Moorvale South Extension Project

Attachment D

AQUATIC ECOLOGY DESKTOP ASSESSMENT

Moorvale South Extension Project

Aquatic Ecology Desktop Assessment

Prepared for: E2M on behalf of Peabody Australia Pty Ltd

Prepared by Ecological Service Professionals Pty Ltd

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Acknowledgement of Country: In the spirit of reconciliation Ecological Service Professionals acknowledges the Koinjmal, Widi, Birriah, Barada Kabalbara Yetimarala, Jangga, Barada Barna, Wangan and Jagalingou peoples as the Traditional Custodians of lands and waters throughout the Isaac region where we have worked, and we recognise their connection to land, sea and community. We pay our respect to their Elders past and present and extend that respect to all Aboriginal and Torres Strait Islander peoples through our scientific work on country.

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1 Introduction

Moorvale South is an open cut coal project located approximately 30 kilometres (km) east of Moranbah in Central Queensland. It is owned by the Coppabella Moorvale Joint Venture (CMJV) and operated by Peabody Energy Australia Pty Ltd (Peabody). Moorvale South is a satellite to the existing Moorvale Coal Mine that is approximately 10km to the north and connected by a haul road corridor. Moorvale South mining operations are currently conducted within Mining Lease ML70354 and coal hauling occurs within ML70355 in accordance with Environmental Authority (EA) EPML00380113. The Moorvale South Extension Project (the Project) seeks an extension of the Moorvale South project within ML70355 and a proposed Mining Lease Application (MLA) area to the north (the Study area).

This report has been prepared by Ecological Service Professionals (ESP) for E2M Pty Ltd (E2M) on behalf of Peabody and provides a comprehensive desktop assessment of available information to describe the aquatic ecology of waterways in the Study area (including any significant aquatic habitat, flora and fauna) and the aquatic ecology legislative and guidelines potentially applicable to the Project. In addition, the findings of the desktop review have been used to inform the design of the baseline field surveys for the Project, which are outlined along with preliminary observations from the late-wet season survey completed in June 2023.

1.1 Scope of Works

This report summarises results of a comprehensive desktop review and gap analysis for the Study area, including:

- a summary of aquatic flora and fauna (including aquatic macroinvertebrates, fish, reptiles and mammals) known from, likely, or predicted to occur in the vicinity of the Study area
- a detailed assessment of aquatic ecological condition of waterways, wetlands and potential surface-expression groundwater dependent ecosystems (GDEs) in the vicinity of the Study area
- an assessment of the potential likelihood of occurrence of any Matters of National Environmental Significance (MNES) and Matters of State Environmental Significance (MSES)
- outline of potential gaps in current baseline knowledge relevant to aquatic ecology identified during the desktop review to support State and Federal approvals for the Project, and
- outline of the design of the baseline field surveys for the Project and preliminary observations from the late-wet season survey completed in June 2023.

2 Desktop Review Methods

A comprehensive desktop review was completed to summarise the known aquatic ecological values of waterways and wetlands in the vicinity of the Study area. This desktop review included an assessment of:

- State and Commonwealth legislation and guidelines relevant to aquatic ecology and potentially applicable to the Study area, and the information required to support an assessment of the Study area under the relevant legislation
- Environmental Values (EVs) and Water Quality Objectives (WQOs), including water, sediment and biological objectives
- database searches, including the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool (DCCEEW 2023a), the Queensland Government Wildlife Online database (DES 2023a), WetlandInfo (DES 2013a, 2013b) and Atlas of Living Australia (ALA) (ALA 2023)
- Queensland Government mapping resources including the Department of Environment and Science (DES) Queensland Wetlands Program (including GDE and Queensland Springs mapping; DES 2018), the Department of Agriculture and Fisheries (DAF) Queensland Waterways for Waterway Barrier Works spatial layer (DAF 2020); and, the Queensland Government Queensland Globe (Queensland Government 2023), including MSES (as they relate to aquatic ecological values only) and the Watercourse Identification Map (WIM)
- Aquatic Conservation Assessment (ACA) for the riverine (Inglis and Howell 2009) and non-riverine (Rollason and Howell 2012) wetlands of the Great Barrier Reef catchment
- data from Department of Regional Development, Manufacturing and Water (DRDMW) surface water quality monitoring station on the Isaac River at Deverill, approximately 12 km southeast of the Study area (station 130410A) between January 2021 and July 2023 (DRDMW 2023)
- review of available high-resolution aerial photography and other mapping resources, to determine whether the waterways within the Study area are likely to be waterways providing for fish passage, and
- review and summary of other available information and studies from the region, including existing receiving environment monitoring programs (REMPs) and assessments from Moorvale South and other mines in the region, where publicly available.

2.1 Limitations and assumptions

The assessment of the Study area was based on a desktop assessment and review of publicly available information only, including from Queensland State Government and

Commonwealth sources. Desktop assessments are limited by the availability and accuracy of publicly available information.

3 Desktop Review Results

3.1 Description of the Study Area

The assessment area for this desktop review comprised aquatic habitats within the Study area to the north of the existing Moorvale South project within ML70355; upstream of this Study area; and downstream of this Study area (in the receiving environment of North Creek).

3.1.1 Isaac River Sub-basin

The Study area is within the Isaac River sub-basin, which is part of the wider Fitzroy River Basin (Figure 3.1). The Isaac River sub-basin covers an area of approximately 22,364 square kilometres (km^2). The Isaac River originates north of Moranbah in the Great Dividing Range and flows in a south-easterly direction, flowing adjacent to the Study area and eventually discharging into the Mackenzie River approximately 150 km downstream of the Study area. Ultimately, the Mackenzie River joins the Fitzroy River, which flows initially north and then east towards the east coast of Queensland, discharging into the Coral Sea south-east of Rockhampton approximately 315 km downstream of Study area (Figure 3.1).

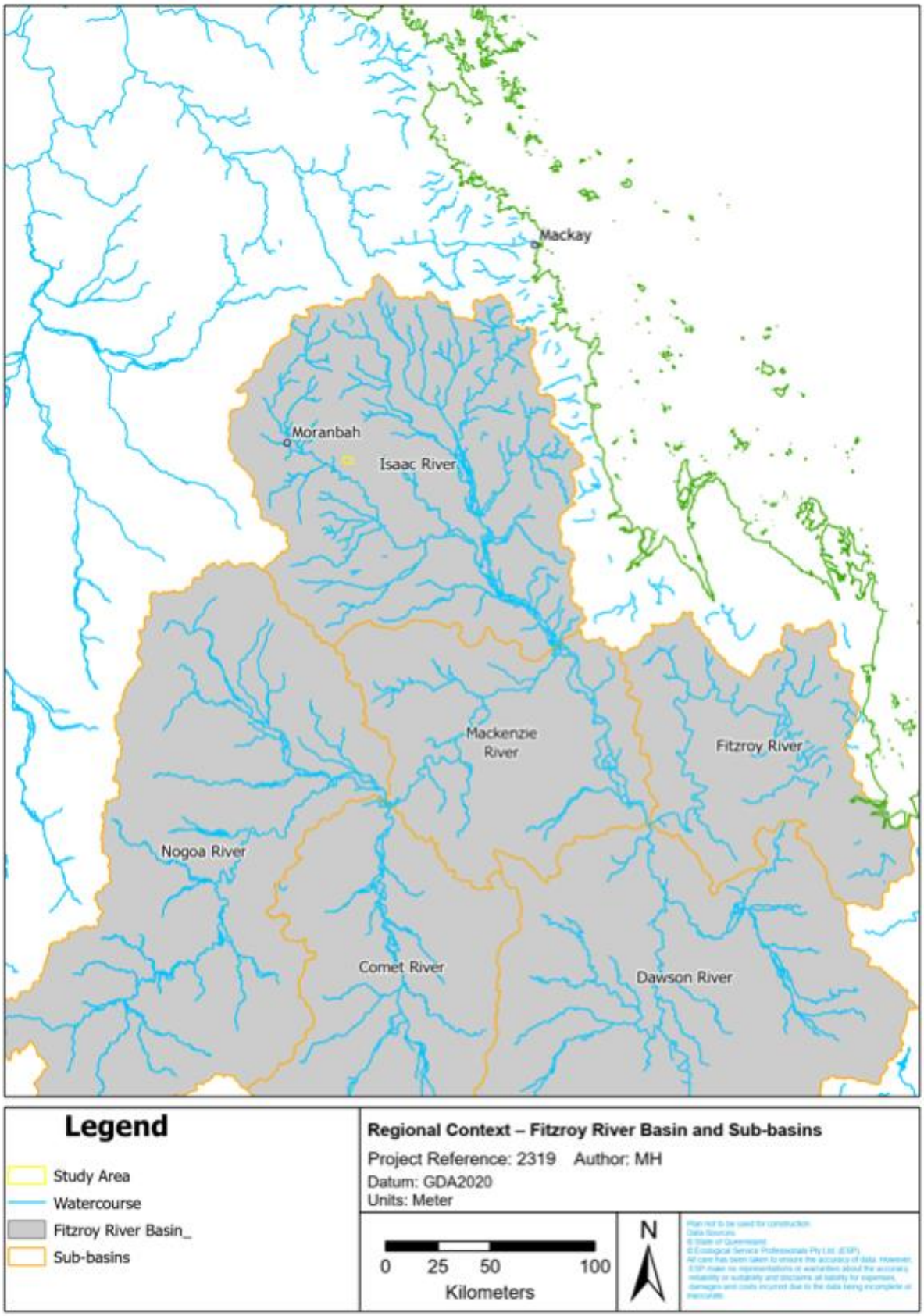

Figure 3.1 Regional context

3.1.2 Waterways and Wetlands in the Vicinity of the Project

A waterway is defined under the *Fisheries Act 1994* as freshwater and tidal waters, both permanent and ephemeral, including a drainage feature, river, creek, stream, watercourse, or inlet of the sea (DAF 2023). There are several waterways in the vicinity of the Study area (Figure 3.2). These include:

- the Isaac River, located approximately 9 km downstream of the Study area
- North Creek, adjacent to the Study area, and
- other unnamed tributaries upstream of, and within, the Study area

In addition to waterways, there are several mapped lacustrine wetlands in the vicinity of the Study area, mostly associated with Moorvale South Mine water storages adjacent to the Study area. However, only one of these lacustrine wetlands is located within the Study area (Figure 3.3). Several farm dams that are unmapped but may provide aquatic habitat are located upstream, within, and downstream of the Study area (based on desktop review of aerial imagery). Palustrine wetlands are also mapped in the region, none of which are within the Study area. The closest palustrine wetlands to the Study area are located along North Creek, approximately 1 km downstream, and approximately 5 km upstream of the Study area (Figure 3.3). There are also several palustrine wetlands along the Isaac River floodplain and associated tributaries, the closest of which is on an unnamed tributary of Devlin Creek, approximately 5 km west of the Project.

There are no High Ecological Significance (HES) wetlands regulated under the *Environmental Protection Act 1994* (EPBC Act) within the Study area; the closest HES wetland approximately 7 km from the Study area on the Isaac River (Figure 3.4). This wetland is upstream of the confluence of North Creek and the Isaac River. Downstream of the Project, the closest HES wetland is approximately 20 km downstream of the Study area and associated with the Isaac River floodplains. HES wetlands in the sub-basin are also mapped as wetland protection areas (WPAs) given they are in the Great Barrier Reef catchment. No wetlands of International or National importance occur in the Isaac River sub-basin (DES 2013b).

