tracks
- Proposed feeder
- Proposed easement
- Tarong Power Station
- Meandu Mine Mining Lease ML6674
- Waterway Barrier Works - Streams**
- Low
- Moderate
- High
- Major

Waterway Barrier Works within the vicinity of the transmission line in the Brisbane River sub-basin and the Barker and Barambah Creeks Sub-basin

Project Number: 2238
 Author: DP
 Date: 18 August 2022
 Datum: GDA94
 Data Sources:
 © Esri 2020; DAF 2020

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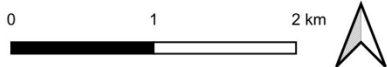


Figure 2.6 Waterway Barrier Works mapped in the vicinity of the Project

2.7 Aquatic Ecosystem Values

2.7.1 Rocky Creek and Tributaries

The aquatic ecological value of small tributaries associated with Rocky Creek is low due to:

- high levels of anthropogenic disturbance along many waterways due to hoop pine plantations and high abundances of terrestrial weeds
- no provision of core, foraging or breeding habitat for aquatic species, with no water recorded in waterways during the wet or dry season surveys
- limited potential to provide connectivity or fauna passage to upstream habitats, except during brief periods of high rainfall and flow when waterways would act primarily as drainage channels, diverting overland flows
- absence of dry season refugia for aquatic flora and fauna, with no water present at sites in the dry season (except for small isolated dams, which held shallow pools but provided very poor value habitat), and
- absence of listed protected species, communities, areas, and habitats.

The aquatic ecology value of Rocky Creek proper is moderate due to:

- presence of a moderate variety of instream habitat types (shallow pools only), which provided habitat for aquatic flora and fauna typical of ephemeral systems in the region
- provision of potential breeding habitat for some aquatic species
- limited potential to provide connectivity or fauna passage to upstream habitats, except during brief periods of high rainfall and flow
- provision of small, groundwater-fed pools which would act as dry season refugia for aquatic flora and small bodied aquatic fauna, and
- absence of listed protected species, communities, areas, and habitats.

The aquatic ecosystem value of the mapped lacustrine wetland on Rocky Creek downstream of the Project is moderate due to:

- presence of a low to moderate variety of instream habitat types, including deep pools (albeit typically modified by dams), which provided habitat for a range of aquatic flora and fauna common in the region
- provision of breeding habitat, with juvenile, intermediate and adult fish recorded
- limited potential to provide connectivity or fauna passage to downstream habitats (except during flood events), due to the presence of the dam wall
- provision of dry season refugia for aquatic flora and fauna, and
- absence of listed protected species, communities, areas, and habitats.

2.7.2 Yarraman Creek, Cooyar Creek and the Brisbane River

The aquatic ecology value of Yarraman and Cooyar Creeks is moderate to high due to:

- presence of a wide variety of instream habitat types during the wet season, including deep pools, which provided habitat for a range of aquatic flora and fauna typical of the region
- provision of breeding habitat, with juvenile, intermediate and adult fish recorded
- provision of important connectivity and fauna passage to upstream and downstream habitats during periods of high rainfall and flow
- provision of dry season refugia for aquatic flora and fauna, and
- presence of core or potential habitat for listed threatened species, but an absence of listed protected communities and areas.

The aquatic ecosystem value of the Brisbane River is high due to the attributes for Yarraman and Cooyar creeks outlined above, except the Brisbane River provides substantial habitat for listed threatened species.

2.7.3 Black Creek

Based on habitat assessments and water and sediment quality, aquatic ecological value in Black Creek is likely low due to:

- high levels of anthropogenic disturbance, including constructed dam and highly engineered channel downstream of the Project
- presence of a low to moderate variety of instream habitat types, including deep pools (albeit highly modified by dams), which provided potential habitat for aquatic flora and fauna common in the region
- very limited potential to provide connectivity or fauna passage to upstream and downstream habitats due to the presence of the dam wall and engineered diversion channel
- provision of dry season refugia for aquatic flora and fauna (Black Creek Dam only), although passage to the dam is highly restricted, and
- likely absence of listed protected species, communities, areas, and habitats.

