



APPENDIX 20 – GROUNDWATER DEPENDENT ECOSYSTEM HABITAT QUALITY MONITORING PROGRAM

**NEW LENTON COAL PTY LTD
NEW LENTON COAL PROJECT**



GDE HABITAT QUALITY MONITORING PROGRAM NEW LENTON COAL PROJECT

PREPARED FOR
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1 Introduction

AARC Environmental Solutions Pty Ltd (AARC) was commissioned by the Lenton Joint Venture to prepare a Groundwater Dependent Ecosystem (GDE) Habitat Quality Monitoring Program (the Program) for the New Lenton Coal Project (the Project).

Lenton Joint Venture (LJV) is an unincorporated joint venture between New Lenton Coal Pty Ltd (NLC) (ACN 095 390 079) and MPC Lenton Pty Ltd (MPC) (ACN 149 618 904). NLC is a wholly owned subsidiary of Bowen Coking Coal, as of July 2022.

The GDE Habitat Quality Monitoring Program has been prepared to complement the Groundwater Dependent Ecosystem Monitoring and Management Plan (GDEMMP) for New Lenton, prepared by 3D Environmental (2024).

'[The] GDEMMP intends to address and manage the uncertainties associated with the environmental impacts of the Project on GDEs through the development of consistently applied monitoring actions, analysis and reporting of data trends, and development of 'early warning' triggers to identify a decline in GDE health' (3D Environmental 2024).

1.1 Project overview

The Project is located within the Northern Bowen Basin, approximately 65 km north of Moranbah and 120 km south-west of Mackay (Figure 1) and is situated within the Isaac Regional Council local government area. The Project is located on Mining Lease (ML) 70337, ML 700053 and ML 700054 (referred to as the New Lenton MLs) (Figure 2), held by LJV. The proposed disturbance footprint for the Project is shown in Figure 2. The New Lenton MLs are subject to the Environmental Authority (EA) EPML00475513, issued under the *Environmental Protection Act 1994* (Queensland) (EP Act).

The Project is declared a controlled action and requires approval under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act). An EPBC Act referral (2020/8778) was submitted to the Department of Agriculture, Water and the Environment (DAWE) (currently the Department of Climate Change, Energy, the Environment, and Water (DCCEEW)) on 3 September 2020. The referral decision in October 2020 states that the proposed action will be assessed via a public environment report (PER).

The proposed disturbance footprint for the Project is an estimated 886 ha, incorporating infrastructure and general mining disturbance (Figure 2). The proposed Project activities comprise:

- 2 mining pits, East Pit and West Pit;
- In-pit and out of pit overburden dumps;
- A mine infrastructure area (MIA);
- Haul roads, including haul road connection with the Burton Mine haul roads and a bed level crossing of the Isaac River;
- Suttor Developmental Road (a public road) realignment, with a new bridge over the Isaac River;
- Mine affected water dams;
- Clean water diversion drains;
- Mine affected water pipeline connecting with pipelines at Burton Mine;
- Diversion of Ti-Tree Creek;
- Levees along the Isaac River; and
- General infrastructure and construction working area.

Open cut mining of the two mining pits is predicted to result in groundwater drawdown with potential to cause impacts beyond the immediate disturbance footprint.