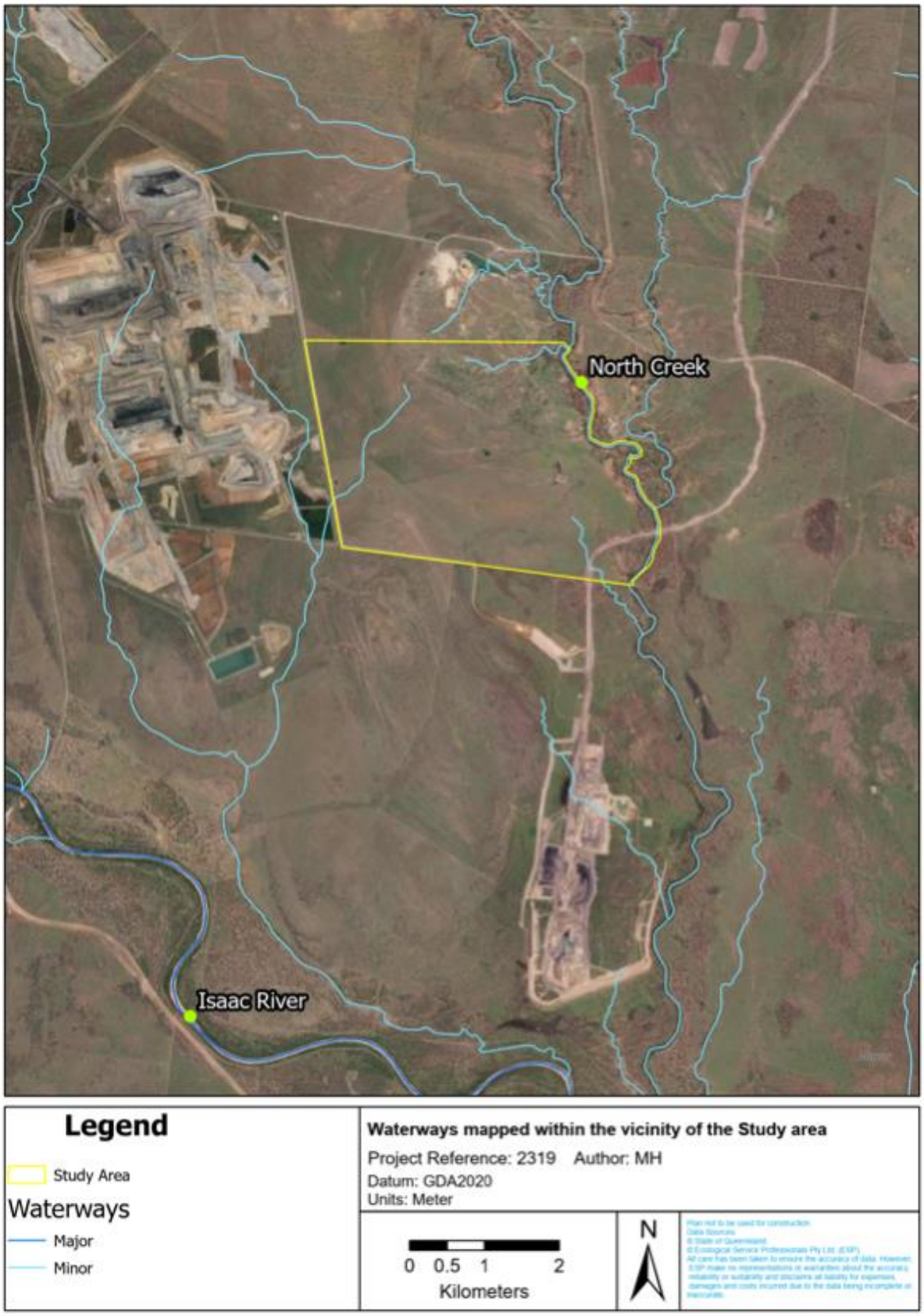

Figure 3.2 Waterways within the vicinity of the Study area

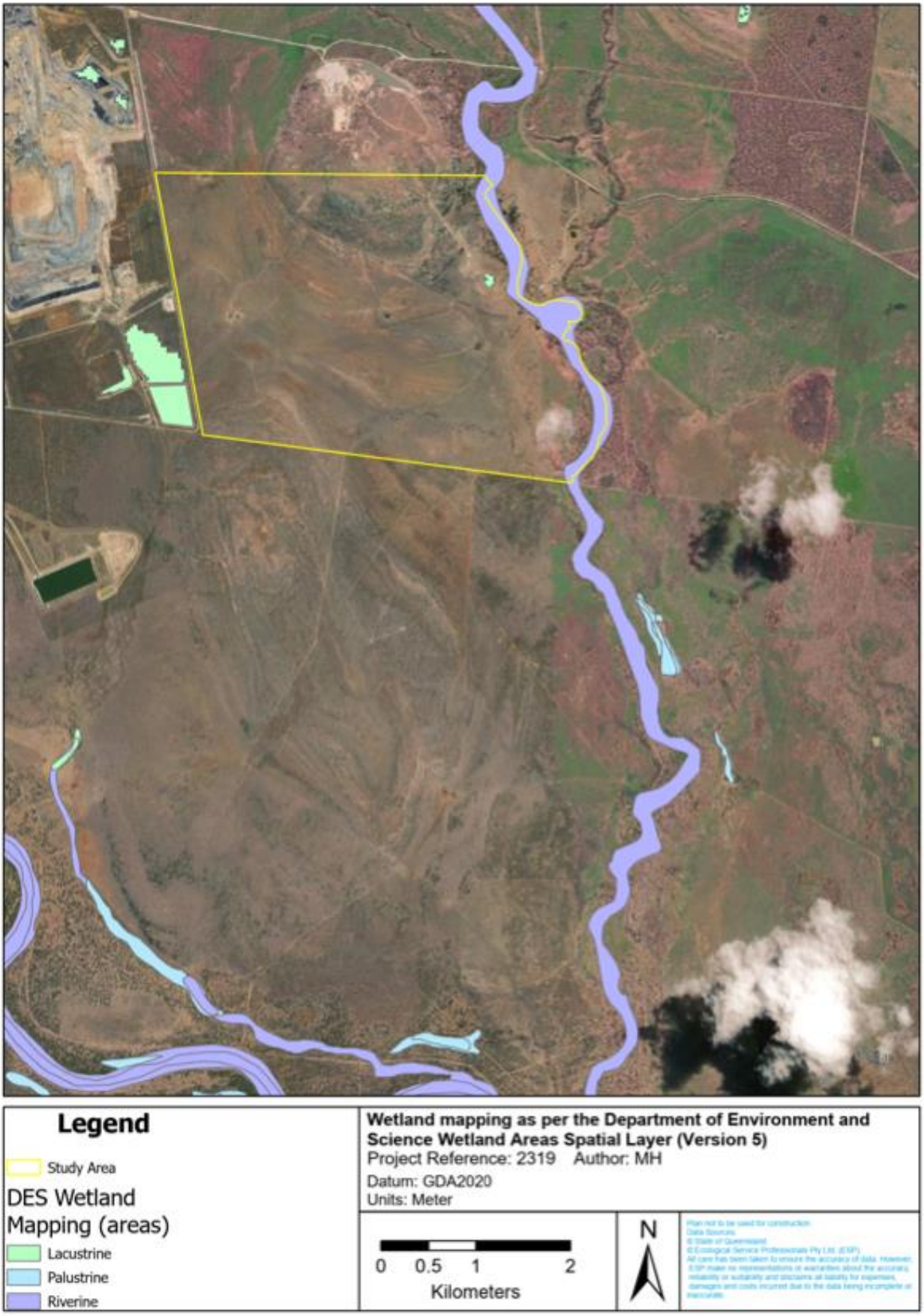

Figure 3.3 Wetlands within the vicinity of the Study area

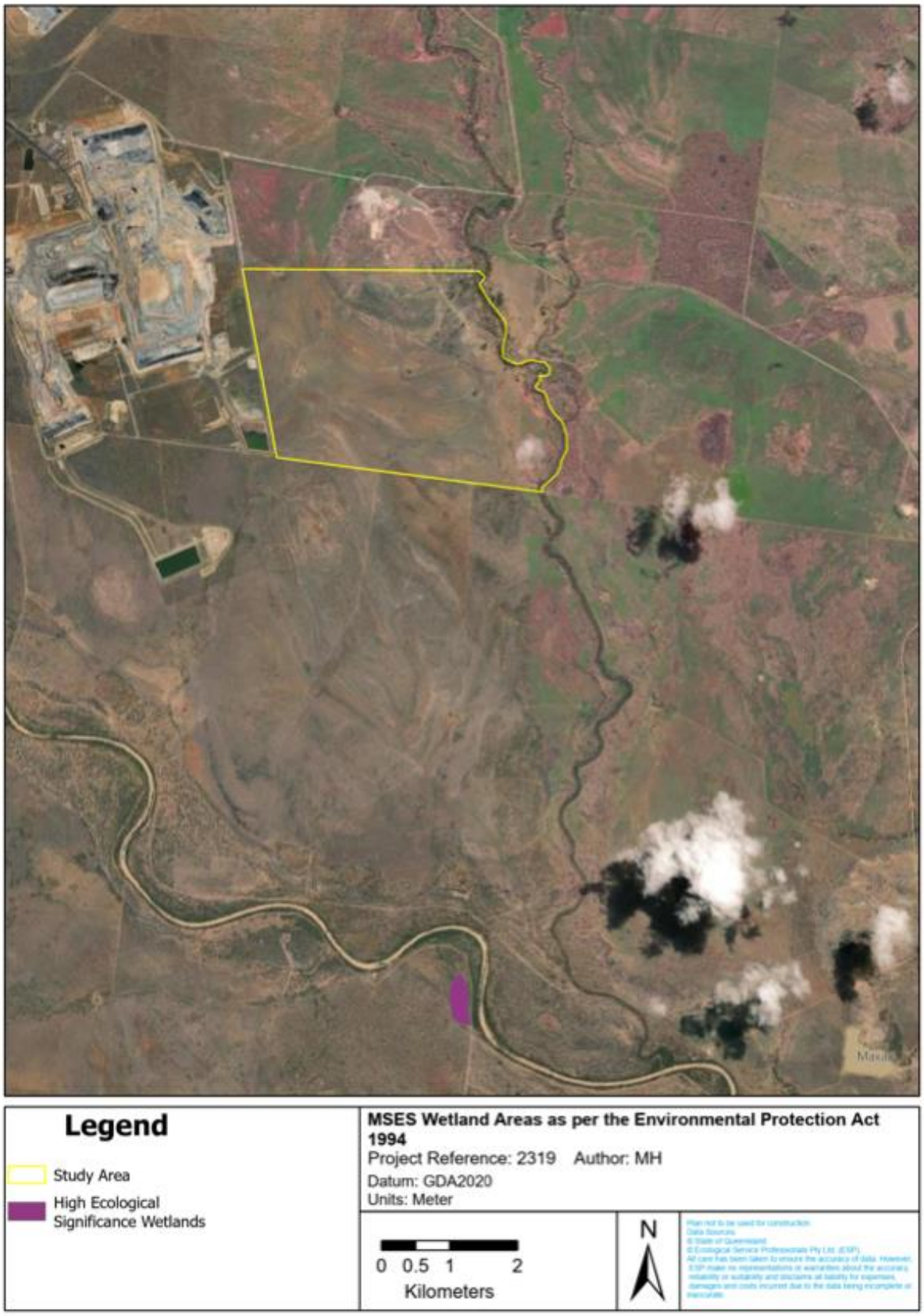

Figure 3.4 High Ecological Significance Wetlands within the vicinity of the Study area

3.1.3 Watercourses in the Vicinity of the Project

A watercourse is defined under the *Water Act 2000* (Water Act) as a river, creek, or other stream, including a stream in the form of an anabranch or a tributary, in which water flows permanently or intermittently, regardless of the frequency of flow events, and does not include drainage features (that lack a natural or artificial channel).

Within the vicinity of the Study area, the Isaac River is mapped as a 'watercourse', as defined by the Water Act (Figure 3.5), and one unnamed tributary within the Study area is mapped as a 'drainage' feature. All other waterways within and adjacent to the Study area, including North Creek, are unmapped (i.e. yet to be defined) under the Water Act.

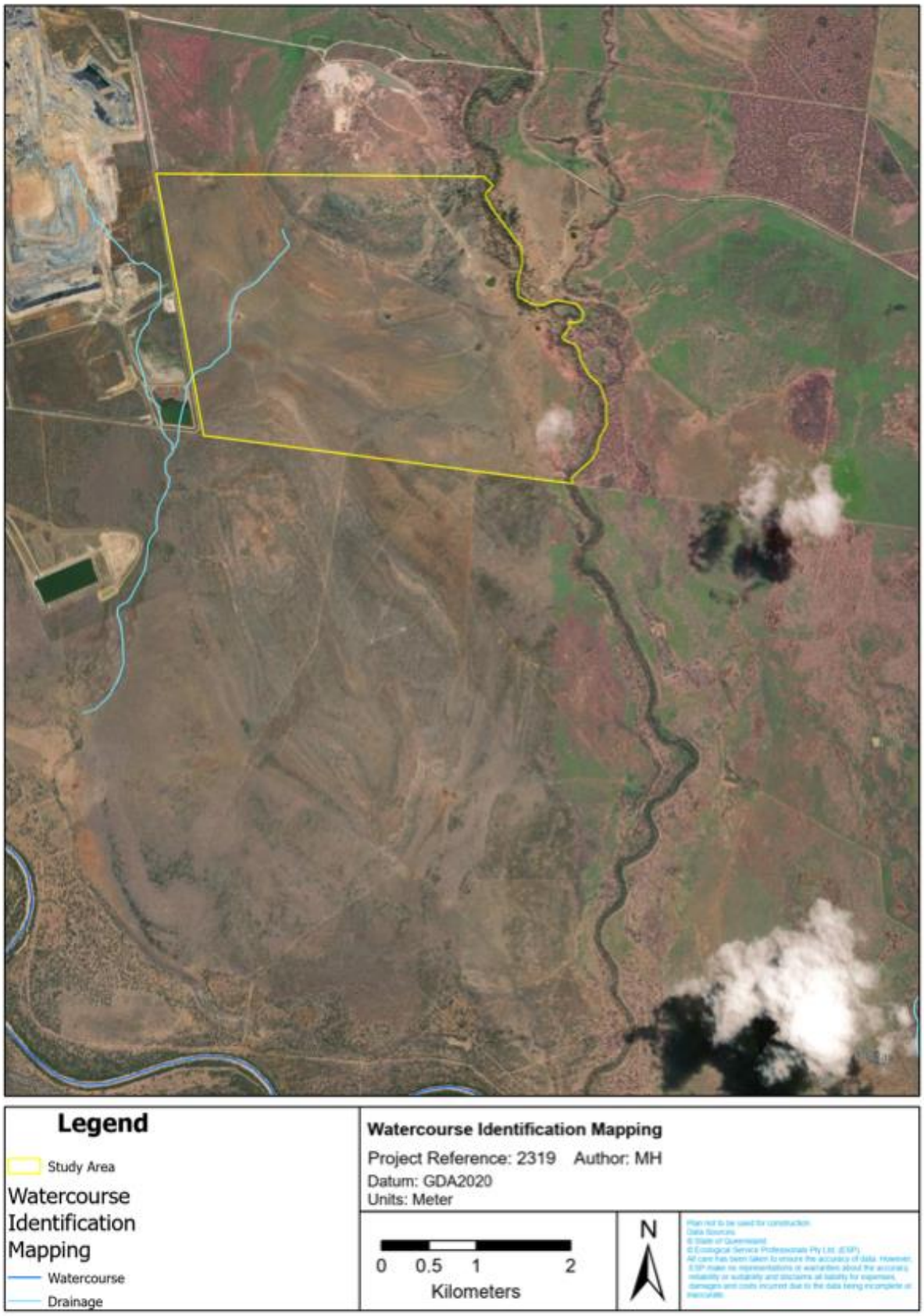

Figure 3.5 Mapped watercourses and drainage features in the vicinity of the Study area

3.2 Aquatic Habitat

3.2.1 Waterways

Land use within the Isaac River sub-basin is primarily grazing, but there are also numerous coal mines in the west of the catchment (Rollason & Howell 2012). Although broad-scale clearing is evident throughout the wider catchment, the riparian zone is typically in good condition, with moderate coverage of vegetation and minimal erosion. The catchment is currently less regulated than any of the other Fitzroy sub-catchments with only small dams occurring in the Upper Isaac River e.g. Burton Gorge Dam. There are significant quantities of water pumped from the Burdekin catchment to supply the needs of coal mining.

Natural waterways in the region are typically temporary or ephemeral streams, which are dry for most of the year and flow for a short time following rainfall events that are more common in the wet season. Intermittent pools that persist for several months may be present in certain reaches of these ephemeral waterways, particularly where clay substrates dominate the bed. During the dry season, larger permanent waterholes provide a refuge for aquatic flora and fauna.

The condition of freshwater habitats in the Isaac River sub-basin is monitored through Ecosystem Health Index Reports, coordinated by the Fitzroy Partnership for River Health (FPRH). A report card summarising the monitoring results is published annually, with grades ranging from ‘A’ to ‘F’ depending on a range of categories relating to the environmental health of the waterways (including physical/chemical, nutrients, toxicants, and ecology) (FPRH 2023). Monitoring carried out in 2021-2022 concluded that the Upper Isaac River sub-basin had an environmental condition grading of ‘B’ (i.e. good), which was an improvement from previous monitoring periods in 2019-2020 and 2020-2021 (both periods received a grading of ‘C’ i.e. fair). The grading of ‘B’ in 2021-2022 was attributed to mostly excellent or good water quality indicators (except for turbidity) and poor condition of macroinvertebrate communities, with low taxonomic richness and richness of sensitive taxa. Grades ranged from fair to fail for macroinvertebrate communities.

These results are consistent with the desktop ACA assessment for the riverine wetlands of the Great Barrier Reef catchment (Inglis and Howell 2009), which classified most waterways within the sub-basin as ‘medium’ conservation significance in accordance with the Aquatic Biodiversity Assessment and Mapping Method (AquaBAMM) (Clayton et al. 2006). Both North Creek (within the Project footprint) and the Isaac River (approximately 9km downstream of the study area) are classified as ‘medium’ conservation significance.

General habitat condition based on the Australian River Assessment System (AUSRIVAS) habitat assessment protocol in the wider Isaac River sub-basin is variable, ranging from poor to good (DPM 2018, ESP 2021a, ESP 2021b). Typically, habitat condition has been described as poor to fair in minor waterways (low stream order) and moderate to good in major waterways (high stream order) within the region (DPM 2018, ESP 2021,ESP 2021b, frc environmental 2018). The Isaac River and North Creek have clearly defined bed and banks, with the banks having low to moderate stability and evidence of erosion. There was a lack habitat features at farm dam sites previously surveyed (frc environmental 2020a).

3.2.2 Lacustrine Wetlands and Farm Dams

According to the desktop ACA assessment for non-riverine (Rollason and Howell 2012) wetlands of the Great Barrier Reef catchment, lacustrine waterbodies within the Study area and broader region (where mapped) are classified as 'medium' or 'high' conservation significance. Aquatic habitat features of farm dams in the vicinity of the Study area are limited to a slight variation in water depth (frc environmental 2020a).

3.2.3 Palustrine Wetlands

According to the desktop ACA assessment for non-riverine (Rollason and Howell 2012) wetlands of the Great Barrier Reef catchment, all mapped palustrine wetlands within 5km of the Study area are mapped as 'medium' conservation significance.

The mapped palustrine wetlands along the Isaac River floodplain (i.e. approximately 10km downstream of the Project footprint) are mapped as 'medium', 'high' and 'very high' conservation significance. Aquatic habitat features of palustrine wetlands previously surveyed in the vicinity of the Study area were limited to a slight variation in water depth (frc environmental 2020a).

3.3 Environmental Values

The quality of natural waters in Queensland is protected under the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (EPP (WWB)). The EPP (WWB) outlines the EVs that may apply to waters in Queensland. For the aquatic ecosystem EV, it also describes various levels of protection and associated WQOs, including for high ecological value (HEV), slightly disturbed, moderately disturbed, and highly disturbed waters.

The waters of North Creek and its tributaries are classified as being within the Isaac northern tributaries sub-catchment under Schedule 1 of the EPP (WWB) (DEHP 2011), with the following EVs (DEHP 2013):

- aquatic ecosystems (moderately disturbed)
- farm supply / use
- stock water
- human consumer
- primary, secondary and visual recreation
- drinking water
- industrial use, and
- cultural and spiritual values.

There are no HEV waters within the Study area or in the vicinity of the Project.

3.4 Water Quality

Water quality in the Isaac River sub-basin can be highly variable over time, primarily due to the ephemeral nature of the waterways. Monitoring carried out in 2021 – 2022 for the

Ecosystem Health Index Report concluded that water quality for the Upper Isaac River sub-basin was characterised by mostly good to excellent physicochemical water quality (except turbidity levels, which were fair), good nutrient concentrations, and good to excellent concentrations of metals and metalloids (FPRH 2023). This was an improvement from 2020 – 2021, when water quality in the Upper Isaac sub-basin was graded as 'fair'.

Results from DRDMW (2021-2023) surface water quality monitoring station (station no.130410A) on the Isaac River showed:

- neutral to alkaline pH, with median values within the WQO range
- variable electrical conductivity, but typically above the WQO
- turbidity was generally low, often falling under the WQO
- moderate concentrations of nutrients, with total nitrogen concentrations sometimes above the WQO, and
- low concentrations of most metal parameters

Results from the existing Moorvale South REMP completed across sites at North Creek and its tributaries, and the Isaac River in the vicinity of the Study area in 2018 were generally consistent with results from the broader region (frc environmental 2018). Overall, water quality sampled during the Moorvale South REMP in 2018 showed:

- mildly alkaline pH, typically outside or just outside of the WQO range
- variable dissolved oxygen, often within or below the WQO range
- low electrical conductivity, typically below the WQO range
- high turbidity and total suspended solids, typically within the WQOs, although some sites were above WQO
- low concentrations of nutrients, below the WQO range, and
- low concentrations of most dissolved metal parameters, although concentrations of aluminium and copper were occasionally high.

Results from water quality sampling completed for other EIS's in the vicinity of the Project (including Olive Downs Coking Coal Project (DPM Enviroscienses 2018), Winchester South Project (ESP 2021a), the Moorvale South Coal Project (frc environmental 2020a), and Horse Pit Extension Project (ESP 2021b) were generally similar to those in the Moorvale South REMP described above.

3.5 Sediment Quality

Sediment quality in North Creek and its tributaries, and the Isaac River in the vicinity of the Study area is routinely monitored as part of the Moorvale South REMP. Recent REMP sampling in 2018 showed that sediment quality was good, and typically characterised by (frc environmental 2018):

- bed sediments dominated by sand, with small amounts of clay, silt and gravel, and

- low concentrations, below the relevant default guideline values (DGV)s, for metals, hydrocarbons, and other tested analytes, with the exception of silver, which was below the limit of reporting (LOR), but above the DGV.