2.7.4 Meandu Creek

The aquatic ecology value of Meandu Creek downstream of Meandu Creek Dam is moderate due to:

- presence of a moderate variety of instream habitat types during the wet season, including deep pools, which provided habitat for a range of aquatic flora and fauna typical of the region
- provision of breeding habitat, with juvenile, intermediate and adult fish recorded
- provision of connectivity and fauna passage to upstream and downstream habitats but typically only during periods of high rainfall and flow
- provision of dry season refugia for aquatic flora and fauna, and

- an absence of core habitat for listed threatened species (though potential platypus habitat exists) and listed protected communities and areas.

2.8 Stygofauna

A stygofauna pilot study was completed at 10 bores in the vicinity of the Project in June 2019 as part of works undertaken for the K2E Project (refer to Figure 1.2 for bore locations; ESP 2021). No stygofauna were recorded from bores during the pilot study.

Based on the desktop review, the most likely potential habitat for stygofauna is the alluvium, which predominantly occurs along Meandu Creek and Yarraman Creek (with alluvium along Rocky Creek generally thin and unsaturated). Stygofauna communities are considered unlikely to occur in the other groundwater units within the Tarong Basin potentially impacted by the Project because:

- Basalt and residual soils – groundwater occurs within the secondary porosity of fractures or between and beneath flows where minor strikes of water may occur within interflow sediments, but all groundwater monitoring bores within and adjacent to Meandu Mine have historically been dry (given the lack of groundwater in the vicinity of Meandu Mine, stygofauna are unlikely to occur).
- Tarong beds, including:
 - Interburden, which is of low permeability and unlikely to be the water bearing unit (given the lack of groundwater, stygofauna are unlikely to occur).
 - Ace Seam, which is typically dry (given the lack of groundwater, stygofauna are unlikely to occur).
 - The general water bearing units (i.e. the King Seam and Queen Seam) are >60 to 100 m below ground level and stygofauna typically have a greater diversity closer to ground level (<30 m) and rarely occur >100 m below ground level. No stygofauna were found within the Queen Seam and King Seam bores during the pilot study. These units will be unaffected by the Project.
- Regolith – monitoring bores are generally dry, though the unit may become variably saturated following recharge (would only potentially support stygofauna at times).
- Maronghi Creek beds – groundwater occurs within fractures that are interpreted to be discontinuous and hydraulically isolated but within the Tarong Basin they are generally >100 m below ground level, and stygofauna rarely occur this deep.

3 Aquatic Ecology Constraints Assessment

3.1 Waterways and Wetlands

The Project support structures and other infrastructure will not result in the direct loss of mapped waterways, with the nineteen support structures located to avoid mapped waterways and wetlands. These structures will be positioned at least 50 m from mapped waterways and wetlands, where possible. Further, much of the transmission line easement will be overhead wires that will not directly impact the waterways below.

Heavy vehicle access to the transmission line is required during construction and for ongoing operation and maintenance. New access tracks over waterways will be avoided by preferentially using existing HQ Plantations access tracks, which may require minor upgrading to make them suitable for construction vehicle access. Between structures D1 and D5, a new access track will be constructed along the easement. Upgrades to existing access tracks and new access tracks may require bed level crossings. The construction of bed-level crossings typically involves the excavation of the crossing bed to an appropriate depth to provide a stable base. The excavation is then lined with a heavy duty geo-fabric, and filled with aggregate using a combination of rock sizes up to 150 mm to lock the rock into place. In some instances where it is not practical to undertake excavation works due to unfavourable soil properties, alternative solutions may be required which may include, but are not limited to the installation of bog mats or geomaterials.