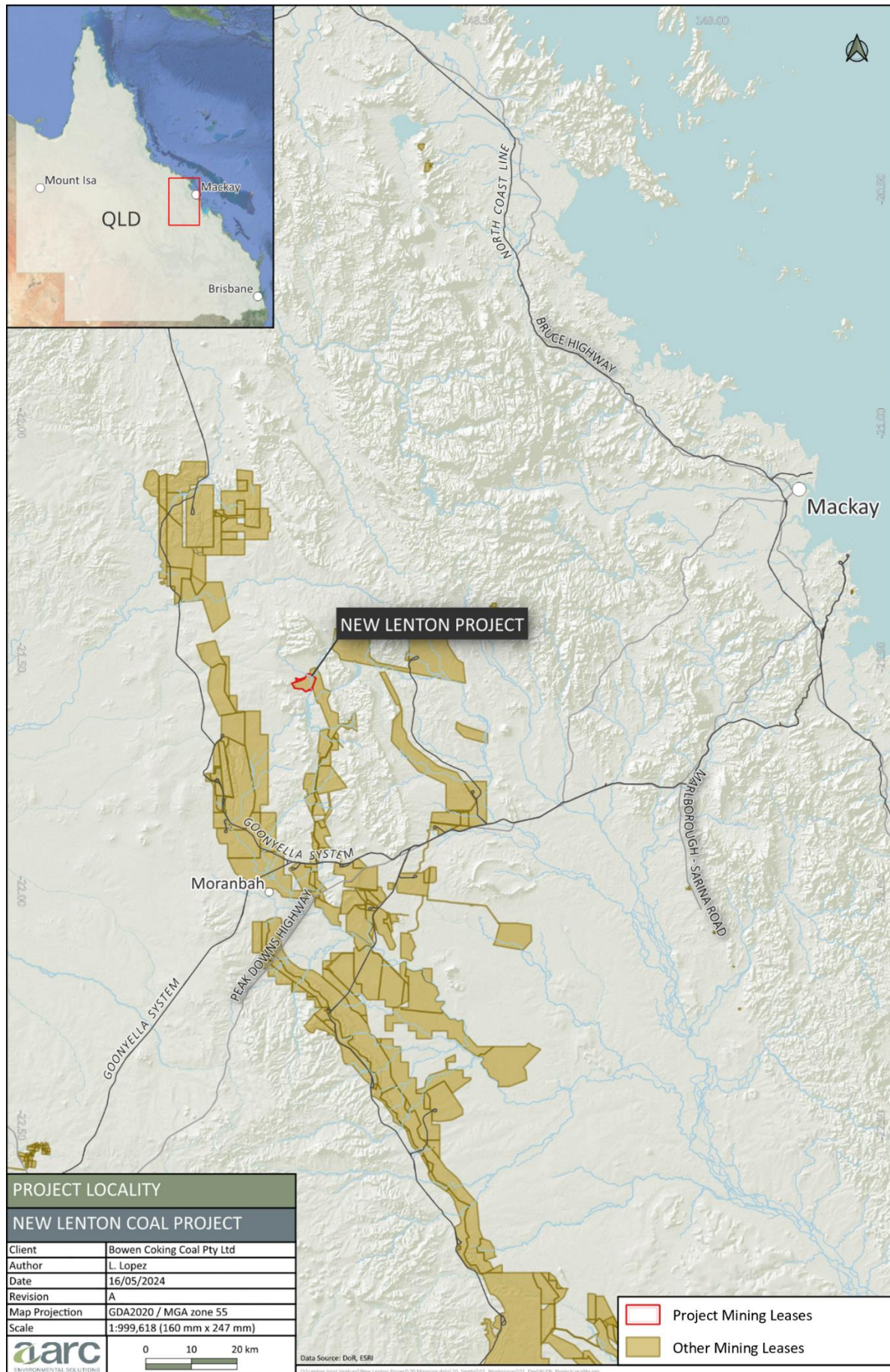


Figure 1: Regional location



1.2 Purpose and scope

The GDEMMP describes a process for establishing thresholds for impacts to GDEs, including investigations if triggers are exceeded and implementing mitigation measures if required. As stated in the GDEMMP (3D Environmental, 2024), “If mitigation measures are not effective, habitat quality data from a GDE habitat quality monitoring program, as prepared by AARC (2024) [i.e. this Program] will be used to assess whether there has been a significant residual impact to riparian habitat and any threatened species that may be associated with it.”