Results from sediment quality sampling completed for other Project in the vicinity of the Project (including the Winchester South Project (ESP 2021a), and Horse Pit Extension Project (ESP 2021b)) were generally similar to those described above. Bed sediments were dominated by fine sediments (predominantly silt and sand), with small amounts of gravel (ESP 2021b). Concentrations of most metals and metalloids in sediment were low and below relevant DGVs, except for chromium and nickel which were occasionally high (ESP 2021a, ESP 2021b).

3.6 Aquatic Plants

Aquatic plant communities of the Fitzroy River basin are generally sparse with a low diversity of species, which has been attributed to the naturally harsh environmental conditions and variable water availability of ephemeral waterways and cattle grazing and trampling (Negus 2007). Across the Isaac River sub-basin, 113 aquatic plant species (i.e. species listed as wetland indicator species) have been recorded, none of which are listed as threatened under State or Commonwealth legislation (DES 2013b). Of these species, 38 species have been recorded from waterways in and around the Study area during previous surveys (DPM Enviros ciences 2018, ESP 2021a, ESP 2021b). There are no published records of any aquatic plant species that are listed as threatened under the *Nature Conservation Act 1992* (NC Act) and the EPBC Act within 50 km of the Study area (DCCEEW 2023a, DES 2023a). Previous surveys in the region have indicated that aquatic plant communities in the waterways were typically dominated by emergent species such as rushes, sedges and / or grasses with a greater diversity and abundance typically recorded during and following the wet season (DPM Enviros ciences 2018, ESP2021a, ESP 2021b). Wetlands and farm dams that retained water for the majority of the year support a higher diversity of aquatic plants compared to waterways (DPM Enviros ciences 2018, ESP2021a, ESP 2021b).

Thirteen species listed as priority flora in the Fitzroy Region ACA are known from the Isaac River sub-basin (listed as wetland indicator species; DES 2023a):

- tall flatsedge (*Cyperus exaltatus*)
- rush (*Eleocharis dulcis*)
- tall spikerush (*Eleocharis sphacelata*)
- sword grass (*Gahnia sieberiana*)
- swamp rise grass (*Leersia hexandra*)
- black tea-tree (*Melaleuca bracteata*)
- broad-leaved tea-tree (*Melaleuca leucadendra*)
- snow-in summer (*Melaleuca linariifolia*)
- weeping bottlebrush (*Melaleuca viminalis*)
- native water hyacynth (*Monochoria cyanea*)

- water milfoil (*Myriophyllum verrucosum*)
- water nymph (*Najas tenuifolia*)
- giant waterlilly (*Nymphaea gigantea*), and
- water snowflake (Nymphoides indica)

These species are priority species as they can form significant macrophyte beds providing important habitat and source of food for fauna species, or are particularly subject to threatening processes (Rollason and Howell 2012).

Nine introduced aquatic plant species have been recorded from the Isaac River sub-basin (DES 2013a; Isaac Regional Council 2019):

- white eclipta (*Eclipta prostrata*)
- watercress (*Rorippa nasturtium-aquaticum*)
- yellow nutgrass (*Cyperus esculentus*)
- toad rush (*Juncus bufonius*)
- awnless barnyard grass (*Echinochloa colona*)
- olive hymenachne (*Hymenachne amplexicaulis* 'Olive')
- para grass (*Urochloa mutica*)
- water lettuce (*Pistia stratiotes*), and
- Hymenachne (*Hymenachne aplexicaulis*).

Olive Hymenachne, water lettuce and Hymenachne are Weed of National Significance (WoNS) and a listed as Category 3 restricted invasive plant under the Queensland *Biosecurity Act 2014* (Biosecurity Act). Olive Hymenachne is regarded as one of the worst weeds in Australia because of its invasiveness, potential for spread, economic and environmental impacts.

3.7 Aquatic Macroinvertebrates

Macroinvertebrate communities in the region are considered to be in moderate to good condition, although community health and composition can be variable and are influenced by surrounding land-use and habitat conditions as well as seasonality. In the 2020 – 2021 Fitzroy Partnership for River Health report card results, the taxonomic richness, PET Richness and SIGNAL 2 scores of macroinvertebrate communities in the Upper Isaac River catchment were poor; however, these results were similar to or healthier than surrounding catchments in the vicinity, and similar to previous results (FPRH 2022). In the 2021 – 2022 Fitzroy Partnership for River Health report card results, the taxonomic richness of macroinvertebrate communities in the Upper Isaac River catchment had a fail score, while PET Richness and SIGNAL 2 scores had improved since 2020 – 2021 and were fair (FPRH 2023).

In previous studies in the vicinity of the Study area, taxonomic richness, PET Richness, and SIGNAL 2 scores for macroinvertebrate communities were typically below or within biological

guideline ranges derived for the Isaac River sub-basin, indicating that macroinvertebrate communities were in low to moderate condition (DPM Enviros ciences 2018, ESP 2021a, ESP 2021b).

Results from the 2018 Olive Downs North REMP (now called the Moorvale South Mine; frc 2018) were consistent with what has been described from previous studies in the broader region (DPM 2018, ESP 2021a,b). Generally, there was high variability in macroinvertebrate indicator scores across sites upstream and downstream of mining activities. Macroinvertebrate indices at most sites were within or above the biological guideline range derived for the Isaac River sub-basin. SIGNAL 2 scores / family bi-plots suggested that habitat conditions were generally favourable for macroinvertebrate communities with some influence from harsh physical conditions, such as those usually associated with ephemeral waterways.

Five groups of macrocrustaceans are known from the region and have been recorded during previous surveys in the vicinity of the Project (DPM Enviros ciences 2018, ESP 2021a):

- fairy shrimp (order Anostraca)
- freshwater shrimp (family Atyidae)
- freshwater prawns (family Palaemonidae)
- yabbies (family Parastacidae), and
- freshwater crab (family Gecarcinucidae).

No exotic or threatened macroinvertebrate or macrocrustacean species were recorded in previous surveys completed on the waterways and wetlands in the vicinity of the Study area (DPM Enviros ciences 2018, ESP 2021a, ESP 2021b, frc environmental 2018, Gauge Industrial & Environmental 2020), and no records of listed macroinvertebrates or macrocrustaceans are known from the Fitzroy River basin and Isaac River sub-basin (DES 2022a).

3.8 Stygofauna

The occurrence of stygofauna communities within the Bowen basin is poorly understood. A previous review of stygofauna studies in the Bowen basin concluded that stygofauna are rare or unlikely to occur within the bedrock (4T 2012). However, they are considered likely to occur in some of the unconsolidated sandy sediments associated with the Isaac River floodplain due to the high porosity, suitable hydraulic conductivity, and interconnectivity. In alluvial sediments, stygofauna are typically found in shallow depths (<20 m), and at electrical conductivity levels of less than 2,000 µS/cm, though they still may occur outside of this range (4T 2012).

Stygofauna may be present in the Quaternary alluvial aquifers in the wider vicinity of the Study area. The Isaac River and its tributaries are ephemeral, particularly in the upper reaches (which often experience prolonged dry periods) (4T 2012). Along with varied permeability, this indicates that the distribution of stygofauna in the upper reaches of the alluvium further from the main rivers, may only be highly localised (i.e. where there is sufficient groundwater storage to sustain populations) (4T 2012). In the lower reaches, and

where there are confluences and extensive river alluvium deposits, the likelihood of saturation and therefore the likelihood of occurrence of stygofauna is greater.

Stygofauna sampling has recently occurred in the vicinity of the Study area as part of stygofauna pilot studies for the following:

- two bores in the Isaac River alluvium were sampled for the Olive Downs Project EIS (located approximately 5 km south of the Study area; DPM Enviros ciences 2018)
- 23 bores (several of which were located in alluvium) were sampled for the Horse Pit Extension Project (located approximately 24 km west of the Study area; ESP 2021b)
- 10 bores (including bores adjacent to the Isaac River) were sampled for the Isaac Downs Project (located approximately 16 km north-west of the Study area; frc environmental 2019), and
- 10 bores (none of which were located in alluvium) were sampled for the Vulcan Complex Project (located approximately 24 km southwest of the Study area; frc environmental 2020b).

No true stygofauna were recorded during these surveys, however they were considered likely to occur in the unconsolidated sediments of the Isaac River alluvium, in the lower reaches of the Isaac River and at the confluences of larger tributaries. Stygoxenic fauna were recorded during some of these surveys, but while stygoxenic fauna will use groundwater ecosystems, they are not dependent on groundwater to complete their lifecycle; that is, they are not obligate inhabitants of groundwater ecosystems and are unable to establish populations in such environments.

Two true (i.e. stygobitic) stygofauna taxa (ostracods from the family Candonidae, and syncarid shrimp) were recently recorded from bores targeting the Isaac River alluvium, sampled as part of the Winchester South Project (located 5 km south of the Study area and surveyed 17 bores; ESP 2021a) and the Moorvale South Coal Project (located immediately adjacent to the Study area; pers. Comms. Peabody Pty Ltd 2022). These findings are consistent with conclusions from all other studies listed above, which concluded that stygofauna are likely to occur in the Isaac River alluvium (DPM Enviros ciences 2018, frc environmental 2019, ESP 2021b).

Overall, aquifers within the Study area are considered to have a low likelihood of supporting stygofauna communities. Although stygofauna have been recorded from fractured rock aquifers (e.g. basalt and coal), they are less likely to occur where there is insufficient hydrological connection to limestone or alluvial aquifers (Doody 2019). However, stygofauna may occur in close vicinity to the Study area, particularly in the nearby North Creek and Isaac River alluvium.

3.9 Aquatic Vertebrates

3.9.1 Fish

There are 41 native species of fish known from the waterways of the Isaac River sub-basin, 15 of which have been recorded from within 20 km of the Project (DES 2013a,b, DES 2023a, DPM Enviros ciences 2018, ESP 2021, ESP 2022; Table 3.1). These species typically have a

wide range of habitat preferences (e.g. smaller drainage lines, larger rivers and wetlands) and are tolerant of a range of water quality conditions (including pH, salinity and dissolved oxygen concentrations). Of these taxa, three are considered endemic to the Fitzroy Basin: southern saratoga (*Scleropages leichardti*), leathery grunter (*Scortum hilli*) and golden perch (*Macquaria ambigua*) (Platten 2011).

Within the vicinity of Study area, a total of 15 species have been recorded in previous surveys, with seven species (including one exotic species, Mozambique tilapia, *Oreochromus mossambicus*) recorded from sites on waterways, and 15 species (including two exotic species, Mozambique tilapia and platy) recorded from sites on farm dams and wetlands (DPM Envirosciences 2018, ESP 2021a, ESP 2021b, ESP 2022, frc environmental 2012). Fish communities were dominated by small-bodied species, with the lack of large-bodied fish likely due to the paucity of deep pool habitats. Agassiz's glassfish (*Ambassis agassizii*) was the most widespread species, followed by Eastern rainbowfish (*Melanotaenia splendida splendida*) and carp gudgeons (*Hypseleotris* spp.) (DPM Envirosciences 2018, ESP 2021a, ESP 2021b, ESP 2022, frc environmental 2012). Fish were recorded at most (but not all) sites surveyed for fish (i.e. sites were suitable habitat was identified). Native species richness at each site varied substantially, from zero to ten species (DPM Envirosciences 2018, ESP 2021a, ESP 2021b, ESP 2022, frc environmental 2012). The lack, or low diversity, of native species across some survey sites may be indicative of the ephemeral nature of the waterways across the region, where complete wetting and drying within tributaries may limit the persistence of native fish. All native fish species identified during the previous fish surveys require some physical instream habitat for shelter and/or reproduction. A variety of physical aquatic habitat (e.g. woody debris and substrate diversity) also supports diverse macroinvertebrate communities, which are prey to many of the fish in the survey area. Most of the surveyed species can tolerate a broad range of water quality conditions.

Five exotic fish species have been recorded in the Isaac River sub-basin (DES 2022b):

- Mozambique tilapia
- goldfish (*Carassius auratus*)
- guppy (*Poecilia reticulata*)
- mosquitofish (*Gambusia holbrooki*), and
- platy (*Xiphophorus maculatus*).

Two of these species (Mozambique tilapia and platy) have been recorded in waterways within the region during previous surveys (DPM Envirosciences 2018, ESP 2021a, ESP 2021b). Mozambique tilapia and mosquitofish are restricted noxious fish under the Biosecurity Act; goldfish and platy are a non-indigenous fish that are declared pest fish when in the wild.

Two threatened species of fish listed under the EPBC Act were identified as possibly occurring in the Fitzroy drainage basin: silver perch (*Bidyanus bidyanus*) and Murray cod (*Maccullochella peelii*). The habitat preferences and ecology of these species are discussed further below in Section 4.2.1.1.

Table 3.1 Freshwater fish recorded from the region

Family *Species Name*	Common Name	Fitzroy River Basin [a]	Isaac River Sub-Basin [b]	Within 20 km of Project [c,d,e,f,g,h,i]
Ambassidae				
Ambassis agassizii	Agassiz's glassfish	Yes	Yes	Yes
Anguillidae				
Anguilla reinhardtii	longfin eel	Yes	Yes	Yes
Anguilla obscura	Pacific shortfin eel	Yes	No	No
Apogonidae				
Glossamia aprion	mouth almighty	Yes	Yes	No
Ariidae				
Neoarius graeffei	blue catfish	Yes	Yes	No
Atherinidae				
Craterocephalus marjoriae	silverstreak hardyhead	Yes	No	No
Craterocephalus stercusmuscarum	flyspecked hardyhead	Yes	Yes	Yes
Belonidae				
Strongylura krefftii	freshwater longtom	Yes	Yes	No
Centropomidae				
Lates calcarifer	barramundi	Yes	Yes	No
Cichlidae				
*Oreochromis mossambicus***	tilapia (Mozambique mouthbrooder)	Yes	Yes	Yes
Clupeidae				
Nematalosa erebi	bony bream	Yes	Yes	Yes
Cyprinidae				
*Carassius auratus**	goldfish	Yes	No	No
*Cyprinus carpio***	European carp	Yes	No	No
Eleotridae				
Gobiomorphus australis	striped gudgeon	Yes	No	No
Hypseleotris compressa	empire gudgeon	Yes	Yes	No
Hypseleotris galii	firetail gudgeon	Yes	Yes	Yes
Hypseleotris klunzingeri	western carp gudgeon	Yes	Yes	Yes
Hypseleotris spp.	common carp gudgeon	Yes	Yes	Yes
Hypseleotris sp.	Midgley's carp gudgeon	Yes	Yes	No
Hypseleotris sp.	Murray-Darling carp gudgeon	Yes	Yes	No
Mogurnda adspersa	southern purple-spotted gudgeon	Yes	Yes	Yes

Family *Species Name*	Common Name	Fitzroy River Basin [a]	Isaac River Sub-Basin [b]	Within 20 km of Project [c,d,e,f,g,h,i]
Oxyeleotris aruensis	Aru gudgeon	Yes	Yes	No
Oxyeleotris lineolata	sleepy cod	Yes	Yes	Yes
Philypnodon grandiceps	flathead gudgeon	Yes	Yes	No
Prionobutis microps	smalleye gudgeon	Yes	No	No
Gerreidae				
Gerres filamentosus	threadfin silverbiddy	Yes	Yes	No
Gobiidae				
Redigobius bikolanus	speckled goby	Yes	No	No
Pseudogobius species	blue-spot goby	Yes	No	No
Hemiramphidae				
Arrhamphus sclerolepis	snubnose garfish	Yes	Yes	No
Lutjanidae				
Lutjanus argentimaculatus	mangrove jack	Yes	No	No
Megalopidae				
Megalops cyprinoides	oxeye herring	Yes	No	No
Melanotaeniidae				
Melanotaenia splendida splendida	eastern rainbowfish	Yes	Yes	Yes
Rhadinocentrus ornatus	ornate rainbowfish	Yes	No	No
Melanotaenia fluviatilis	Murray River rainbowfish	Yes	No	No
Melanotaenia duboulayi	crimson-spotted rainbowfish	No	No	Yes
Monodactylidae				
Monodactylus argenteus	diamondfish	Yes	No	No
Mugilidae				
Mugil cephalus	sea mullet	Yes	Yes	No
Trachystoma petardi	freshwater mullet	Yes	No	No
Osteoglossidae				
Scleropages leichardti	southern saratoga	Yes	Yes	No
Percichthyidae				
*Maccullochella peelii****	Murray cod	Yes	No	No
Macquaria ambigua	golden perch	Yes	Yes	Yes
Plotosidae				
Neosilurus ater	black catfish	Yes	Yes	No
Neosilurus hyrtlii	Hyrtl's catfish	Yes	Yes	Yes
Porochilus rendahli	Rendahl's tandan	Yes	Yes	Yes

Family *Species Name*	Common Name	Fitzroy River Basin [a]	Isaac River Sub-Basin [b]	Within 20 km of Project [c,d,e,f,g,h,i]
Tandanus tandanus	freshwater catfish	Yes	Yes	Yes
Poeciliidae				
*Gambusia holbrooki***	mosquitofish	Yes	Yes	No
*Poecilia reticulata**	guppy	Yes	Yes	No
*Xiphophorus maculatus**	platy	Yes	Yes	Yes
Pseudomugilidae				
Pseudomugil signifer	Pacific blue eye	Yes	Yes	No
Retropinnidae				
Retropinna semoni	Australian smelt	Yes	Yes	Yes
Retropinnidae				
Scatophagus argus	spotted scat	Yes	No	No
Selenotoca multifasciata	striped scat	Yes	No	No
Scorpaenidae				
Notesthes robusta	bullrout	Yes	Yes	No
Synbranchidae				
Ophisternon gutturale	swamp eel	Yes	Yes	No
Terapontidae				
Amniataba percoides	barred grunter	Yes	Yes	Yes
*Bidyanus bidyanus****	silver perch	Yes	Yes	No
*Hephaestus fuliginosus*****	sooty grunter	Yes	No	No
Leiopotherapon unicolor	spangled perch	Yes	Yes	Yes
Scortum hillii	leathery grunter	Yes	Yes	Yes
Terapon jarbua	crescent grunter	Yes	No	No
Total No. Native Species		**53**	**41**	**15**
Total No. Exotic Species		**6**	**5**	**2**

* indicates introduced species
** indicates restricted noxious pest species under the *Biosecurity Act 2014*
*** indicates listed threatened species under the EPBC Act
**** indicates native species that is considered a pest in the Isaac River sub-basin
[a] Source: DES 2013a
[b] Source: DES 2013b
[c] Sources: DES 2023, ALA 2023, DPM Enviroscience 2018, ESP 2019, ESP 2021, ESP 2022, frc Environmental 2012 and frc environmental 2021

3.9.2 Turtles

Six species of native freshwater turtles are known to occur in the Isaac River sub-basin (DES 2013b):

- broad-shelled river turtle (*Chelodina expansa*)
- eastern snake-necked turtle (*Chelodina longicollis*)
- white throated snapping turtle (*Elseya albagula*)
- Krefft's river turtle (*Emydura macquarii krefftii*)
- Fitzroy River turtle (*Rheodytes leukops*), and
- saw-shelled turtle (*Wollumbinia latisternum*)

The broad-shelled river turtle, eastern snake-necked turtle, Krefft's river turtle and saw-shelled turtle are widely distributed on the east coast of Australia in rivers and wetlands. These turtle species are not listed under the EPBC Act and are listed as least concern under the NC Act (DES 2013b).