The section of new access tracks between structures D1 and D5 crosses an upstream waterway of Black Creek (between structures D1 and D2; refer to Figure 2.3). This section of Black Creek is stream order two and likely to be of low ecological value. Aquatic habitats, flora and fauna are likely common and typical of the region, and immediately downstream the waterway forms part of the Meandu Mine and Tarong power stations water management systems. As such, potential impacts to the aquatic ecology from the new access track between structure D1 and D5 are expected to be minor.

The exact location and type of upgrades required to existing tracks is yet to be determined and will be dependent on the condition and requirements of each track. However, it is understood that there will be no upgrades required to existing access tracks that run along Rocky Creek proper (order four waterway). Where upgrades to existing access tracks are located high in the Rocky Creek catchment (stream order one or two) and within the HQ plantation, impacts are expected to be minor. During the field survey in July 2019, the five sites assessed at mapped waterways of Rocky Creek within the easement area did not contain any aquatic habitat, and had no defined bed or banks; as such, they were considered drainage depressions that would only convey overland flow during periods of high rainfall. They were highly disturbed by hoop pine plantation operations and terrestrial weeds (primarily lantana). Two unmapped dams within the easement were also assessed during the field survey, which consisted of small, dry depressions and contained limited aquatic habitat (emergent aquatic plants at one site only). Any aquatic habitats that may be present in unmapped dams and waterways in the upstream areas of Rocky Creek (stream order one or two in the HQ Plantation area) are likely to be common and typical of the region and while removal may mean a loss of available (poor value) aquatic habitat, this is not expected to impact aquatic ecology on a regional scale.

Overall directed impacts of the new access road that crosses the headwaters of Black Creek and upgrades to existing access roads located in the headwaters of Rocky Creek are expected to be minor given waterways in this area are of low ecological value and aquatic habitats, flora and fauna are common and typical of the region. Further direct impacts will be reduced by:

- limiting the disturbance at any one time by planning construction and using disturbed areas for laydown and storage areas
- maintaining fish passage where required (as outlined in Section 3.3), and
- after decommissioning where bed level crossings and access tracks are not required by the landholder, these will be removed, and bed and bank profiles returned to surrounding waterway profile.

3.2 Riparian Vegetation

An easement area approximately 60 m wide will be required along much of the transmission line. Full clearing of the hoop pine plantation areas within the easement is proposed. However, no clearing of the remnant semi-evergreen vine thicket and dry rainforest communities (RE12.5.13c) and limited clearing (40 m wide) of the high value regrowth vegetation (RE12.5.13c and RE12.11.11) between structures D1 and D5 is proposed. A cleared width of approximately 8.6 m for new access tracks will also be required. Riparian vegetation along waterways crossed by the easement or access roads may be removed. However, riparian vegetation along many of these waterways consists of hoop pine plantations and weeds. Removal of this vegetation is likely to result in minor impacts to waterways.

3.3 Waterway Barrier Works

Waterway crossings have the potential to prevent or restrict the movement of aquatic fauna, such as fish. Many fish migrate upstream and downstream, and between different aquatic habitats, at different stages of their life cycle, with stimuli for movement including small and large flow events and increases in water temperature. Spring and summer are generally the most important months for migration; however, maintaining fish passage is important throughout the year.

The preferred alignment crosses three mapped waterways for waterway barrier works, including (refer to Figure 2.6):

- two tributaries of Rocky Creek mapped as low (green) and moderate (amber) risk, and
- one tributary of Black Gully mapped as a low (green) risk.

The crossing at the two tributaries of Rocky Creek will be overhead wires above the waterway that will not impact fauna passage below. The tributary of Black Creek includes a new access track across the waterway that has the potential to impact the fauna passage. Assessment of the Black Gully crossing has not completed; however, this area is high in the catchment and heavily influenced by adjacent land use. This waterway is unlikely to be connected to breeding, feeding or refuge areas further upstream given the position in the catchment, and downstream is very poorly connected given it forms part of Meandu Mine

and Tarong power stations water management systems, including pumps, release valves and constructed dams and channels.