The purpose of this Program is to identify potential changes in GDE habitat quality within the Project’s area of predicted groundwater drawdown, in particular:

- establish a GDE baseline monitoring program, assessing GDE habitat quality within the area of predicted groundwater drawdown prior to Project activities that could result in drawdown in areas with GDEs;
 - providing an understanding of natural seasonal variation in GDE habitat quality; and
 - allowing GDE habitat quality threshold criteria (for GDEs associated with MNES values) to be refined, representing significant declines in habitat quality and providing triggers for environmental offset requirements, noting the initial GDE habitat quality threshold criteria are provided in Section 3.4.
- establish an ongoing GDE habitat quality monitoring program, to be carried out during operations:
 - providing for early detection of potential declining habitat condition in GDEs impacted by drawdown; and
 - enabling the operator to investigate and implement early mitigation measures for the protection of GDEs, as required.

Monitoring data collected during the Program will be used to assist in the measurement of the significance of Project-related impacts to GDEs and associated threatened species habitat, in conjunction with the GDEMMP.

‘SMART’ criteria (specific, measurable, achievable, realistic and timebound) have been used to design the Program, to ensure it can be effectively implemented and achieves the defined purpose.

2 Background

2.1 GDE occurrence in the survey area

An assessment of GDE presence within the area of predicted groundwater drawdown for the Project was completed by 3D Environmental (2023). This assessment confirmed the presence of a single Terrestrial GDE (TGDE) within the predicted drawdown area for the Project (3D Environmental 2023), the riparian vegetation fringing the Isaac River. This TGDE is associated with the regional ecosystem (RE) 11.3.25 Blue gum (*Eucalyptus tereticornis*) open woodland fringing drainage lines on sandy-loam soils (Figure 3).

Additionally, national GDE mapping (GDE Atlas) has identified a potential GDE associated with the EPBC Act listed Poplar Box Grassy Woodland on Alluvial Plains Threatened Ecological Community (Poplar Box TEC) within the predicted drawdown area for the Project (3D Environmental 2023). Although the initial assessment did not determine that the Poplar Box TEC is groundwater dependent, the advice to the decision maker from the IESC (2024-147: New Lenton Coal Project (EPBC 2020/8778) – New Development) requested additional seasonal information before groundwater dependence can be discounted (3D Environmental 2024). Poplar Box TEC is associated with RE 11.3.2 Poplar Box (*Eucalyptus populnea*) woodland on alluvial plains (Figure 3).

Both the riparian TGDE and the Poplar Box TEC in the area provide habitat for several threatened species listed as MNES under the EPBC Act, including the Greater Glider, Koala and Squatter Pigeon (AARC 2024). Previous habitat mapping of the survey area (AARC 2024) has identified Greater Glider and Koala habitat associated with both the riparian TGDE and the Poplar Box TEC within the survey area. Potential habitat for the Squatter Pigeon within the predicted drawdown area is associated only with the Poplar Box TEC (AARC 2024).

The field verified vegetation associated with the riparian TGDE and Poplar Box TEC and their related MNES values are provided in Table 1. The extent of both vegetation communities in relation to the predicted drawdown area is illustrated in Figure 3.

Table 1: Potential GDEs mapped within the survey area

Map unit*	Vegetation community (regional ecosystem)	Associated RE code	GDE value	MNES value
VC4	Blue gum (<i>Eucalyptus tereticornis</i>) open woodland fringing drainage lines on sandy-loam soils	11.3.25	Confirmed	• Fauna Habitat: - o Greater Glider - o Koala
VC1	Poplar box (<i>Eucalyptus populnea</i>) woodland on alluvial plains	11.3.2	Potential	• Poplar Box TEC • Fauna Habitat: - o Greater Glider - o Koala - o Squatter Pigeon

*In accordance with AARC (2024) – MNES Terrestrial Ecology Impact Assessment Report New Lenton Coal Project.

2.2 Potential drawdown impacts

A detailed assessment of potential risks to GDE function resulting from the Project's activities has been conducted by 3D Environmental (2023). This assessment describes variations in risk levels relative to groundwater drawdown and the interactions with GDEs. With implementation of the GDEMMP, it is considered that the risk to GDEs from drawdown posed by mine development ranges from 'Low' to 'Insignificant' (3D Environmental 2023).