The white-throated snapping turtle is listed as critically endangered under the EPBC Act and endangered under the NC Act, while the Fitzroy River turtle is listed as vulnerable under both the EPBC Act and the NC Act (DES 2013b). Their preferred habitat, distribution and ecology is discussed further below in Section 4.1.3.1.

Previous surveys in the region have found that turtles are not particularly abundant or widespread throughout the waterways and wetlands in the vicinity of the Study area (ESP 2021a, 2021b), which is likely a reflection of the ephemeral nature of the region, where only isolated pools persist year-round and act as refugia for turtles.

Eastern snake-neck turtles and Krefft's river turtle are known to occur in the vicinity of the Study area and have been recorded in previous surveys completed on the Isaac River and surrounding waterways and wetlands (DPM Enviros ciences 2018, ESP 2021, ESP 2022; frc environmental 2019). Within the Study area, it is considered that the mapped lacustrine wetlands and farm dams would provide potential habitat for turtles.

3.9.3 Platypus

Platypus are considered to be an iconic species and are protected generally as 'Special Least Concern' under the NC Act.

Platypus occur in eastern Australia from Cooktown in north Queensland to Victoria and Tasmania. Platypus inhabit freshwater streams, rivers, lakes and dams. Platypus are typically nocturnal, feeding on aquatic invertebrates along the stream bed from dusk until dawn (Carrick et al 2008). When not active, platypus rest in burrows in the river bank that typically open at the water's edge amongst tree roots and overhanging vegetation. Platypus can tolerate a relatively wide range of environmental conditions, but prefer habitat that has an abundance of invertebrate prey, permanent pools and runs, moderate to good water quality, and steep well-vegetated banks for burrows. In Queensland, platypus are usually found in rivers east of the Great Dividing Range, but do occur in some western-flowing streams (ALA 2023).

No platypus or potential habitat for this species were recorded during previous surveys in the vicinity of the Study area (DPM Envirosciences 2018, ESP 2021a, ESP 2021b). There are no records of platypus from within 20 km of the Project (ALA 2023, DES 2023a,b). The closest record of platypus to the Project is recorded near Wandoo, approximately 70 km east of the Project (ALA 2023). Therefore, platypus are considered highly unlikely to occur in the vicinity of the Project.

3.10 Surface Expression Groundwater-Dependent Ecosystems

GDEs are ecosystems that require access to groundwater to meet all or some of their water requirements on a permanent or intermittent basis for maintenance of the ecosystem (Richardson et al. 2011). GDEs are classified by Doody et.al. (2019) into three broad types:

- ecosystems dependent on the surface-expression of groundwater (i.e. aquatic GDEs)
- aquifer and cave ecosystems (i.e. subterranean GDEs), and
- ecosystems dependent on the subsurface presence of groundwater (i.e. terrestrial GDEs, including some riparian vegetation communities).

This section provides an assessment of the potential occurrence of aquatic GDEs in the area surrounding the Project (assessment of terrestrial GDEs and subterranean GDEs is not part of this scope).

Aquatic GDEs in freshwater environments are classified as either (Doody et al. 2019):

- river baseflow systems (i.e. aquatic and riparian ecosystems that exist in or adjacent to streams which are fed by groundwater), or
- wetlands (i.e. aquatic communities and fringing vegetation dependent on groundwater fed lakes and wetlands, such as palustrine and lacustrine wetlands that receive groundwater discharge, and can include spring and swamp ecosystems).

Desktop mapping of potential aquatic GDEs in Queensland shows potential surface-expression GDE is located along North Creek and the Isaac River (Figure 3.6). Previous assessments completed have indicated that there were no surface expression aquatic GDEs along reaches of the Isaac River or North Creek due to (frc environmental 2019):

- these waterways not flowing all year and most floodplain palustrine wetlands do not hold water all year, excluding the artificial farm dams
- flow volumes in the Isaac River and North Creek not increasing in the absence of tributary inflows
- the level and extent of water of wetlands and farms dams varied between the two seasons surveyed, and
- there were no springs or seeps.

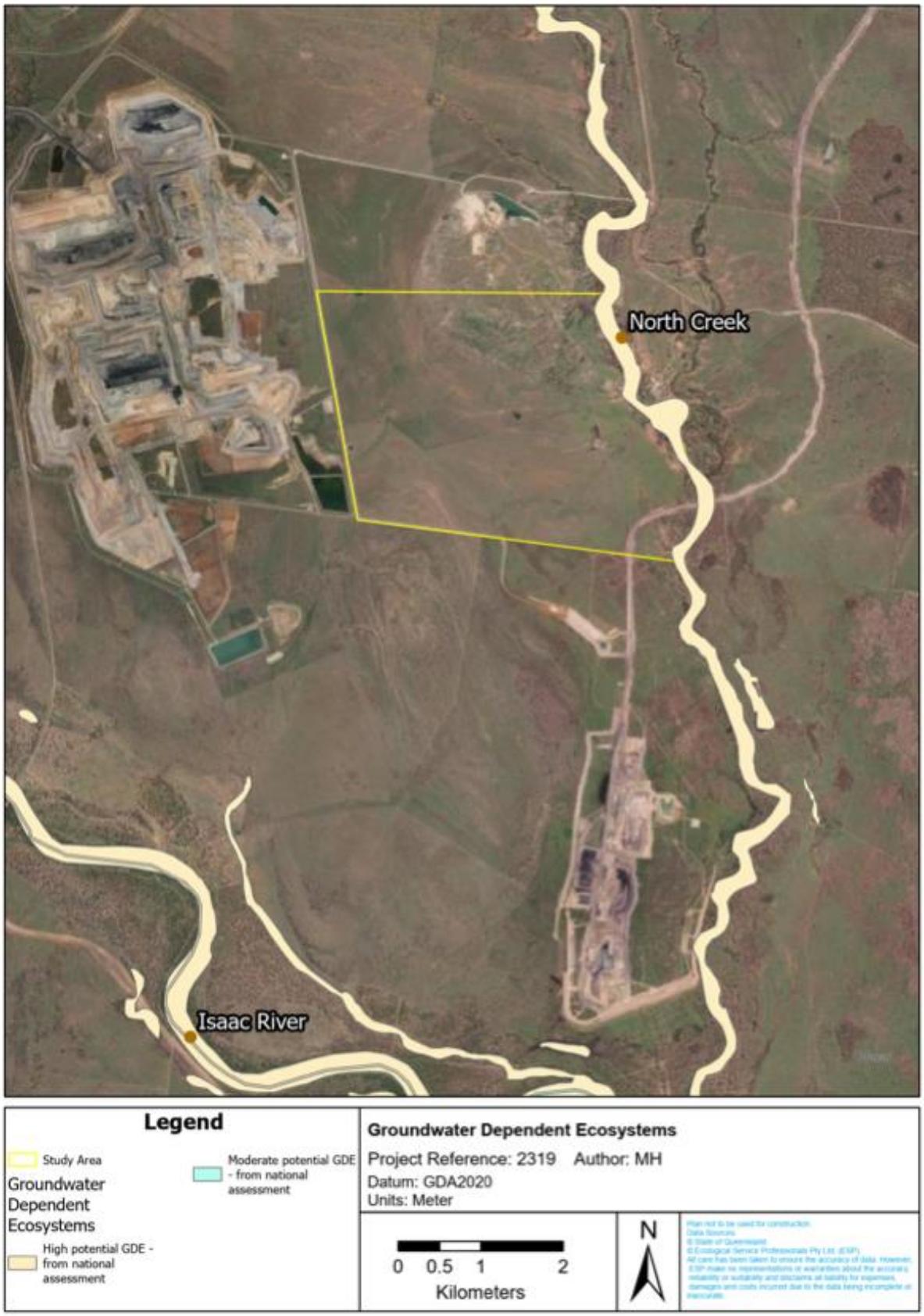

Figure 3.6 Mapped potential GDEs in the vicinity of the Project

4 Summary of MSES and MNES

4.1 Matters of State Environmental Significance

Several MSES relevant to aquatic ecology occur or have the potential to occur in the vicinity of the Project, including:

- watercourses and wetlands
- waterways providing for fish passage, and
- listed threatened species.

These matters are discussed in more detail in the sections below. No other aquatic MSES occur in the vicinity of the Study area, based on the desktop assessment. This result will be confirmed following completion of proposed seasonal baseline field surveys. Regulated vegetation and any threatened semi-aquatic species (e.g., frogs and waterbirds) will be addressed in the terrestrial ecology assessment.

4.1.1 Watercourses and Wetlands

No watercourses or wetlands that are MSES are present within the Study area. The closest HES wetland (and WPA) to the Study area is approximately 7 km away on the Isaac River (Figure 3.4). This wetland is upstream of the confluence of North Creek and the Isaac River. Downstream of the Project, the closest HES wetland (and WPA) is approximately 20 km downstream of the Study area and associated with the Isaac River floodplain.

4.1.2 Waterways Providing for Fish Passage

Many species of native fish known from the region 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 waterways in the vicinity of the Study area provide temporary habitat and aquatic fauna movement corridors during flow events.

The DAF Queensland Waterways for Waterway Barrier Works mapping indicates the level of ‘risk’ associated with undertaking waterway barrier works within Queensland waterways with regards to fish passage (DAF 2020). This dataset represents pre-development conditions and shows waterways which have been affected by mining activities in the region (and therefore does not reflect the current locations of waterways in the area).

Where works associated with the Project are undertaken on the mining lease under the conditions of an existing EA (and not a development approval), a waterway barrier works approval under the *Fisheries Act 1994* will not be required; however, fish passage requirements in the Study area need to be considered. In the vicinity of the Study area (Figure 4.1):

- the Isaac River (approximately 9km downstream of the Project) is mapped as major risk (purple) of impacts to fish passage

- North Creek (adjacent to the Project area) is mapped as major risk (purple) of impacts to fish passage, and
- other mapped tributaries upstream of and within Study area, and within the vicinity of the Study area are mapped as low (green) to moderate (amber) risk of impacts to fish passage.

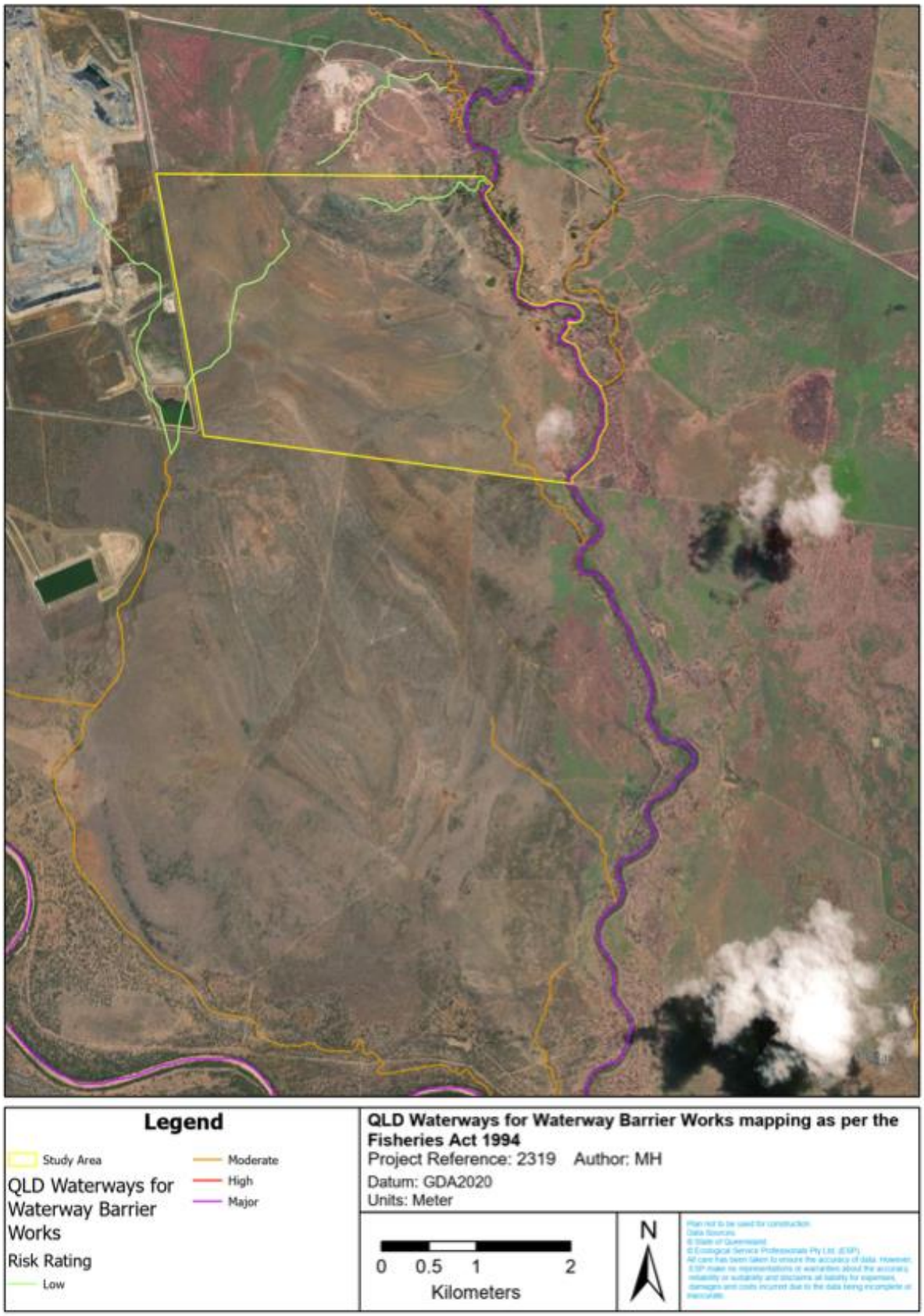

Figure 4.1 Waterway Barrier Works mapping in the vicinity of the Study area

4.1.3 Listed Threatened Species

4.1.3.1 Turtles

Two species of turtle listed as potentially occurring within 20 km of the Study area (DCCEEW 2023a) are threatened under the EPBC Act and NC Act: Fitzroy River turtle (listed as vulnerable under the NC Act) and white-throated snapping turtle (*Elseya albagula*; listed as endangered under the NC Act).