There may also be waterway crossings associated with upgrading existing tracks, with the exact location of upgrades yet to be determined. However, there will be no upgrades to Rocky Creek proper, which is mapped as a high (red) risk (refer to Figure 2.6). As such waterway crossings associated with upgrading existing tracks will only occur on the mapped low (green) and moderate (amber) risk waterways to the west of Rocky Creek proper (refer to Figure 2.6). Sites assessed in this area (along the easement) in July 2019, did not contain any aquatic habitat, and had no defined bed or banks; as such, they were considered drainage depressions that would only convey overland flow during periods of high rainfall. Two unmapped dams within the easement were also assessed during the field survey, which consisted of small, dry depressions and contained limited aquatic habitat (emergent aquatic plants at one site only). As such, fish passage is likely to be limited in these green and amber waterways in the headwaters of Rocky Creek due to the ephemeral nature of the waterways, and they unlikely to connect to any important breeding, feeding or refuge area further upstream.

Overall, potential impacts to fish passage in the headwaters of Black Creek and Rocky Creek (green and amber waterways) are considered minor and will be further reduced by the following measures:

- using previously cleared tracks for existing crossings to minimise new watercourse crossings
- designing of waterway crossings will be in accordance with State Code 18 (constructing or raising waterway barrier works in fish habitat), where required, and
- after decommissioning where access tracks are not required by the landholder, these will be removed, and bed and bank profiles returned to surrounding waterway profile.

3.4 Water Quality and Environmental Values

3.4.1 Bank Stability, Erosion and Stormwater Runoff

Vegetation clearing and earthworks for the Project have the potential to influence bank stability and erosion, which, in turn, can increase turbidity, sedimentation and nutrients in downstream waterways. Risks are greater during times of high flow when there is a greater risk of erosion and stormwater runoff, as well as close to the disturbed area and decrease with distance downstream.

Increased suspended sediment and/or sedimentation can potentially impact the health, composition and resilience of aquatic fauna and flora by affecting respiration, breeding and feeding (e.g. clogging fish gills) or by burying benthic communities. High levels of turbidity can impact growth and diversity of aquatic plants and algae as light required for photosynthesis is reduced (although there are few aquatic plants in the receiving environment). Increased nutrients can also lead to aquatic plant and algal blooms, potentially resulting in high dissolved oxygen concentrations during the day (during net photosynthesis), but very low dissolved oxygen concentrations during the night and early morning (when there is a net consumption of oxygen during respiration). In extreme cases, this can lead to

eutrophication and fish kills. However, species in the area are tolerant of variable water quality conditions, including periods of high suspended sediments, sedimentation, turbidity, and nutrients.

To minimise water quality impacts, construction of the proposed transmission line will be undertaken in a manner which:

- minimises the construction period and completes construction during the dry period (avoiding high runoff periods during the wet season, where possible), with construction currently planned to occur over 10 months likely commencing in February 2023 (noting the waterways in the area are dry for most of the year)
- minimises the impact on riparian vegetation
- minimises soil disturbance e.g. using a hand clearing (chainsaw) or a fella-buncher (or excavator with cutting attachment) to clear vegetation near watercourses
- cuts trees above ground level to increase bank stability, and
- ensures vegetation is re-established over disturbed ground.

A specific Erosion and Sediment Control Plan will be developed and implemented for the Project to minimise and manage impacts related to erosion. Development of this plan will be in accordance with the IECA Best Practice Erosion and Sediment Control Guidelines 2008 and the standard environmental controls of the Environmental Management Plan (EMP), including:

- minimising ground disturbance and retaining ground cover to reduce the potential erosion surface area
- undertaking progressive rehabilitation of disturbed areas as soon as practicable to establish ground cover, and
- undertaking visual assessments for the presence and effectiveness of erosion and sediment control structures and measures, particularly preceding significant rainfall events, in areas where soil disturbance has taken place.

Where these measures occur, impacts of bank stability, erosion and stormwater runoff are expected to be minor.