Monitoring as part of the GDEMMP will be used to further characterise the GDEs that are likely to be impacted by the Project and resolve uncertainties in response and function of the GDEs to better understand Project risks (3D Environmental 2024).

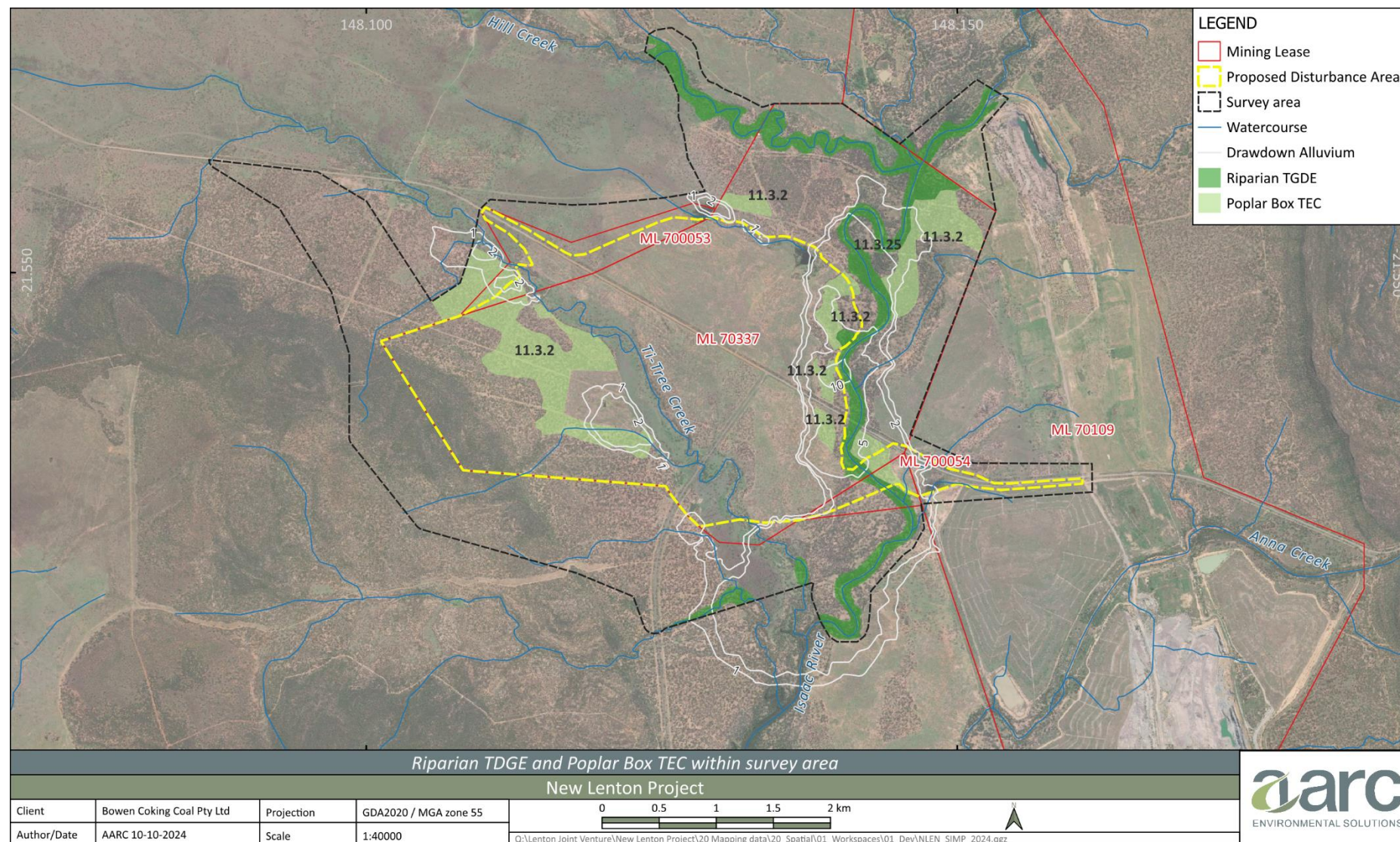


Figure 3: Riparian TGDE and Poplar Box TEC within the survey area

3 Monitoring program

3.1 Approach

The Program comprises:

- Baseline assessment – the baseline assessment will account for natural seasonal variation to obtain an understanding of the condition and quality of the GDE prior to mining activities that result in groundwater drawdown in areas with GDEs (noting the initial GDE habitat quality threshold criteria are provided in Section 3.4 that will apply to activities commencing in the baseline period); and
- Ongoing monitoring – the GDE habitat quality monitoring will collect necessary information required for measuring changes in GDE health (assessed under the GDEMMP) and habitat quality (this Program) during operations and post closure.

The monitoring programs form a component of a larger GDE monitoring program, detailed in the GDEMMP (3D Environmental 2024) and summarised in the following sections. The methods proposed to achieve the habitat quality monitoring purpose are provided in Section 3.3.

The field assessment and reporting for the Program is to be undertaken by a Suitably Qualified Ecologist.

3.1.1 Baseline assessment

The baseline assessment aims to focus on areas of confirmed and potential groundwater dependency within the area of predicted groundwater drawdown for the Project to characterise the baseline ecological condition of the vegetation.

The baseline assessment using BioCondition methods, will be undertaken during the first two years of this Program (Section 3.3, Table 3). The results of that assessment will be used to refine the BioCondition class (Table 4), from which changes to BioCondition class can be compared (Section 3.4 GDE habitat quality threshold criteria). The initial GDE habitat quality threshold criteria provided in Section 3.4 will apply to activities commencing in the baseline period.

The BioCondition class will be compared to the BioCondition class after completing the ongoing monitoring described in Section 3.1.2; and frequency of ongoing monitoring outlined in Section 3.3, Table 3.

3.1.2 Ongoing GDE habitat quality monitoring

Ongoing GDE habitat quality monitoring will commence following the completion of the baseline survey, in conjunction with the GDEMMP, utilising monitoring sites established in the baseline condition assessment.

Of note, in accordance with the GDEMMP (3D Environmental 2024), sites that do not demonstrate groundwater dependence during the baseline assessment of the GDEMMP will be eliminated from the ongoing monitoring program.

Results from GDE habitat quality monitoring will be used in conjunction with the GDE health results gathered under the GDEMMP (3D Environmental 2024).

Exceedances of the GDE habitat quality threshold limit (Section 3.4) and/or GDE health threshold limits (under the GDEMMP) during the monitoring period will trigger investigation and implementation of mitigation measures, in accordance with the GDEMMP (3D Environmental 2024). If GDE habitat quality exceeds defined thresholds limits (Table 5), the ongoing monitoring program may be extended for two years to confirm if the detected reduction constitutes a long-term decline in habitat quality or is a short-term perturbation (i.e., can be corrected with appropriate mitigation measures or a return to normal climatic regimes).

In accordance with the GDEMMP (3D Environmental 2024), results from the ongoing monitoring under this Program will be used to determine if changes in GDE habitat quality meet the threshold limit to constitute a significant residual impact to GDEs and associated MNES habitat. Further information regarding GDE habitat quality threshold criteria is provided in Section 3.4.

3.2 Site selection for monitoring

Under the GDEMMP, monitoring sites have been selected to ensure adequate monitoring across the GDEs, focussing on areas of confirmed groundwater dependency to characterise the baseline ecological condition of the site (3D Environmental 2024). The allocation of monitoring sites under the GDEMMP has been primarily driven by the distribution of field verified GDEs, as well as overlap with field verified Poplar Box TEC and GDE mapping represented in the GDE Atlas (3D Environmental 2024). Further detail regarding monitoring site selection is provided by 3D Environmental (2024) in the GDEMMP.