The Fitzroy River turtle is endemic to the natural, permanent riverine habitats in the middle to lower areas of the Fitzroy River basin in Queensland (Limpus et al 2011, DoCCEW 2023b), and has an estimated occurrence in a range of less than 10,000 km^2 (Cogger et al 1993). This species prefers permanent freshwater riverine reaches (particularly deep pools interspersed with areas of riffle habitat) and large, isolated permanent waterholes (Cogger 2000). Preferred areas have high water clarity, and are often associated with ribbonweed (*Vallisneria* sp.) beds (Cogger et al 1993, DCCEEW 2023b). Their distribution extends from the Fitzroy Barrage to the upper areas of the Dawson, Nogoa and Connors rivers. Known sites include Boolburra, Gainsford, Glenroy Crossing, Theodore, Baralaba, the Mackenzie River, the Connors River, Duaringa, Marlborough Creek and Gogango (Cogger et al 1993). Known key sites for the Fitzroy River turtle include Glenroy and Redbank crossings on the Fitzroy River, Theodore Weir on the Dawson River, Cardowan pump pool on the Connors River, and Marlborough Creek (Limpus et al 2011).

The white-throated snapping turtle is endemic to New Guinea and south-eastern Queensland, where it occurs in the Fitzroy, Mary and Burnett River basins and associated smaller drainages in south-eastern Queensland (Limpus et al 2011). This species prefers clear, flowing and well oxygenated rivers with sandy-gravel substrate that have suitable shelters and refuges (e.g. submerged rock crevices, undercut banks and/or submerged logs and fallen tree (Limpus et al 2011)). During the day, turtles occupy habitats of high shade (i.e. submerged logs, overhanging riparian vegetation), and at night they inhabit shallow riffles. White-throated snapping turtles are well-adapted for maintaining their position at specific foraging sites in very structured habitats such as log tangles and rocky outcrops with or without currents (Limpus et al 2011). In contrast to the Fitzroy River turtle, the white-throated snapping turtle has a wider distribution throughout the Fitzroy basin, occurring more widely in permanent freshwater habitat (Limpus et al 2011). It may also commonly occur in impoundments, having previously been recorded in (Limpus et al 2011).

There are no records of the Fitzroy River turtle or the white-throated snapping turtle from within 20 km of the Project (ALA 2023, DES 2023a). The closest record of the Fitzroy River turtle to the Study area is recorded near Lotus Creek, approximately 80 km southeast of the Study area, while the closest record of the white-throated snapping turtle is on Connors River, approximately 70 km southeast of the Study area (ALA 2023). Based on desktop assessment of known distribution and habitat preferences, the Fitzroy River turtle and the white-throated snapping turtle are unlikely to occur in any of the smaller watercourses within the Study area, and no core foraging or nesting habitat for these species is likely to exist. This conclusion is consistent with results from other recent assessments in the region (DPM Enviroscienses 2018, ESP 2021a, ESP 2021b). This finding will be confirmed following completion of proposed seasonal baseline field surveys.

4.1.3.2 Platypus

Platypus (listed as special least concern under the NC Act) are known to occur in the Isaac River sub-basin (DES 2013b). No platypus or potential habitat for this species were recorded during previous surveys in the vicinity of the Study area (DPM Envirosciences 2018, ESP 2021a, ESP 2021b) and there are no records of platypus from within 50 km of the Study area (ALA 2023; DES 2023a). While they are considered unlikely to occur in the vicinity of the Study area, this finding will be confirmed following completion of proposed seasonal baseline field surveys.

4.2 Matters of National Environmental Significance

Several MNES relevant to aquatic ecology occur or have the potential to occur in the vicinity of the Study area, including:

- listed threatened species, and
- a water resource, in relation to coal seam gas and large coal mining.

These matters are discussed in more detail in the sub-sections below. No other MNES (including threatened ecological communities) relating to aquatic ecology occur or are likely to occur within the vicinity of the Study area, based on the desktop assessment. This result will be confirmed following completion of proposed seasonable baseline field surveys.

4.2.1 Listed Threatened Species

4.2.1.1 Fish

Two species of fish known to occur in the Fitzroy Basin are threatened under the EPBC Act: silver perch (listed as critically endangered under the EPBC Act) and Murray cod (listed as vulnerable under the EPBC Act) (DCCEEW 2023).

The natural distribution of the silver perch is limited to the Murray-Darling basin and their preferred habitat is high flowing rivers (DCCEEW 2013), although it has been frequently translocated across Queensland (Pusey et al 2004). This species inhabits freshwater rivers, lakes and reservoirs, typically in areas of high water flow (DCCEEW 2013). Silver perch are a popular angling species and are also raised in aquaculture and in farm dams (Bray and Thompson 2019). They can migrate over large distances, moving between rivers and their tributaries. They are omnivorous and their diet includes larvae, molluscs, annelids and algae. Silver perch was not listed in the EPBC Protected Matters Search Tool Report, but it is known to occur approximately 21 km northeast of the Study area at Lake Bundoora (DCCEEW 2023a, ALA 2023), though no known stocking events have occurred in the lake in the last 10 years (State of Queensland 2020). There are no known records of this species occurring within 20 km of the Study area (DES 2023a, ALA 2023), including during previous fish surveys (ESP 2021a, ESP 2021b, DPM Envirosciences 2018). The waterways within the Study area do not provide the preferred habitat of this species (i.e. flowing riverine habitat) and they are considered highly unlikely to occur in the vicinity of the Study area.

The natural distribution of Murray cod is within the Murray-Darling basin only. This species was translocated to the Fitzroy River basin, and although the translocation is thought to have failed to establish a permanent population, the species is stocked throughout the basin

(Pusey et al 2004, NMCRT 2010, Ye et al 2014, DCCEEW 2023b). Murray cod are frequently found in main channels of rivers and larger tributaries and are considered main-channel specialists, preferring deep pools and channels with structurally complex features such as large rocks, snags, overhanging banks and vegetation, and woody debris (DCCEEW 2023b). They are considered apex predators, actively hunting throughout the water column, and aggressively attack other fish within their territories.

Murray cod was not listed in the EPBC Protected matters Search Tool Report (DCCEEW 2023a) as potentially occurring within 50 km of the Project footprint, and there are no records of this species from the Isaac River sub-basin (DES 2023a, ALA 2023), including during previous fish surveys (ESP 2021a, ESP 2021b, DPM Enviros ciences 2018). The closest known record of Murray cod is from Lake Maraboon, in the Nogoa River sub-basin, approximately 180 km south of the Study area, where they have historically been stocked (although not since the early 1990s; State of Queensland 2020). It is highly unlikely that this species would inhabit the waterways in the vicinity of the Study area given their ephemeral nature (i.e. lack of deep channel / pool habitat) and distance from their known range.

4.2.1.2 Turtles

Two species of turtle listed as potentially occurring within 20 km of the Study area are threatened under the EPBC Act (DCCEEW 2023a): Fitzroy River turtle and white-throated snapping turtle. These species are considered unlikely to occur in the vicinity of the Study area, as discussed above in Section 4.1.3.1.

4.2.2 Water Resources

Water resources relevant to aquatic ecology within the vicinity of the Study area based on desktop review include:

- waterways (which were generally ephemeral or intermittent in nature)
- lacustrine wetlands and farm dams (all if which appear modified by the presence of dams for agriculture or mining)
- palustrine wetlands, and
- mapped potential aquatic (i.e. surface-expression) GDEs.

5 Sampling Design and Methodology

5.1 Aquatic Ecology Surveys

Although broad-scale information regarding the aquatic ecological condition of waterways and wetlands in the wider Upper Isaac River sub-basin is available (as summarised in the desktop assessment above), limited recent data for aquatic ecological indicators is available for within the Study area and immediate surrounds (including North Creek and its tributaries). Given the paucity of data available from these waterways and wetlands, comprehensive seasonal baseline aquatic ecology surveys (i.e. one survey during the late-wet season, and one survey during the early-wet season) will be completed at waterways and wetlands in the vicinity of the Study area. The aquatic ecological indicators assessed include aquatic habitat (including bioassessment scores at waterway sites only), in-situ water quality, sediment quality, aquatic plants, macroinvertebrates, fish, turtles (if appropriate habitat is identified) and aquatic ecological value.

The late-wet season survey was completed in June 2023 (with preliminary observations provided in Section 6) and the early wet season survey is proposed for late 2023. Sampling methods for the proposed upcoming early wet season survey will be the same as outlined below for the late-wet survey, unless indicated.

5.1.1 Survey Site Locations

Sampling locations were distributed throughout waterways and wetlands upstream of, adjacent to, within and downstream of the Project area (refer to Section 6). It is understood based on Project information received to date that any potential impacts associated with the Project are most likely to occur within the catchment of North Creek (i.e. will not extend to the Isaac River or Isaac River floodplains); as such, survey sites were located on this waterway and its tributaries.

5.1.2 Aquatic Habitat

Aquatic habitat assessments were completed to describe the aquatic habitat condition, connectivity and value of each site. Assessments were based on the Australian River Assessment System (AUSRIVAS) habitat assessment protocol (DNRM 2001), modified where required to suit the purpose of this study (e.g. additional assessments to adequately identify the presence and value of potential habitat for listed threatened species). Observations for aquatic habitat value included:

- features of the water body, including bank height, estimate of flow, estimated width and depth of any standing water present
- details of the riparian zone (e.g. width, canopy height, species present) and adjacent land use
- aquatic habitat types present and their relative percent cover within the reach
- details of the sediment types present (e.g. relative composition of grain sizes, presence of anoxic sediments)
- details regarding any evidence of disturbances or impacts (if present) on aquatic ecosystems, and
- overall habitat condition and value.

Habitat assessments were completed using an electronic template to avoid transcription errors. Georeferenced photographs of the reach and key habitat features were also taken at each site. The aquatic habitat at each site was summarised to assist interpretation of the biological survey results.

At each site (excluding dry, wetland and dam sites), overall habitat condition was also assessed based on the river bioassessment score protocol described in the *Queensland Australian River Assessment System Sampling and Processing Manual* (DNRM 2001). Each site was assessed on a number of criteria and given a numeric score for each criterion. The sum of the numerical score from each criterion will be used to produce an overall habitat condition score during data analyses that allocates each site to one of four categories:

- >110 are considered to be in excellent condition,
- between 75 and 110 are considered to be in good condition,
- between 39 and 74 are considered to be in moderate condition, and
- ≤38 are considered to be in poor condition.

At each wetland site, ground-truthing was conducted to assess the extent of each wetland as per the *Queensland Wetland Definition and Delineation Guideline – Part A: A Guide to Existing Wetland Definitions and the Application of the Queensland Wetland Program Definition* (DERM 2010) and the *Queensland Wetland Definition and Delineation Guideline – Part B: Delineation and Mapping Guideline* (DERM 2011).

5.1.3 Water Quality

The surface water quality assessment is not designed as a comprehensive baseline survey of water quality for the Project. Further, there is currently existing data available for metals and metalloids and hydrocarbons from the region. As such, only in-situ surface water quality data was collected to provide an indication of the condition of in-situ water quality at the time of the surveys to inform the interpretation of biological survey results.

At each site holding sufficient water, physicochemical water quality (temperature, pH, electrical conductance (EC), dissolved oxygen (DO), and turbidity) was measured using a YSI ProDSS multi-parameter water quality sonde at a depth of 20 cm below the water surface. The water quality meter was calibrated prior to field sampling. In-situ water quality results will be reviewed, and results will be compared to available WQOs (**Error! Reference source not found.**), adopted from the following sources the *EPP (Water and Wetland Biodiversity) for the Isaac River sub-basin* (DEHP 2013).

5.1.4 Sediment Quality

Given concentrations in sediment tend to have limited temporal variability, sediment quality in the stream channel will be assessed at each site only during the late-wet season survey. A single composite sample was collected from a low-flow stream bank using a stainless-steel trowel, in accordance with methods outlined in the *Monitoring and Sampling Manual: Environmental Protection (Water) Policy 2009* (DES 2018) and the guide to *Sediment Quality Assessment: A Practical Guide, Second Edition* (Simpson & Batley 2016). The composite sample comprised 5 to 10 sediment grabs collected 1 to 10 m apart along the length of each site. Samples were collected into suitable sample containers.

Samples were held under the appropriate conditions (e.g. in eskies in the field and during transport) and delivered to ALS Environmental (a NATA-accredited laboratory) within the required holding timeframes for analysis of particle size distribution, total organic carbon, hydrocarbons, and metals and metalloids.

Strict QA/QC protocols were adhered to throughout each stage of sampling, in accordance with the *Monitoring and Sampling Manual: Environmental Protection (Water) Policy 2009* (DES 2018). Powder-free nitrile gloves were worn during sample container handling, to reduce the risk of sample contamination during collection.

One field duplicate sample was collected from one site and analysed for the parameters listed above for QA/QC purposes.

The sediment quality results will be reviewed, and all parameters below or equal to the laboratory LOR at all sites will be noted and not considered further. Results for remaining parameters will be compared to the DGVs and guideline value-high (GV-High) (where available) outlined in the ANZG (2018) and Simpson et al. (2013) (Table 5.1).

Table 5.1 Default guideline values (DGVs) and guideline values-high (GV-High) for sediment quality (ANZG 2018)

Parameter	Unit	DGV	GV-High [a]
Total Organic Carbon	%	–	–
Metals and Metalloids			
Aluminium	mg/kg	–	–
Arsenic	mg/kg	20	70
Boron	mg/kg	–	–
Cadmium	mg/kg	1.5	10.0
Chromium	mg/kg	80	370
Cobalt	mg/kg	–	–
Copper	mg/kg	65	270
Iron	mg/kg	–	–
Lead	mg/kg	50	220
Manganese	mg/kg	–	–
Mercury	mg/kg	0.15	1.00
Molybdenum	mg/kg	–	–
Nickel	mg/kg	21	52
Selenium	mg/kg	–	–
Silver	mg/kg	1	4
Uranium	mg/kg	–	–
Vanadium	mg/kg	–	–
Zinc	mg/kg	200	410
Total Petroleum Hydrocarbons			
C6 – C9 Fraction	mg/kg	–	–
C10 – C14 Fraction	mg/kg	–	–
C15 – C28 Fraction	mg/kg	–	–
C29 – C36 Fraction	mg/kg	–	–
C10 – C36 Fraction (sum)	mg/kg	280	550

mg/kg = milligrams per kilogram dry weight.

– no GV exists for this parameter

[a] GV-high to be used as an indicator of potential high-level toxicity problems, not as a guideline value to ensure protection of ecosystems

5.1.5 Aquatic Plants

At each site (excluding wetland and dam sites), aquatic plant communities were semi-quantitatively assessed using ten replicated quadrats along a 100 m belt transect via visual assessment. The following were recorded in each quadrat:

- the location (i.e. on bank or in stream) of aquatic plants
- aquatic plant growth form (i.e. submerged, emergent, floating), and
- percent cover of each species (both native and exotic).

At wetland and dam sites, aquatic plants were assessed via visual estimates of species diversity and total percent coverage within the area of the wetland or dam.

For each site, the total taxonomic richness and percent cover will be calculated to inform the interpretation of biological survey results and to assess the overall aquatic ecological value of the site.

5.1.6 Macroinvertebrate Communities

At sites holding sufficient water, macroinvertebrate communities (including macrocrustaceans) were surveyed to provide an assessment of ecosystem health. One AUSRIVAS sample was collected from a 10 m section of each available habitat type (e.g. bed / pool and edge) using the standard kick-sweep method (DNRM 2001).

All samples were collected using a standard triangular AUSRIVAS dip net (DNRM 2001). Samples were transferred into labelled sample jars, preserved in a 70% methanol solution and transported to ESP's laboratory for processing. The macroinvertebrates in each sample was sorted, counted and identified to the lowest practical taxonomic level (in most instances family) to comply with standard AUSRIVAS methodology (DNRM 2001). Any macrocrustaceans (e.g. yabbies and freshwater crabs) caught during fish surveys (see below) were also recorded.

Appropriate QA/QC checks will be completed in accordance with the recommendations in the *Queensland Australian River Assessment System Sampling and Processing Manual* (DNRM 2001) and the *Monitoring and Sampling Manual: Environmental Protection (Water) Policy 2009* (DES 2018). A second ecologist will check approximately 10% of picked samples, and at least 10% of samples will be re-identified and counted by a second ecologist. An error rate of <10% is considered acceptable, as per the Laboratory Identification QA/QC guidelines (DNRM 2001; DES 2018).

Standard macroinvertebrate indices will be calculated for each site, including taxonomic richness and the presence of sensitive taxa through calculation of PET (Plecoptera/Ephemeroptera/Trichoptera) richness and SIGNAL2 scores (Chessman 2003).

Results will be compared against the relevant biological objectives scheduled under the *EPP (Water and Wetland Biodiversity) for the Isaac River sub-basin* (DEHP 2013) (Table 5.2). These values are derived for streams (i.e. flowing waters) and as such comparisons of results from wetlands and dams with the biological objectives should be interpreted with caution (as they are stagnant habitats).

Table 5.2 Biological guidelines values for the Isaac River sub-basin freshwaters (DEHP 2013) [a]

Index	Composite [b]	Edge
Taxonomic richness	12 – 21	23 – 33
PET richness	2 – 5	2 – 5
SIGNAL score	3.33 – 3.85	3.31 – 4.20

[a] Macroinvertebrate biological guidelines are based on the *Environmental Protection (Water) Policy 2009 Isaac River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all waters of the Isaac River Sub-basin (including Connors River)* guidelines based on a moderately disturbed ecosystem in fresh waters

[b] Mixture of all bed habitats within the site (e.g. sandy pool, rocky pool, riffle, run, cascade)

SIGNAL 2 scores can be interpreted in conjunction with the number of families found in the sample. This is achieved using a SIGNAL 2 / family bi-plot (Chessman 2003). The plots are divided into quadrants, with each quadrant indicative of environmental conditions that may influence a community (Figure 5.1). Quadrant boundaries for the SIGNAL 2 / family bi-plot used for this assessment will be based on the upper (80th percentile) biological guideline values for taxonomic richness and SIGNAL scores.