3.4.2 Fuels and Chemicals

There is a potential risk of fuels, oils and other chemicals required for vehicles and equipment used during the Project to spill and enter waterways, impacting water quality and aquatic ecology. Herbicides may also be used to manage vegetation during construction and operation. Hydrocarbons and other contaminants (such as herbicides) can impact growth, morphology, reproduction and development of aquatic flora and fauna. Acute and chronic toxic effects can also occur. The type, volume and concentration of hydrocarbons and other contaminants, along with environmental factors (e.g. dilution, mixing, existing exposure levels) determines the severity of impact. Where spills are small and short-term, aquatic ecosystems are likely to recover.

Impacts of fuel spills will be minimised by refuelling machinery and equipment off-site. In addition, the following measures in accordance with the EMP will be undertaken to ensure that the water quality of waterways is maintained including:

- Refuelling of vehicles and machinery is not to take place within 100 m of a watercourse or open drain. Where possible all refuelling will be off-site at an approved refuelling station.
- Vehicles will be well maintained avoid the risk of accidental fuel spillage. Any spillage will be cleaned up immediately.
- Spill kits are to be kept at the work area and monitored for restocking regularly. All machinery and vehicles carrying additional fuel/oil/diesel over 20 L are to be equipped with a spill kit at all times.
- Routine or major servicing of vehicles will not be undertaken within the easement.

Appropriate storage of chemicals and hydrocarbons, and implementation of appropriate containment and spill response procedures, will minimise any potential impacts associated with leaks and spills.

3.5 Waste and Litter

Waste and litter produced during construction and operation has the potential to entangle larger aquatic fauna and contribute to the degradation of water and sediment quality if it was to enter the aquatic ecosystems. However, waste will be in accordance with the EMP including:

- preparing and implementing a Waste Management Plan
- discarding of litter or cigarette butts to the ground or water body will be prohibited, and
- waste awaiting collection is to be left in a tidy and secure manner such that it does not have the potential to be windblown.

3.6 Pest Species

Increases in invasive species can lead to significant changes to the community structure and health of aquatic ecosystems through:

- out-competing native species for resources and space
- degrading habitat conditions as a result of feeding behaviours (fish) and growth patterns (plants)
- reducing water quality (e.g. changing dissolved oxygen levels or increasing turbidity), and
- resulting in the decline and/or displacement of species reducing the overall diversity of the community.

However, the Project is unlikely to result in the addition of new invasive species of aquatic flora or fauna, or the growth and spread of aquatic pest species provided that standard weed

hygiene protocols are implemented for vehicles and machinery during construction and maintenance activities. Further, a pre-construction weed survey will be undertaken prior to construction activities commencing and a post-construction weed survey will be undertaken after the first wet season once construction is finalised to manage weeds.

3.7 Riverine Protection

Powerlink will ensure that any excavation or placing fill in a waterway is carried out in accordance with the *Riverine Protection Permit Exemption Requirements (WSS/2013/726)* or is otherwise authorised under relevant legislation.

3.8 Groundwater Dependent Ecosystems

The Project is expected to have minor impacts on groundwater, with significant groundwater inflows not anticipated and any groundwater that enters footing sumps to be dewatered and disposed appropriately to avoid impacts to groundwater quality. Given stygofauna and surface expression GDEs are not expected to occur in the close vicinity of the Project, potential impacts to these are not expected.

3.9 Threatened or Significant Aquatic Species

Given listed threatened or otherwise significant aquatic species are unlikely to occur in the close vicinity of the Project, impacts are not expected to occur. Management of water quality through the EMP as outlined in Section 3.4 will further reduce potential impacts to any threatened or migratory species occurring downstream.

4 References

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State of Queensland 2022, *Queensland Globe Map of Waterways, Wetlands, and Surface Expression GDEs*, State of Queensland Department of Natural Resources, Mines and Energy.