Within the riparian TGDE, nine permanent habitat quality monitoring sites will be established at each of the nine TGDE monitoring sites under the GDEMMP (Figure 4), including two control sites located outside the predicted drawdown area (sites 3A and 3B for the riparian TGDE), shown in Table 2). The control sites (Table 2) will be established as reference sites for GDE habitat quality, to detect regional impacts not caused by groundwater drawdown associated with the Project's activities (e.g., drought).

TEC habitat quality monitoring sites will be established in the Poplar Box TEC, four of them within the predicted drawdown area complementary to the proposed TEC monitoring sites under the GDEMMP, and one additional control site, which does not require monitoring under the GDEMMP. This control site (TEC 5) has been selected as the control site for Poplar Box TEC due to its location East of the Isaac River while being outside the predicted drawdown area by a reasonable distance. It is also located in the same patch of Poplar Box TEC where two monitoring sites are proposed (TEC 2 and TEC 3) (Figure 4).

The proposed locations of GDE habitat quality monitoring sites are provided in Table 2, and shown in relation to the GDEMMP monitoring sites in Figure 4. As the sites to monitor GDE habitat quality will be established to complement GDE health monitoring sites under the GDEMMP, they have been named accordingly (Table 2), except for site TEC 5.

Proposed monitoring sites may be adjusted based on local conditions, such as accessibility.

Table 2: Proposed monitoring transects start point

Habitat Quality Monitoring site	Associated RE	Purpose of habitat quality assessment	Justification of site selection	Coordinates (GDA 2020 / MGA, zone 55)
Site 1	11.3.25	Riparian TGDE / MNES Fauna habitat	GDEMMP monitoring site	618097E, 7615686N
Site 1A	11.3.25	Riparian TGDE / MNES Fauna habitat	GDEMMP monitoring site	618114E, 7615861N
Site 1B	11.3.25	Riparian TGDE / MNES Fauna habitat	GDEMMP monitoring site	618141E, 7615068N
Site 2A	11.3.25	Riparian TGDE / MNES Fauna habitat	GDEMMP monitoring site	618221E, 7616654N
Site 2B	11.3.25	Riparian TGDE / MNES Fauna habitat	GDEMMP monitoring site	618538E, 7614403N
Site 2C	11.3.25	Riparian TGDE / MNES Fauna habitat	GDEMMP monitoring site	618113E, 7613613N

Habitat Quality Monitoring site	Associated RE	Purpose of habitat quality assessment	Justification of site selection	Coordinates (GDA 2020 / MGA, zone 55)
Site 2D	11.3.25	Riparian TGDE / MNES Fauna habitat	GDEMMP monitoring site	617687E, 7613174N
Site 3A	11.3.25	Riparian TGDE / MNES Fauna habitat	GDEMMP control monitoring site	618668E, 7617338N
Site 3B	11.3.25	Riparian TGDE / MNES Fauna habitat	GDEMMP control monitoring site	617446E, 7612474N
TEC 1	11.3.2 (Poplar Box TEC)	Poplar Box TEC / MNES Fauna habitat	GDEMMP monitoring site	618166E, 7614902N
TEC 2	11.3.2 (Poplar Box TEC)	Poplar Box TEC / MNES Fauna habitat	GDEMMP monitoring site	618529E, 7616313N
TEC 3	11.3.2 (Poplar Box TEC)	Poplar Box TEC / MNES Fauna habitat	GDEMMP monitoring site	618761E, 7617026N
TEC 4	11.3.2 (Poplar Box TEC)	Poplar Box TEC / MNES Fauna habitat	GDEMMP monitoring site	615142E, 7616588N
TEC 5 (not in GDEMMP)	11.3.2 (Poplar Box TEC)	Poplar Box TEC / MNES Fauna habitat	Control monitoring site: • same patch of Poplar Box TEC where monitoring sites TEC 2 and TEC 3 are located • over 300m from predicted drawdown • within the Project ML	619189E, 7616974N