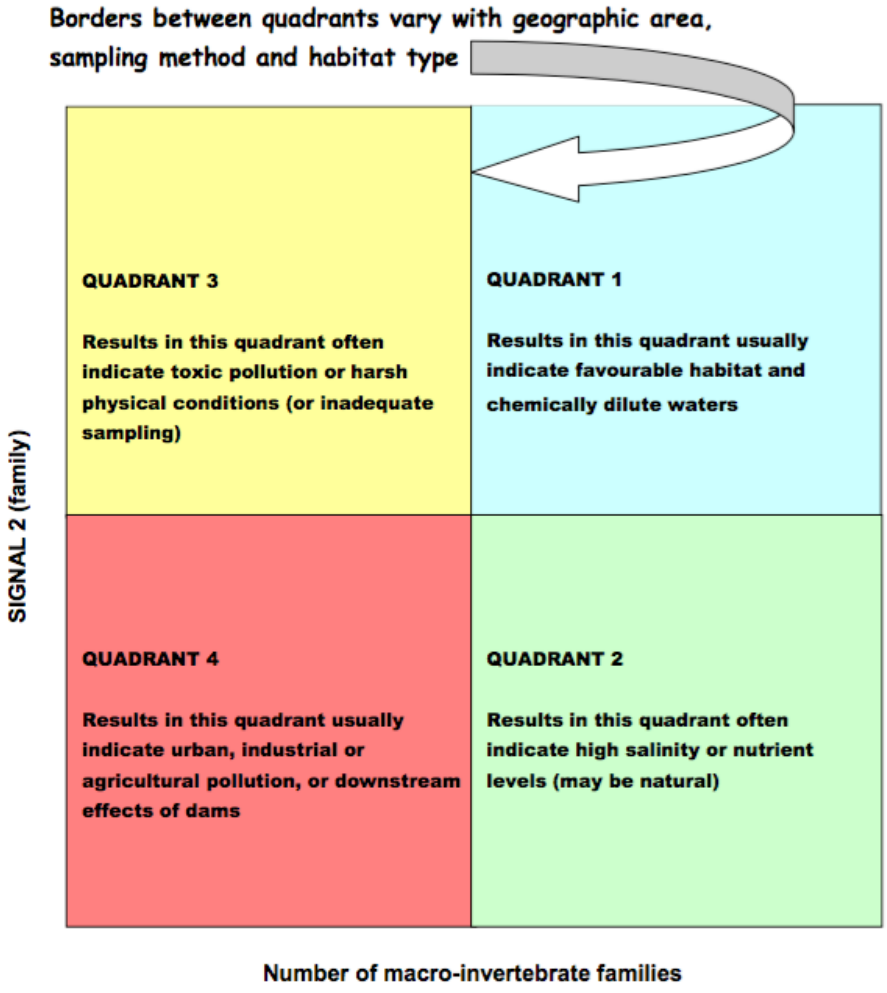

Figure 5.1 Quadrant diagram for SIGNAL2 / family bi-plot (Chessman 2003)

5.1.7 Stygofauna Pilot Study

A stygofauna pilot study will be undertaken in conjunction with the early wet aquatic ecology field survey. The pilot study will be completed in accordance with the *Guideline for the Environmental Assessment of Subterranean Aquatic Fauna*[1]. Sampling will be completed at 10 bores, distributed throughout the Study area and comparable nearby bores outside of this area. Bores selected will be those that are most likely to provide habitat for stygofauna,

[1] DSITIA 2015, *Guideline for the Environmental Assessment of Subterranean Aquatic Fauna,* State of Queensland, Brisbane.

based on the available information. Each bore must be established for at least six months prior to stygofauna sampling.

Stygofauna will be sampled in each bore using the passive netting method, as outlined in DES's *Monitoring and Sampling Manual 2018: Background Information on Sampling Bores for Stygofauna* and *Sampling Bores for Stygofauna* (DES 2018[2]). At each bore, the sampling net will be lowered to the bottom of the bore using a fishing reel; raised up and down to dislodge any fauna attached to the bottom of the bore; and drawn up and down a distance of approximately 30 cm a total of four times, before being brought to the surface and sieved using either a 50 µm or 150 µm sieve. This process will be repeated until a total of six hauls (notionally three with the 50 µm mesh and three with the 150 µm mesh, depending on bore conditions) have been completed at each bore.

Information for each bore will also be recorded, including the bore number, bore diameter, bore depth, water depth, height of collar, whether the casing extends for the entire length of the bore, and whether the bore is screened. The location of each bore will be marked with the GPS and photographs of bore and surrounding area will be taken. In situ water quality measurements for electrical conductivity and pH will also be taken at each sampling bore, to aid in the interpretation of results.

Stygofauna samples will be preserved in ethanol and transported back to ESP's laboratory, where they will be picked, sorted, and identified to the lowest practical taxonomic level by our experienced ecologists using the available keys. Where required, we will liaise with the Queensland Herbarium to request access or contribute to the Queensland Government Subterranean Aquatic Fauna Database during the identification of any stygofauna specimens. Where stygofauna are found and where further identification is deemed to be required (e.g. species-level), we will submit samples to Peter Hancock, a stygofauna specialist, for identification, including the use of genetic techniques if deemed required.

If the pilot study concludes that the Project may result in a significant impact to stygofauna, a comprehensive survey will be required. A total of 40 samples from a minimum of 10 representative bores would be sampled as per the methods outlined above for the pilot survey. If required, the comprehensive survey would be completed in a different season to the pilot study, as per the guidelines. A comprehensive stygofauna assessment does not form part of the current scope and is therefore not included in our methodology.

5.1.8 Aquatic Vertebrates

5.1.8.1 Fish

At each site holding sufficient water, fish communities were surveyed using a combination of methods depending on the habitats of the site, including fyke nets, seine nets and / or baited traps.

[2] DES (2018), *Monitoring and Sampling Manual: Environmental Protection (Water) Policy 2009,* Department of Environment and Science Government, Brisbane.

All sampling was completed in accordance with the techniques and methodologies appropriate to the conditions at each site, as outlined in the latest version of the *Monitoring and Sampling Manual: Environmental Protection (Water) Policy 2009* (DES 2018) and the *Survey Guidelines for Australia's Threatened Fish* (SEWPaC 2011a); and relevant permits issued to ESP, including General Fisheries Permit 208641, Animal Ethics Approval CA 2020/06/1378 and Scientific Purposes Permit WA0017831.

These methods (along with suitable habitat assessments) are considered sufficient for recording the listed threatened fish species that may occur in the broader region (i.e. silver perch and Murray cod) if present within the waterways in the vicinity of the Project. Specifically, fyke netting is considered a suitable method for detecting these species (SEWPaC 2011a); though it is noted that these species are considered unlikely to occur based on findings of the desktop review (as outlined in the sections above).

All native fish were identified, counted, and returned to the environment. The total length (mm) of a subsample of 20 individual fish per species caught at each site were measured. Pest fish were identified, counted and euthanized in accordance with permit conditions.

The abundance of fish species caught at each site will be calculated and tabulated. Life history stages of native fish will be determined using length measurements (based on information in Pusey et al. 2004), graphed and discussed.

5.1.8.2 Turtles

Turtles were surveyed at sites that contain suitable potential habitat only. Turtles were surveyed in conjunction with fish surveys (i.e. fyke nets set for fish surveys were set to trap turtles as well).

All sampling was completed in accordance with the trapping methodology outlined in the *Terrestrial Vertebrate Fauna Survey Guidelines for Queensland* (Eyre et. al 2018) as well as relevant permits issued to ESP, including Animal Ethics Approval CA 2020/06/1378 and Scientific Purposes Permit WA0017831.

Once caught, any turtles will be identified and returned to the environment. Observations of suitable habitat for turtles (including nesting habitat) will also be noted.

5.1.8.3 Platypus

Platypus will not be directly assessed as they are considered unlikely to occur in the vicinity of the Study area. However, visual observations for habitat features preferred by platypus or their potential presence were completed at each site, including (Scott and Grant 1997):

- presence of permanent pools (not deeper than 5 m) with runs and riffles
- a diversity of instream features to refuge amongst (e.g. submerged aquatic vegetation, submerged rock crevices, undercut banks and/or submerged logs and fallen trees)
- presence of platypus burrows along the banks, and
- relatively steep earth banks well-consolidated by riparian vegetation and with growth overhanging the bank.

If potential platypus habitat is identified, targeted surveys (e.g. visual surveys at dusk and dawn) may be recommended at these sites.

5.2 Aquatic Ecosystem Values

The overall aquatic ecosystem values of the waterways and wetlands will be identified based on the criteria outlined in Table 5.3. The criteria were developed in accordance with the *Guidelines for Identifying High Ecological Values Aquatic Ecosystems* (Aquatic Ecosystems Task Group 2012), which identifies five core criteria that can be used to determine aquatic ecosystems of high value:

- Diversity: The aquatic ecosystem exhibits exceptional diversity of species (native / migratory), habitats, and / or geomorphological features / processes; includes diversity of ecosystem types (rivers, wetlands, subterranean systems, etc,), biotic diversity (within and between species) and / or abiotic (e.g. geomorphic) features and processes;
- Distinctiveness: The aquatic ecosystem is rare / threatened or unusual; and / or supports rare / threatened / endemic species / communities / genetically unique populations; and / or exhibits rare or unusual geomorphological features / processes and / or environmental conditions (and is likely to support unusual assemblages of species adapted to these conditions, and / or are important in demonstrating key features of the evolution of Australia's landscape, riverscape or biota);
- Vital Habitat: An aquatic ecosystem provides vital habitat for flora and fauna species if it supports unusually large numbers of a particular native or migratory species; and / or maintenance of populations of specific species at critical life cycle stages; and / or key significant refugia for aquatic species that are dependent on the habitat particularly at times of stress; and
- Naturalness: The ecological character of the aquatic ecosystem is not adversely affected by modern human activity.
- Representativeness: The aquatic ecosystem is an outstanding example of an aquatic ecosystem class to which it has been assigned, within a drainage division.

While these guidelines were developed to identify high ecological value aquatic ecosystems at a national level (drainage division scale) they can be used at a range of scales and will therefore be adapted where appropriate (e.g. incorporating results of sampling parameters and river bio-assessment scores) to suit the purposes of this assessment as per advice in the guidelines.

Table 5.3 Criteria used to assess aquatic ecosystem value

Criteria [a]	Low	Moderate	High
Diversity	Low biodiversity of aquatic flora and fauna Low habitat diversity Low to moderate habitat bio-assessment scores	Moderate to good biodiversity of aquatic flora and fauna Moderate habitat diversity Good habitat bio-assessment scores	High biodiversity of aquatic flora and fauna High habitat diversity Very good bio-assessment scores
Distinctiveness	Species, communities and processes common Available habitat types common No habitat for protected species No listed protected aquatic areas, habitats or species High tolerance to change or highly adaptive communities	Species, communities and processes moderately common Available habitat types relatively common No core habitat for protected species Listed protected aquatic areas, habitats or species, but unlikely to provide significant habitat (e.g. breeding area) Moderate tolerance to change or moderately adaptive communities	Species, communities and processes rare Available habitat types rare Core habitat for protected species Listed protected aquatic areas, habitats or species Sensitive or poorly adaptive communities
Vital Habitat	Poor refuge or breeding area Supports low numbers of native species Little fisheries value Poor connectivity and fish passage	Limited refuge or breeding area Supports moderate numbers of native species Moderate fisheries value Limited connectivity and fish passage	Important refuge or breeding area Supports high numbers of native species High fisheries value High connectivity and important corridor for fish passage
Naturalness	Highly disturbed Poor riparian condition Poor habitat condition	Moderately disturbed Moderate to good riparian condition Moderate to good habitat condition	Undisturbed, pristine Excellent riparian condition Excellent habitat condition
Representativeness	Highly disturbed Poor example of ecosystem type	Moderately disturbed Average example of ecosystem type	Undisturbed Outstanding example of ecosystem type

[a] Source: Aquatic Ecosystems Task Group 2012

5.3 Waterway Determination

As per DAF's factsheet for determining *What is a waterway?* (DAF 2022), a waterway must have at least one of the following attributes:

- defined bed and banks:
    - bed and banks need to be continuous upstream and downstream of the site rather than isolated and broken sections of a depression.
- an extended (if not permanent) period of flow:
    - flow must continue beyond the duration of a rain event and have some reliability attached to rainfall. There is a need to distinguish between channels that funnel immediate localised rainfall and waterways where flow has arisen from an upstream catchment.
- adequate flow:
    - flow needs to be sufficient to sustain basic ecological processes and habitats, and to maintain biodiversity within or across the feature. The adequacy of the flow depends on the ecological function of the channel (e.g. waterways that connect to fish habitat like a wetland or waterhole may only need infrequent and short-duration flows to provide connectivity for fish).
- fish habitat at, or upstream of, the site:
    - most instream features (submerged logs, overhanging vegetation) provide habitat for fish under adequate flow conditions or, in the case of pools, during dry periods. Periodic connectivity to upstream and off stream fish habitat are also considered fish habitat.

During the late-wet season survey (only), a waterway determination assessment was completed to identify whether the waterways within and upstream of the Project meet the definition of a waterway providing for fish passage under the Fisheries Act. Mapped features were assessed to validate the extent of waterways providing for fish passage, including field validation of the main channel width to calculate the area of waterways providing for fish passage within and upstream of the Project.

Surveys were completed at sites on mapped and unmapped watercourses, with photographs and formal habitat assessments completed at each site. The formal habitat assessment sites were located on tributaries to North Creek and the Isaac River, as well as unmapped features throughout the Study area, however most are unmapped features distributed throughout the Study area. Reaches upstream and downstream of these points were traversed to determine the extent of each feature, where possible.

The habitat assessments focused on key attributes for defining a waterway in accordance with the *Fisheries Act 1994,* including:

- channel characteristics (e.g. description of beds and banks including bank height, channel width and gradient)

- presence of aquatic habitat e.g. pools (including a description of conditions at the time of survey and potential habitat during flows)
- substrate composition (estimated percent coverage of bedrock, boulders, cobbles, gravel, sand and silt)
- riparian vegetation (width of riparian zone, species present and estimated cover)
- aquatic plants (coverage, growth form and species)
- in-stream habitat availability, including features that may be important for fish (e.g. large or small woody debris, undercut banks), and
- existing waterway barriers.

Where possible, ground-truthing of mapped waterway features ceased approximately 100 m upstream of the field-determined extent of waterways providing for fish passage, with further spot checks of mapped upstream reaches where access allows. Note that in some instances, determination of the upstream of extent of features was not possible due to access constraints.

6 Late Wet Season Survey Preliminary Observations

Aquatic ecology assessments were completed at 12 sites during the late wet season from15 to 20 June 2023. Six of these sites contained water during the survey (specifically sites NC2, G1, D1, D2, Lac1 and D3). There were some minor changes to sites originally proposed during the survey. The initial location proposed for site NC2 was dry at the time of the survey, however, a nearby location was holding water so the site was moved to this new location. An additional dam (site D3) within the Study area was also added to the survey to increase the number of sites with water present during the survey.

Waterway determinations were completed at 25 sites within the Study area. All determination sites were dry at the time of the survey.

A summary of survey sites and aquatic ecological indicators sampled is presented in Table 6.1, and waterway determination sites presented in Table 6.2. Site locations are displayed on Figure 6.1 and Figure 6.2.