Appendix A Transmission Line Site Habitat Assessments

TL1



General comments: Located on a mapped tributary of Rocky Creek within the easement. This site was dry at the time of the sampling event in June 2019 and was characterised as a drainage depression with no defined channel, bed or banks, likely conveying overland flow only during sustained high rainfall periods. Aquatic habitat condition and value were poor.

Channel characteristics

Main channel		Full channel	
Left bank height (m)	NA (no banks)	Left bank height (m)	NA (no banks)
Right bank height (m)	NA (no banks)	Right bank height (m)	NA (no banks)
Main channel width (m)	NA (no banks)	Bank full width	NA (no banks)
Wetted width (m)	0		

Site details

Water depth (m)	0	Site hydrology	Ephemeral
Water level (m)	Dry	Connectivity	Not connected
Flow	Dry		

Substrate characteristics

No channel was evident; substrate at site consisted of silt / clay soil

In-stream habitat characteristics

Shading of reach	Extensive (>75%)	Overhanging bank vegetation	None
Trailing back vegetation	None	Undercut banks	None
Deep pools (>1m deep)	None	Shallow pools (<1m deep)	None
Runs / glides	None	Riffles	None
Snags and woody debris	Extensive (>75%)	Branches	Little (1-0%)
Detritus	Extensive (>75%)	Periphyton	None
Filamentous algae	None	Moss	None
Aquatic plant (emergent)	None	Aquatic plant (submerged)	None
Aquatic plant (floating)	None	Aquatic plant (pest)	None

Riparian characteristics

No banks were evident so the riparian zone was undefined. Vegetation was continuous along the waterway, and consisted of hoop pine plantation with an understory of lantana. The site was highly disturbed by external influences including terrestrial weeds and forestry operations.

TLD1



General comments: Located on an unmapped dam in the Rocky Creek catchment immediately adjacent to the easement. This site was dry at the time of the sampling event in June 2019 and was characterised as a small, shallow depression with no permanent water. Aquatic habitat condition and value were poor.

Channel characteristics

Main channel		Full channel	
Left bank height (m)	NA (no banks)	Left bank height (m)	NA (no banks)
Right bank height (m)	NA (no banks)	Right bank height (m)	NA (no banks)
Main channel width (m)	NA (no banks)	Bank full width	NA (no banks)
Wetted width (m)	0		

Site details

Water depth (m)	0	Site hydrology	Ephemeral
Water level (m)	Dry	Connectivity	Not connected
Flow	Dry		

Substrate characteristics

Substrate at site consisted of silt / clay soil

In-stream habitat characteristics

Shading of reach	Extensive (>75%)	Overhanging bank vegetation	None
Trailing bank vegetation	None	Undercut banks	None
Deep pools (>1m deep)	None	Shallow pools (<1m deep)	None
Runs / glides	None	Riffles	None
Snags and woody debris	Extensive (>75%)	Branches	Little (1-0%)
Detritus	Extensive (>75%)	Periphyton	None
Filamentous algae	None	Moss	None
Aquatic plant (emergent)	None	Aquatic plant (submerged)	None
Aquatic plant (floating)	None	Aquatic plant (pest)	None

Riparian characteristics

No banks were evident so the riparian zone was undefined. Vegetation was continuous around depression, and consisted of hoop pine plantation with an understory of lantana. The site was highly disturbed by external influences including terrestrial weeds and forestry operations.

TL3



General comments: Located on a mapped tributary of Rocky Creek within the easement. This site was dry at the time of the sampling event in June 2019 and was characterised as a drainage depression with no defined channel, bed or banks, likely conveying overland flow only during sustained high rainfall periods. Aquatic habitat condition and value were poor.