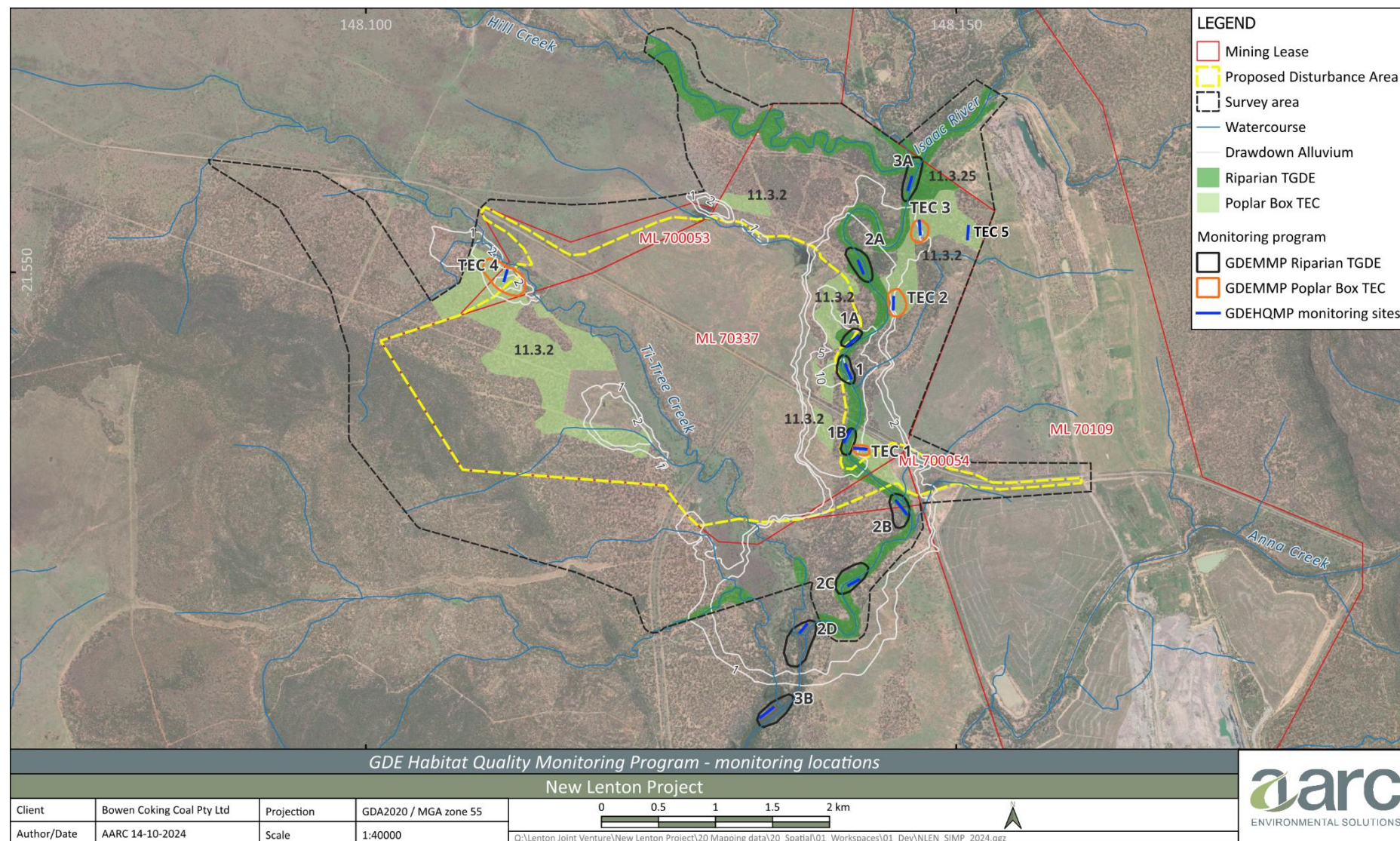


Figure 4: GDE Habitat Quality Monitoring Program - monitoring locations

3.3 Proposed monitoring methods

The methodology proposed to inform the calculation of habitat quality is an assessment adapted from the 'Guide to Determining Terrestrial Habitat Quality Version 1.3' (DES 2020). The same assessment methodology will be used for the baseline and ongoing monitoring and will include:

- 1) site-based attributes assessment (in accordance with the BioCondition assessment methodology); and
- 2) species habitat attributes assessment.