Table 6.1 Assessment completed at each aquatic ecology site and ecological indicators sampled during the late-wet season survey

Site Name	Location	Habitat assessment	In-Situ water quality	Sediment quality	Aquatic plants	Macro-invertebrates	Fish	Turtles
NC1^	North Creek upstream	Y	NS	Y	Y	NS	NS	Y
NC2*	North Creek adjacent	Y	Y	Y	Y	Y	Y	Y
NC3^	North Creek adjacent	Y	NS	Y	Y	NS	NS	Y
NC4^	North Creek downstream	Y	NS	Y	Y	NS	NS	Y
Lac1	Mapped lacustrine wetland within Study Area	Y	Y	Y	Y	Y	Y	Y
D1	Unmapped dam on unmapped feature within Study Area	Y	Y	Y	Y	Y	Y	Y
D2	Unmapped dam on unnamed tributary within Study Area	Y	Y	Y	Y	Y	Y	Y
G1	Potential GDE to the south	Y	Y	Y	Y	Y	Y	Y
Trib1^	Unnamed tributaries of North Creek within Study Area	Y	NS	Y	Y	NS	NS	Y
Trib2^	Unnamed tributaries of North Creek within Study Area	Y	NS	Y	Y	NS	NS	Y
Trib3^	Unnamed tributaries of North Creek downstream of the Study Area	Y	NS	Y	Y	NS	NS	Y
D3#	Unmapped dam within Study Area	Y	Y	–	Y	–	Y	Y

^ Site dry at the time of the survey
* Site moved upstream from original proposed location
# Additional site added to the survey
– Not surveyed
Y Indicator sampled
NS Indicator not sampled as appropriate habitat features were not present or sufficient water not available

Table 6.2 Formal habitat assessment sites for waterway determinations

Site Name	Location	Latitude*	Longitude*
WWD5	Feature 1	-22.0681	148.3261
WWD6	Feature 1	-22.0730	148.3215
WWD10	Feature 1	-22.0810	148.3168
WWD12	Feature 2	-22.0621	148.3462
WWD23	Feature 2	-22.0639	148.3395
WWD24	Feature 2	-22.0642	148.3387
WWD25	Feature 2	-22.0637	148.3411
WWD17	Feature 3	-22.0829	148.3478
WWD22	Feature 3	-22.0903	148.3516
WWD1	Unmapped tributary 1	-22.0770	148.3385
WWD2	Unmapped tributary 1	-22.0777	148.3447
WWD3	Unmapped tributary 1	-22.0720	148.3344
WWD4	Unmapped tributary 1	-22.0698	148.3308
WWD18	Unmapped tributary 1	-22.0797	148.3518
WWD19	Unmapped tributary 1	-22.0810	148.3501
WWD20	Unmapped tributary 1	-22.0841	148.3521
WWD7	Unmapped tributary 2	-22.0719	148.3154
WWD8	Unmapped tributary 2	-22.0683	148.3163
WWD9	Unmapped tributary 2	-22.0657	148.3166
WWD11	Unmapped tributary 3	-22.0893	148.3478
WWD13	Unmapped tributary 3	-22.0850	148.3415
WWD14	Unmapped tributary 3	-22.0846	148.3387
WWD15	Unmapped tributary 3	-22.0884	148.3490
WWD16	Unmapped tributary 3	-22.0852	148.3461
WWD21	Unmapped tributary 3	-22.0872	148.3371

*GDA 2020

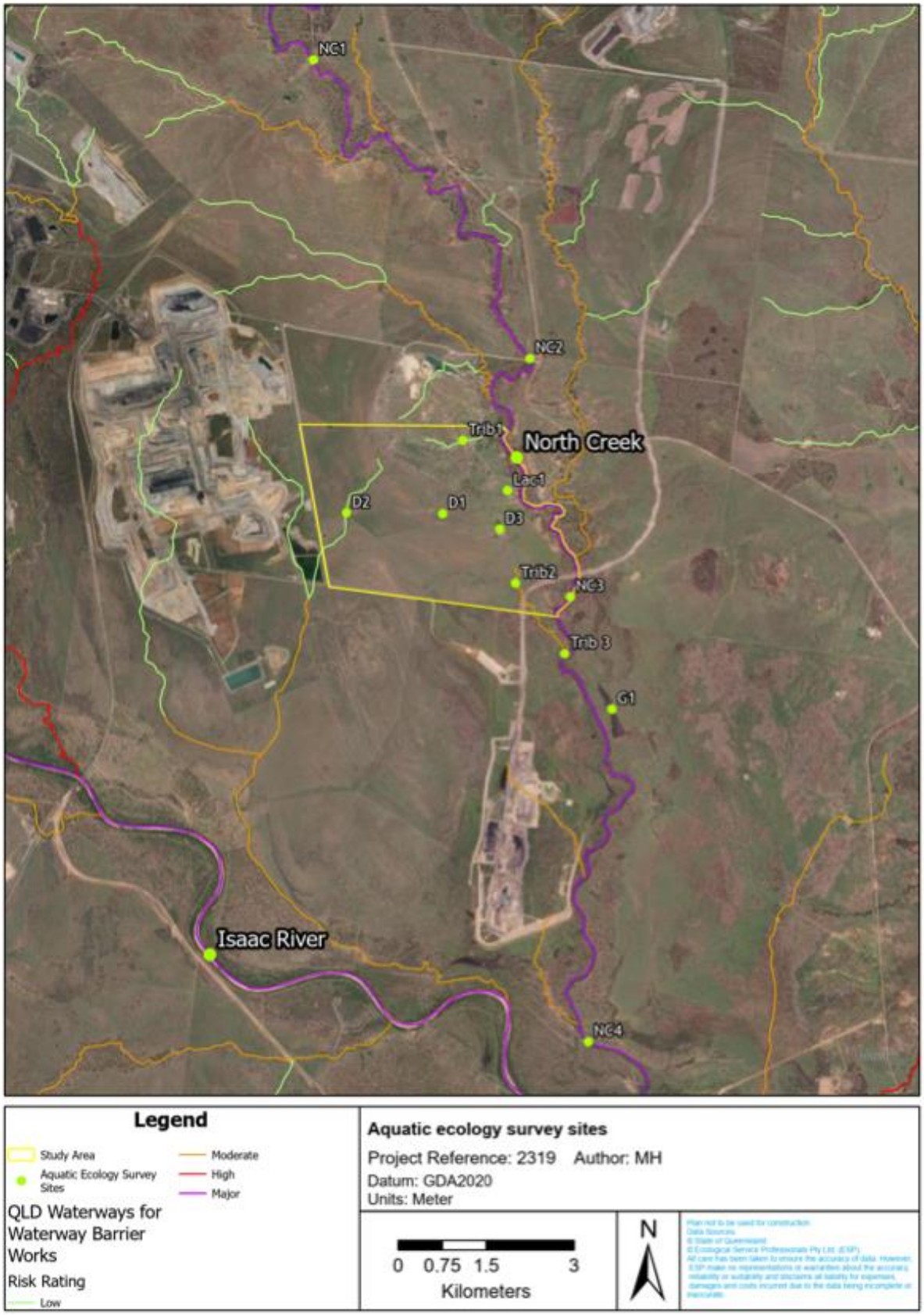

Figure 6.1 Location of aquatic ecology survey sites surveyed during the late-wet season survey

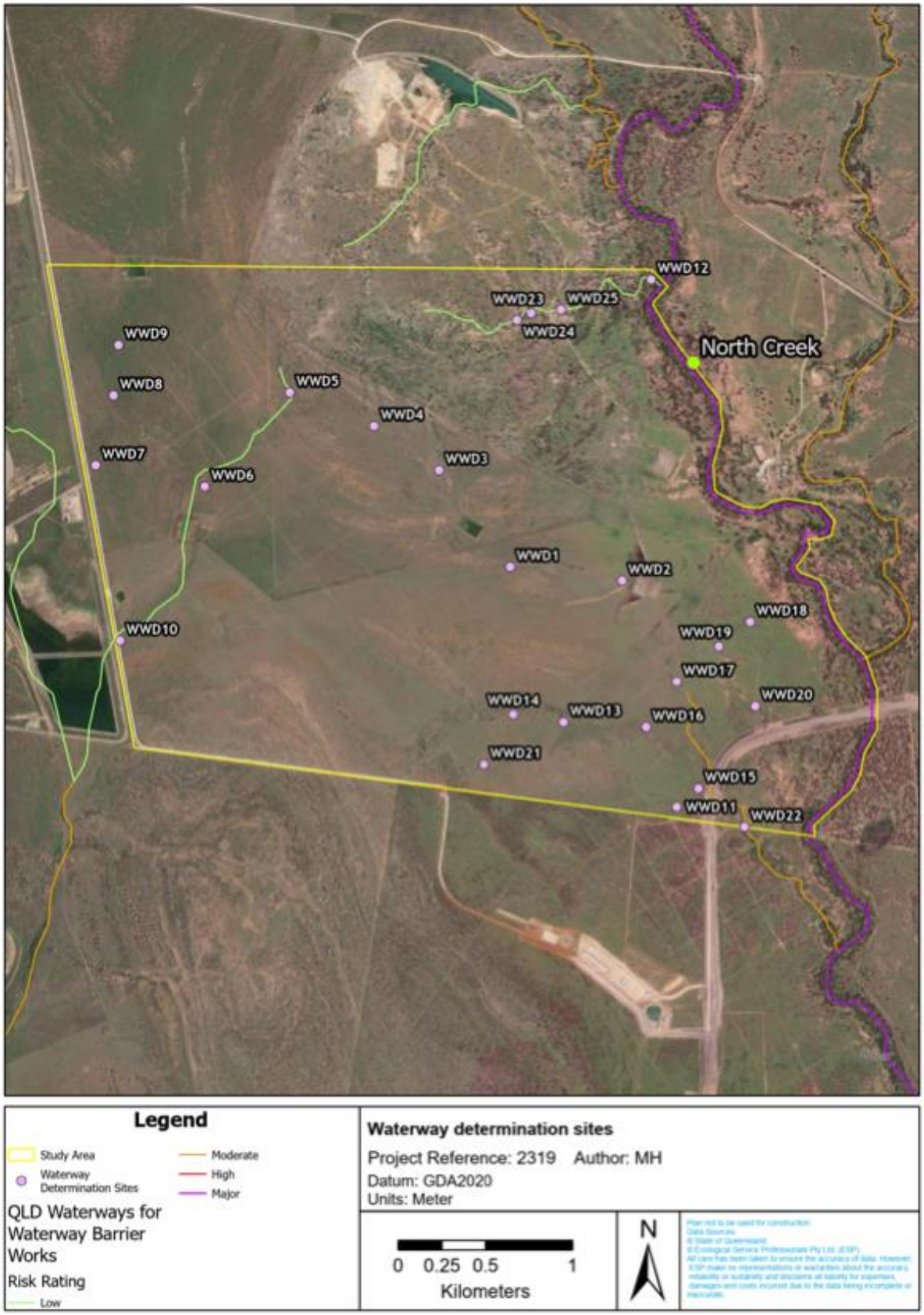

Figure 6.2 Location of waterway determination sites surveyed during the late-wet season survey

6.1 Aquatic Habitat Condition

Overall, aquatic habitat condition of waterways within the Study area (Trib 1 and Trib 2) was poor to fair, while waterways outside of the Study area (Trib 3, NC1, NC2, NC3, NC4) were fair to good. All waterway sites were dry except for the relocated site NC2, located on North Creek, to the northeast of the Study area. Site NC2 consisted of a large pool habitat that would be connected upstream and downstream during periods of flow. Waterway sites contained varying amounts of instream habitat structure (such as woody debris, trailing terrestrial roots and vegetation).

The mapped lacustrine wetland (Lac1), unmapped farm dams (D1, D2, and D3) and mapped GDE (G1) sites were typically in poor to fair aquatic ecological condition. They consisted of relatively uniform instream aquatic habitat (dominated by shallow and deep pools) and typically had a low diversity of instream structural complexity (e.g. woody debris, trailing roots and vegetation), providing limited habitat for aquatic fauna communities.

6.2 Water Quality

Water quality measured in situ was recorded at all sites that contained water during the field survey. All water quality data will be analysed in our detailed technical report.

6.3 Sediment Quality

Sediment quality samples were collected from all aquatic ecology sites except site D3. All sediment quality data will be analysed in our detailed technical report.

6.4 Aquatic Plant Communities

Most aquatic ecology sites contained no, or a low abundance of, aquatic plants. Where aquatic plants were observed, communities were dominated by emergent growth forms that were typically growing along the banks, specifically, *Cyperus procerus* (sedge) and *Juncus usitatus* (common rush). However, some farm dam sites contained a high abundance of submerged algae, *Nitella* sp.

Communities consisted of native species common to the region. No declared aquatic pest species were identified in the vicinity of the Project.

6.5 Macroinvertebrate Communities

Qualitative (i.e. AUSRIVAS) macroinvertebrate samples were collected from all aquatic ecology sites that contained water during the field survey, except site D3. All macroinvertebrate community data will be analysed in our detailed technical report.

6.6 Fish Communities

Fish communities were surveyed at the six aquatic ecology sites that contained water during the field survey. Fish community abundance and diversity ranged from poor to moderate across all sites. Abundance ranged from three to 798 individuals, and diversity ranged from one to nine species. The lowest abundance and diversity were at site Lac1, while the highest

abundance was recorded at sites D2 and the diversity was recorded at site NC2. Ten of the 41 native fish species known from the Isaac River catchment were caught during the field survey. One exotic fish species was caught at three sites (G1, D3, and NC2): Mozambique mouthbrooder (*Oreochromis mossambicus*).

No fish considered MSES / MNES were caught in the vicinity of the Study area. Two listed threatened species of fish have the potential to occur in the project area based on the desktop review: silver perch and Murray cod. However, they are considered unlikely to occur based on preliminary findings from this field survey.

6.7 Turtle Communities

Turtle communities were surveyed at all six aquatic ecology sites that contained suitable habitat during the field survey. No turtles were recorded during the late-wet field survey, however potential habitat for common species was recorded (particularly in larger mapped wetlands and farm dams).

As outlined in the desktop review, two listed threatened species of turtle are known from the broader region: Fitzroy River turtle and white-throated snapping turtle. However, no habitat for these species was recorded within the Study area and these species were considered unlikely to occur based on preliminary findings from this field survey.

6.8 Platypus and Other Aquatic Vertebrates

No platypus (special least concern under the NC Act) were recorded during the field survey, and no potential habitat for this species was noted in the vicinity of the Study area. As such, it is considered unlikely to occur based on desktop review and findings from this field survey.

6.9 Waterway determinations

A total of 25 waterway determinations were conducted within the Study area during the field survey. Most determination sites had at least one waterway feature, most often defined bed and banks, indicating that some waterways and unmapped features within the Study area may be defined as waterways providing for fish passage. However, waterway determination analyses are ongoing and will be presented in our detailed technical report.

7 Summary

The desktop assessment identified numerous aquatic MNES and MSES potentially occurring within the Study area. These matters have been considered in the planning and design of the seasonal field surveys. Based on the preliminary observations during the late-wet field survey, there was no significant aquatic habitat present in the vicinity of the project. No MSES or MNES species were considered likely to occur, however, early indications suggest waterway providing for fish passage may be identified within the Study area. These preliminary observations need to be confirmed through analysis of the data. Further field assessments in the early wet season and subsequent data analyses will seek to refine the likelihood of occurrence of aquatic MNES and MSES within the Study area and ground-truth aquatic habitat condition, value and extent, with the results presented in our detailed technical report.

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Appendix A Fauna and Flora Database Searches

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 14-Jul-2023

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	26
Listed Migratory Species:	11

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	16
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	39
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Brigalow (Acacia harpophylla dominant and co-dominant)	Endangered	Community known to occur within area	In feature area
Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin	Endangered	Community likely to occur within area	In feature area
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	Community likely to occur within area	In feature area
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	Community likely to occur within area	In buffer area only

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat may occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Grantiella picta			
Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Neochmia ruficauda ruficauda			
Star Finch (eastern), Star Finch (southern) [26027]	Endangered	Species or species habitat likely to occur within area	In feature area
Poephila cincta cincta			
Southern Black-throated Finch [64447]	Endangered	Species or species habitat may occur within area	In feature area
Rostratula australis			
Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area	In feature area
Stagonopleura guttata			
Diamond Firetail [59398]	Vulnerable	Species or species habitat may occur within area	In feature area
MAMMAL			
Dasyurus hallucatus			
Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area	In feature area
Macroderma gigas			
Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Nyctophilus corbeni			
Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area	In feature area
Petauroides volans			
Greater Glider (southern and central) [254]	Endangered	Species or species habitat known to occur within area	In feature area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)			
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Endangered	Species or species habitat known to occur within area	In feature area
PLANT			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Denhamia megacarpa Large-fruited Denhamia [91342]	Endangered	Species or species habitat may occur within area	In buffer area only
Dichanthium queenslandicum King Blue-grass [5481]	Endangered	Species or species habitat known to occur within area	In feature area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Eucalyptus raveretiana Black Ironbox [16344]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Samadera bidwillii Quassia [29708]	Vulnerable	Species or species habitat likely to occur within area	In feature area
REPTILE			
Denisonia maculata Ornamental Snake [1193]	Vulnerable	Species or species habitat known to occur within area	In feature area
Egernia rugosa Yakka Skink [1420]	Vulnerable	Species or species habitat may occur within area	In feature area
Elseya albagula Southern Snapping Turtle, White-throated Snapping Turtle [81648]	Critically Endangered	Species or species habitat may occur within area	In feature area
Furina dunmalli Dunmall's Snake [59254]	Vulnerable	Species or species habitat may occur within area	In feature area
Hemiaspis damelii Grey Snake [1179]	Endangered	Species or species habitat may occur within area	In feature area
Lerista allanae Allan's Lerista, Retro Slider [1378]	Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Rheodytes leukops Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver [1761]	Vulnerable	Species or species habitat likely to occur within area	In feature area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat may occur within area	In buffer area only
Migratory Wetlands Species			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Pandion haliaetus			
Osprey [952]		Species or species habitat likely to occur within area	In buffer area only
Tringa nebularia			
Common Greenshank, Greenshank [832]		Species or species habitat may occur within area	In buffer area only