Channel characteristics

Main channel		Full channel	
Left bank height (m)	NA (no banks)	Left bank height (m)	NA (no banks)
Right bank height (m)	NA (no banks)	Right bank height (m)	NA (no banks)
Main channel width (m)	NA (no banks)	Bank full width	NA (no banks)
Wetted width (m)	0		

Site details

Water depth (m)	0	Site hydrology	Ephemeral
Water level (m)	Dry	Connectivity	Not connected
Flow	Dry		

Substrate characteristics

No channel was evident; substrate at site consisted of silt / clay soil

In-stream habitat characteristics

Shading of reach	Extensive (>75%)	Overhanging bank vegetation	None
Trailing back vegetation	None	Undercut banks	None
Deep pools (>1m deep)	None	Shallow pools (<1m deep)	None
Runs / glides	None	Riffles	None
Snags and woody debris	Extensive (>75%)	Branches	Extensive (>75%)
Detritus	Extensive (>75%)	Periphyton	None
Filamentous algae	None	Moss	None
Aquatic plant (emergent)	None	Aquatic plant (submerged)	None
Aquatic plant (floating)	None	Aquatic plant (pest)	None

Riparian characteristics

No banks were evident so the riparian zone was undefined. Vegetation was continuous along the waterway, and consisted of hoop pine plantation with an understory of lantana. The site was highly disturbed by external influences including terrestrial weeds and forestry operations.

TL4



General comments: Located on a mapped tributary of Rocky Creek within the easement. This site was dry at the time of the sampling event in June 2019 and was characterised as a drainage depression with no defined channel, bed or banks, likely conveying overland flow only during sustained high rainfall periods. Aquatic habitat condition and value were poor.

Channel characteristics

Main channel		Full channel	
Left bank height (m)	NA (no banks)	Left bank height (m)	NA (no banks)
Right bank height (m)	NA (no banks)	Right bank height (m)	NA (no banks)
Main channel width (m)	NA (no banks)	Bank full width	NA (no banks)
Wetted width (m)	0		

Site details

Water depth (m)	0	Site hydrology	Ephemeral
Water level (m)	Dry	Connectivity	Not connected
Flow	Dry		

Substrate characteristics

No channel was evident; substrate at site consisted of silt / clay soil

In-stream habitat characteristics

Shading of reach	Extensive (>75%)	Overhanging bank vegetation	None
Trailing back vegetation	None	Undercut banks	None
Deep pools (>1m deep)	None	Shallow pools (<1m deep)	None
Runs / glides	None	Riffles	None
Snags and woody debris	Extensive (>75%)	Branches	Extensive (>75%)
Detritus	Extensive (>75%)	Periphyton	None
Filamentous algae	None	Moss	None
Aquatic plant (emergent)	None	Aquatic plant (submerged)	None
Aquatic plant (floating)	None	Aquatic plant (pest)	None

Riparian characteristics

No banks were evident so the riparian zone was undefined. Vegetation was continuous along the waterway, and consisted of native forest and hoop pine plantation with an understory of lantana in some areas. The site was highly disturbed by external influences including terrestrial weeds and forestry operations.

TLD2



General comments: Located on an unmapped dam in the Rocky Creek catchment within the easement, adjacent to site TL4. This site was dry at the time of the sampling event in June 2019 and was characterised as a small, shallow depression with no permanent water. Aquatic habitat condition and value were poor.

Channel characteristics

Main channel		Full channel	
Left bank height (m)	NA (no banks)	Left bank height (m)	NA (no banks)
Right bank height (m)	NA (no banks)	Right bank height (m)	NA (no banks)
Main channel width (m)	NA (no banks)	Bank full width	NA (no banks)
Wetted width (m)	0		

Site details

Water depth (m)	0	Site hydrology	Ephemeral
Water level (m)	Dry	Connectivity	Not connected
Flow	Dry		

Substrate characteristics

Substrate at site consisted of silt / clay

In-stream habitat characteristics

Shading of reach	Extensive (>75%)	Overhanging bank vegetation	None
Trailing back vegetation	None	Undercut banks	None
Deep pools (>1m deep)	None	Shallow pools (<1m deep)	None
Runs / glides	None	Riffles	None
Snags and woody debris	Extensive (>75%)	Branches	Little (1-10%)
Detritus	Extensive (>75%)	Periphyton	None
Filamentous algae	None	Moss	Some (10-50%)
Aquatic plant (emergent)	Little (1-10%)	Aquatic plant (submerged)	None
Aquatic plant (floating)	None	Aquatic plant (pest)	None

Riparian characteristics

Riparian vegetation was continuous around depression, and consisted of native forest with an understory of lantana in some sections. The site was highly disturbed by external influences including terrestrial weeds and nearby forestry operations.

TL5



General comments: Located on a mapped tributary of Rocky Creek 30 m north-west of the current easement (on the previous alignment). This site was dry at the time of the sampling event in June 2019 and was characterised as a drainage depression with no defined channel, bed or banks, likely conveying overland flow only during sustained high rainfall periods. Aquatic habitat condition and value were poor.

Channel characteristics

Main channel		Full channel	
Left bank height (m)	NA (no banks)	Left bank height (m)	NA (no banks)
Right bank height (m)	NA (no banks)	Right bank height (m)	NA (no banks)
Main channel width (m)	NA (no banks)	Bank full width	NA (no banks)
Wetted width (m)	0		

Site details

Water depth (m)	0	Site hydrology	Ephemeral
Water level (m)	Dry	Connectivity	Not connected
Flow	Dry		

Substrate characteristics

No channel was evident; substrate at site consisted of silt / clay soil.

In-stream habitat characteristics

Shading of reach	Extensive (>75%)	Overhanging bank vegetation	None
Trailing back vegetation	None	Undercut banks	None
Deep pools (>1m deep)	None	Shallow pools (<1m deep)	None
Runs / glides	None	Riffles	None
Snags and woody debris	Extensive (>75%)	Branches	Extensive (>75%)
Detritus	Extensive (>75%)	Periphyton	None
Filamentous algae	None	Moss	None
Aquatic plant (emergent)	None	Aquatic plant (submerged)	None
Aquatic plant (floating)	None	Aquatic plant (pest)	None

Riparian characteristics

No banks were evident so the riparian zone was undefined. Vegetation was continuous along the waterway, and consisted of hoop pine plantation with an understory of lantana. The site was highly disturbed by external influences including terrestrial weeds and forestry operations.

TL6



General comments: Located on a mapped tributary of Rocky Creek 80 m north-west of the current easement (on the previous alignment). This site was dry at the time of the sampling event in June 2019 and was characterised as a drainage depression with no defined channel, bed or banks, likely conveying overland flow only during sustained high rainfall periods. Aquatic habitat condition and value were poor.

Channel characteristics

Main channel		Full channel	
Left bank height (m)	NA (no banks)	Left bank height (m)	NA (no banks)
Right bank height (m)	NA (no banks)	Right bank height (m)	NA (no banks)
Main channel width (m)	NA (no banks)	Bank full width	NA (no banks)
Wetted width (m)	0		

Site details

Water depth (m)	0	Site hydrology	Ephemeral
Water level (m)	Dry	Connectivity	Not connected
Flow	Dry		

Substrate characteristics

No channel was evident; substrate at site consisted of silt / clay soil.

In-stream habitat characteristics

Shading of reach	Extensive (>75%)	Overhanging bank vegetation	None
Trailing back vegetation	None	Undercut banks	None
Deep pools (>1m deep)	None	Shallow pools (<1m deep)	None
Runs / glides	None	Riffles	None
Snags and woody debris	Extensive (>75%)	Branches	Extensive (>75%)
Detritus	Extensive (>75%)	Periphyton	None
Filamentous algae	None	Moss	None
Aquatic plant (emergent)	None	Aquatic plant (submerged)	None
Aquatic plant (floating)	None	Aquatic plant (pest)	None

Riparian characteristics

No banks were evident so the riparian zone was undefined. Vegetation was continuous along the waterway, and consisted of hoop pine plantation with an understory of lantana. The site was highly disturbed by external influences including terrestrial weeds and forestry operations.