Other Matters Protected by the EPBC Act

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Anseranas semipalmata			
Magpie Goose [978]		Species or species habitat may occur within area overfly marine area	In feature area
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis			
Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata			
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
[Chalcites osculans as Chrysococcyx osculans](#) Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area	In feature area
[Gallinago hardwickii](#) Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area overfly marine area	In feature area
[Haliaeetus leucogaster](#) White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area	In feature area
[Merops ornatus](#) Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
[Myiagra cyanoleuca](#) Satin Flycatcher [612]		Species or species habitat may occur within area overfly marine area	In buffer area only
[Pandion haliaetus](#) Osprey [952]		Species or species habitat likely to occur within area	In buffer area only
[Rostratula australis as Rostratula benghalensis (sensu lato)](#) Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area	In feature area
[Tringa nebularia](#) Common Greenshank, Greenshank [832]		Species or species habitat may occur within area overfly marine area	In buffer area only

Extra Information

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Isaac Downs coal mine project, near Moranbah, Qld	2019/8413		Post-Approval	In buffer area only
Isaac River Coal Mine Project	2021/8980		Post-Approval	In feature area
Olive Downs Project Mine Site and Access Road	2017/7867		Post-Approval	In buffer area only
Peak Downs Mine Continuation Project	2022/09350		Referral Decision	In buffer area only
Winchester South Project Mine Site and Access Road, near Moranbah, Qld	2019/8460		Assessment	In buffer area only
Controlled action				
Alpha Coal Project - Mine and Rail Development	2008/4648	Controlled Action	Post-Approval	In buffer area only
Arrow Bowen Pipeline (CSG), QLD	2012/6459	Controlled Action	Post-Approval	In feature area
Bowen Gas Project	2012/6377	Controlled Action	Post-Approval	In feature area
Caval Ridge Open Cut Coal Mine Project	2008/4417	Controlled Action	Post-Approval	In buffer area only
Codrilla Open Cut Coal Mining and Processing Operation with Associated Infrastructure	2009/4892	Controlled Action	Post-Approval	In buffer area only
Construct and Operate the Connors River Dam and Pipelines	2008/4429	Controlled Action	Post-Approval	In buffer area only
Develop an Open Cut Coal Mine at Daunia	2008/4418	Controlled Action	Post-Approval	In feature area

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
Eagle Downs Coal Mine Central Queensland	2008/3945	Controlled Action	Post-Approval	In buffer area only
Extension to the exisiting Isaac Plains Mine, near Moranbah, Qld	2016/7827	Controlled Action	Post-Approval	In buffer area only
Goonyella Riverside Mine to South Walker Creek Mine Dragline Move	2016/7788	Controlled Action	Completed	In buffer area only
Harrybrandt Open Cut Coal Mine and Associated Infrastructure, Bowen Basin, Qld	2012/6483	Controlled Action	Completed	In buffer area only
install & operate gas pipeline	2005/2059	Controlled Action	Post-Approval	In buffer area only
Millenium Open Cut Coal Mine Expansion Project, QLD	2009/4821	Controlled Action	Post-Approval	In buffer area only
Moranbah South Project Coal Mine, QLD	2012/6337	Controlled Action	Post-Approval	In buffer area only
Olive Downs Project Electricity Transmission Line	2017/7869	Controlled Action	Post-Approval	In feature area
Olive Downs Project Rail Spur	2017/7870	Controlled Action	Post-Approval	In buffer area only
Olive Downs Project Water Pipeline	2017/7868	Controlled Action	Post-Approval	In buffer area only
Open Cut Coal Mining	2004/1770	Controlled Action	Post-Approval	In feature area
Relocation of approximately 16km of Dysart Road and associated service infrastructure	2013/6868	Controlled Action	Post-Approval	In buffer area only
The Grosvenor Coal Mine Project	2007/3785	Controlled Action	Post-Approval	In buffer area only
Winchester South Project Electricity Transmission Line, near Moranbah, Qld	2019/8458	Controlled Action	Assessment Approach	In feature area
Winchester South Project Water Pipeline, near Moranbah, Qld	2019/8459	Controlled Action	Assessment Approach	In feature area
Not controlled action				
Broadlea North Coal Project open cut mine and associated infrastructure	2005/2179	Not Controlled Action	Completed	In buffer area only
Broadlea to Mallawa and Mallawa to Wotonga Rail Duplication	2006/3046	Not Controlled Action	Completed	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Carborough Downs mine extension	2006/3085	Not Controlled Action	Completed	In buffer area only
construction and operation of Carborough Downs Mine	2005/2064	Not Controlled Action	Completed	In buffer area only
Coppabella-Ingsdon Railway Duplication	2008/4103	Not Controlled Action	Completed	In buffer area only
Eagle-1 Exploration Drilling, North West Shelf, WA	2019/8578	Not Controlled Action	Completed	In buffer area only
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
Integrated Isaac Plains Project	2006/3043	Not Controlled Action	Completed	In buffer area only
Olive Downs Project	2005/2377	Not Controlled Action	Completed	In feature area
Open cut coal mine 7km NE of Moranbah (Isaac Plains)	2005/2070	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
Moranbah South Feasibility Seismic Survey	2010/5497	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Referral decision				
Expansion of open cut coal mine and diversion of creeks in existing mine operati	2006/2845	Referral Decision	Completed	In buffer area only

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

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EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 14-Jul-2023

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	30
Listed Migratory Species:	14

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	19
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	2
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	77
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Brigalow (Acacia harpophylla dominant and co-dominant)	Endangered	Community known to occur within area	In feature area
Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin	Endangered	Community likely to occur within area	In feature area
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	Community likely to occur within area	In feature area
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	Community likely to occur within area	In buffer area only
Weeping Myall Woodlands	Endangered	Community likely to occur within area	In buffer area only

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat known to occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Geophaps scripta scripta](#) Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Grantiella picta](#) Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Neochmia ruficauda ruficauda](#) Star Finch (eastern), Star Finch (southern) [26027]	Endangered	Species or species habitat likely to occur within area	In feature area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
[Poephila cincta cincta](#) Southern Black-throated Finch [64447]	Endangered	Species or species habitat may occur within area	In feature area
[Rostratula australis](#) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area
[Stagonopleura guttata](#) Diamond Firetail [59398]	Vulnerable	Species or species habitat may occur within area	In feature area
MAMMAL			
[Dasyurus hallucatus](#) Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area	In feature area
[Macroderma gigas](#) Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Nyctophilus corbeni](#) Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area	In feature area
[Petauroides volans](#) Greater Glider (southern and central) [254]	Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)			
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Endangered	Species or species habitat known to occur within area	In feature area
Pteropus poliocephalus			
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
PLANT			
Aristida annua			
[17906]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Denhamia megacarpa			
Large-fruited Denhamia [91342]	Endangered	Species or species habitat may occur within area	In buffer area only
Dichanthium queenslandicum			
King Blue-grass [5481]	Endangered	Species or species habitat known to occur within area	In feature area
Dichanthium setosum			
bluegrass [14159]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Eucalyptus raveretiana			
Black Ironbox [16344]	Vulnerable	Species or species habitat known to occur within area	In feature area
Omphalea celata			
[64586]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Samadera bidwillii			
Quassia [29708]	Vulnerable	Species or species habitat likely to occur within area	In feature area
REPTILE			
Denisonia maculata			
Ornamental Snake [1193]	Vulnerable	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Egernia rugosa Yakka Skink [1420]	Vulnerable	Species or species habitat may occur within area	In feature area
Elseya albagula Southern Snapping Turtle, White-throated Snapping Turtle [81648]	Critically Endangered	Species or species habitat may occur within area	In feature area
Furina dunmalli Dunmall's Snake [59254]	Vulnerable	Species or species habitat may occur within area	In feature area
Hemiaspis damelii Grey Snake [1179]	Endangered	Species or species habitat may occur within area	In feature area
Lerista allanae Allan's Lerista, Retro Slider [1378]	Endangered	Species or species habitat likely to occur within area	In feature area
Rheodytes leukops Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver [1761]	Vulnerable	Species or species habitat likely to occur within area	In feature area

Listed Migratory Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area	In feature area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat likely to occur within area	In buffer area only
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Myiagra cyanoleuca](#) Satin Flycatcher [612]		Species or species habitat likely to occur within area	In buffer area only
[Rhipidura rufifrons](#) Rufous Fantail [592]		Species or species habitat may occur within area	In buffer area only
Migratory Wetlands Species			
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area	In feature area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
[Gallinago hardwickii](#) Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area	In feature area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
[Pandion haliaetus](#) Osprey [952]		Breeding known to occur within area	In buffer area only
[Tringa nebularia](#) Common Greenshank, Greenshank [832]		Species or species habitat may occur within area	In buffer area only

Other Matters Protected by the EPBC Act

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area overfly marine area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat likely to occur within area overfly marine area	In buffer area only
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area overfly marine area	In buffer area only
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
Pandion haliaetus Osprey [952]		Breeding known to occur within area	In buffer area only
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat may occur within area overfly marine area	In buffer area only
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Tringa nebularia			
Common Greenshank, Greenshank [832]		Species or species habitat may occur within area overfly marine area	In buffer area only

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Coolibah	Nature Refuge	QLD	In buffer area only
Dipperu	National Park (Scientific)	QLD	In buffer area only

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Carmichael Coal Mine and Rail Project	2010/5736		Post-Approval	In buffer area only
Caval Ridge Mine Horse Pit Extension, Bowen Basin	2021/9031		Assessment	In buffer area only
Isaac Downs coal mine project, near Moranbah, Qld	2019/8413		Post-Approval	In buffer area only
Isaac River Coal Mine Project	2021/8980		Post-Approval	In feature area
Lake Vermont Meadowbrook Coal Mine Project, Qld	2019/8485		Assessment	In buffer area only
Moranbah North & Grosvenor Mines rail and pipeline realignment	2023/09489		Referral Decision	In buffer area only
Moranbah North Extension Project, Moranbah, Qld	2018/8338		Post-Approval	In buffer area only
Olive Downs Project Mine Site and Access Road	2017/7867		Post-Approval	In buffer area only
Peak Downs Mine Continuation Project	2022/09350		Referral Decision	In buffer area only
Saraji East Mining Lease Project, Qld	2016/7791		Assessment	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Urannah Dam and Pipelines Project	2020/8708		Completed	In buffer area only
Vulcan Coal Mine ? Matilda Pit and Ancillary Infrastructure	2022/09361		Assessment	In buffer area only
Winchester South Project Mine Site and Access Road, near Moranbah, Qld	2019/8460		Assessment	In buffer area only
Controlled action				
7 North Dam Extension Project - Peak Downs Mine	2012/6260	Controlled Action	Completed	In buffer area only
Alpha Coal Project - Mine and Rail Development	2008/4648	Controlled Action	Post-Approval	In buffer area only
Arrow Bowen Pipeline (CSG), QLD	2012/6459	Controlled Action	Post-Approval	In feature area
BHP Billiton Goonyella to Abbot Point rail project	2011/6082	Controlled Action	Completed	In buffer area only
Bowen Gas Project	2012/6377	Controlled Action	Post-Approval	In feature area
Caval Ridge Open Cut Coal Mine Project	2008/4417	Controlled Action	Post-Approval	In buffer area only
Central Queensland Integrated Rail Project	2012/6321	Controlled Action	Completed	In buffer area only
Codrilla Open Cut Coal Mining and Processing Operation with Associated Infrastructure	2009/4892	Controlled Action	Post-Approval	In buffer area only
Construct and Operate the Connors River Dam and Pipelines	2008/4429	Controlled Action	Post-Approval	In buffer area only
Construction and operation of an extension to the existing underground coal mine, Grosvenor Mine, ne	2016/7796	Controlled Action	Post-Approval	In buffer area only
Develop an Open Cut Coal Mine at Daunia	2008/4418	Controlled Action	Post-Approval	In feature area
Eagle Downs Coal Mine Central Queensland	2008/3945	Controlled Action	Post-Approval	In buffer area only
Ellensfield Underground Coal Mine	2007/3643	Controlled Action	Post-Approval	In buffer area only
Establishment of Galilee Coal Mine and Associated Infrastructure	2009/4737	Controlled Action	Post-Approval	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
Extension to the exisiting Isaac Plains Mine, near Moranbah, Qld	2016/7827	Controlled Action	Post-Approval	In buffer area only
Gas pipeline	2002/728	Controlled Action	Post-Approval	In buffer area only
Goonyella Riverside Coal Mine Expansion	2005/2248	Controlled Action	Completed	In buffer area only
Goonyella Riverside Mine to South Walker Creek Mine Dragline Move	2016/7788	Controlled Action	Completed	In buffer area only
Grosvenor West Coal Project	2012/6281	Controlled Action	Completed	In buffer area only
Harrybrandt Open Cut Coal Mine and Associated Infrastructure, Bowen Basin, Qld	2012/6483	Controlled Action	Completed	In buffer area only
install & operate gas pipeline	2005/2059	Controlled Action	Post-Approval	In buffer area only
Kemmis 2 open cut coal mine South Walker Creek, 25 km WSW of Nebo Bowen Basin, QLD	2013/7025	Controlled Action	Post-Approval	In buffer area only
Lake Vermont open cut coal northern extension project, central Qld	2016/7701	Controlled Action	Post-Approval	In buffer area only
Millenium Open Cut Coal Mine Expansion Project, QLD	2009/4821	Controlled Action	Post-Approval	In buffer area only
Moranbah South Project Coal Mine, QLD	2012/6337	Controlled Action	Post-Approval	In buffer area only
MRA2C Project, South Walker Creek Operations	2017/7957	Controlled Action	Post-Approval	In buffer area only
New Saraji Coal Mine Project	2007/3845	Controlled Action	Completed	In buffer area only
Norwich Park & Blackwater CSG Fields & supporting infrastructure Bowen Basin	2011/6032	Controlled Action	Completed	In buffer area only
Norwich Park to Blackwater Gas Pipeline	2011/6031	Controlled Action	Completed	In buffer area only
Olive Downs Project Electricity Transmission Line	2017/7869	Controlled Action	Post-Approval	In feature area
Olive Downs Project Rail Spur	2017/7870	Controlled Action	Post-Approval	In buffer area only
Olive Downs Project Water Pipeline	2017/7868	Controlled Action	Post-Approval	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
Open Cut Coal Mining	2004/1770	Controlled Action	Post-Approval	In feature area
Red Hill Mining Project,20kms north of Moranbah, Qld	2013/6865	Controlled Action	Post-Approval	In buffer area only
Relocation of approximately 16km of Dysart Road and associated service infrastructure	2013/6868	Controlled Action	Post-Approval	In buffer area only
South Walker Creek Mulgrave Pit mine extension, Nebo, QLD	2014/7272	Controlled Action	Post-Approval	In buffer area only
Spring Creek to Phillips Creek Diversion	2019/8576	Controlled Action	Post-Approval	In buffer area only
The Broughton Coal Mine Project, Bowen Basin, QLD	2014/7132	Controlled Action	Completed	In buffer area only
The Grosvenor Coal Mine Project	2007/3785	Controlled Action	Post-Approval	In buffer area only
Vulcan Complex Project	2020/8676	Controlled Action	Post-Approval	In buffer area only
Winchester South Project Electricity Transmission Line, near Moranbah, Qld	2019/8458	Controlled Action	Assessment Approach	In feature area
Winchester South Project Water Pipeline, near Moranbah, Qld	2019/8459	Controlled Action	Assessment Approach	In feature area
Not controlled action				
275 kV double circuit transmission line	2006/2896	Not Controlled Action	Completed	In buffer area only
Broadlea North Coal Project open cut mine and associated infrastructure	2005/2179	Not Controlled Action	Completed	In buffer area only
Broadlea to Mallawa and Mallawa to Wotonga Rail Duplication	2006/3046	Not Controlled Action	Completed	In buffer area only
Carborough Downs mine extension	2006/3085	Not Controlled Action	Completed	In buffer area only
construction and operation of Carborough Downs Mine	2005/2064	Not Controlled Action	Completed	In buffer area only
Coppabella-Ingsdon Railway Duplication	2008/4103	Not Controlled Action	Completed	In buffer area only
Eagle-1 Exploration Drilling, North West Shelf, WA	2019/8578	Not Controlled Action	Completed	In buffer area only
Hail Creek open cut coal mine expansion	2006/2506	Not Controlled Action	Completed	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
Integrated Isaac Plains Project	2006/3043	Not Controlled Action	Completed	In buffer area only
Moranbah North Coal Mine Methane Power Project	2007/3565	Not Controlled Action	Completed	In buffer area only
Moranbah to Alpha Pipeline Project	2012/6257	Not Controlled Action	Completed	In buffer area only
Nebo Town Water Supply Pipeline	2012/6416	Not Controlled Action	Completed	In buffer area only
Olive Downs Project	2005/2377	Not Controlled Action	Completed	In feature area
Open cut coal mine 7km NE of Moranbah (Isaac Plains)	2005/2070	Not Controlled Action	Completed	In buffer area only
Upgrade of a section of the Goonyella Rail System	2011/5857	Not Controlled Action	Completed	In buffer area only
Vulcan Bulk Sample Project	2019/8504	Not Controlled Action	Completed	In buffer area only
Water pipeline	2006/2595	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
Dysart East multi seam open cut coal mine project, Qld	2014/7224	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Moranbah South Feasibility Seismic Survey	2010/5497	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Moranbah South Project 2013 Seismic Exploration Program, Qld	2013/6814	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Referral decision				
Expansion of open cut coal mine and diversion of creeks in existing mine operati	2006/2845	Referral Decision	Completed	In buffer area only

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
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-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

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