The following associated MNES have been considered in methodology for species habitat attributes assessment:

- Riparian TGDE monitoring areas:
 - Greater Gilder (*Petauroides volans*); and
 - Koala (*Phascolarctos cinereus*).
- Poplar Box TEC monitoring areas:
 - Greater Glider;
 - Koala; and
 - Squatter Pigeon (Southern) (*Geophaps scripta scripta*).

The proposed monitoring schedule is provided in Table 3. Each method is described in the following sections. A review of the methods and monitoring schedule will occur during the analysis of the monitoring results.

Table 3: Proposed assessment methods for each monitoring stage and monitoring schedule

Monitoring method	Monitoring stage	Frequency	Role responsible for monitoring
Site-based attributes assessment (in accordance with the BioCondition assessment methodology)	• Baseline condition assessment to derive start condition (BioCondition class)	• Biannually during baseline condition assessment	Suitably Qualified Ecologist
	• Ongoing GDE habitat quality monitoring	• Biennially (every 2 years), during the dry season, for 5 years during ongoing GDE habitat quality monitoring	
Species habitat attributes assessment	• Baseline condition assessment	• Biannually during baseline condition assessment	Suitably Qualified Ecologist
	• Ongoing GDE habitat quality monitoring	• Biennially (every 2 years), during the dry season, for 5 years during ongoing GDE habitat quality monitoring	

3.3.1 Site-based attributes assessment

The site-based attributes assessment component from the BioCondition is proposed as it can quantitatively measure vegetation composition, structure and function (Eyre *et al.* 2015) and is suitable for providing reliable records of vegetation condition and evaluating vegetation changes through time. This assessment method will be utilised to assess habitat quality associated with GDE monitoring sites proposed within the GDEMMP, including areas of Poplar Box TEC. Site-based attributes will be surveyed in accordance with the 'Queensland Herbarium 'BioCondition Condition Assessment Framework for Terrestrial Biodiversity in Queensland' Version 2.2. (BioCondition Assessment Manual) (Eyre *et al.* 2015).

The attributes to be collected at each assessment site are as follows:

- 100 m transect;
 - Tree canopy cover;
 - Tree sub-canopy cover;
 - Native shrub cover; and
 - Photographs at each transect end.
- 100 m x 50 m plot;
 - Number of large eucalypt trees;
 - Number of large non-eucalypt trees;
 - Tree canopy height – median canopy height (m);
 - Recruitment of canopy species – proportion of dominant canopy species that are regenerating; and
 - Native tree species richness – number of species present.
- 50 m x 20 m plot;
 - Coarse woody debris – length of all logs >10 cm diameter and 0.5 m in length.
- 50 m x 10 m plot; and
 - Native shrub, grass and forbs/other species richness; and
 - Non-native plant cover – cover of exotic species as a component of the overall vegetation cover (%).
- 1 m x 1 m quadrats.
 - Native perennial grass cover (%);
 - Organic litter cover (%);
 - Native forbs and other species (%);
 - Native shrubs (<1 m in height) (%);
 - Non-native grass (%); and
 - Non-native forbs and shrubs (%).

The site-based attributes will be described according to DES (2020) with comparison against reference site BioCondition benchmarks (DES 2024). The attribute scores will be incorporated into the BioCondition assessment for each monitoring site using weightings described by Eyre *et al.* (2015).

3.3.2 Species habitat attributes assessment

Assessment of species habitat attributes provide an indication of the ability of the habitat associated with GDE monitoring sites proposed within the GDEMMP to support fauna species. In accordance with the 'Guide to determining terrestrial habitat quality' (DES 2020) the relevant species habitat attributes are:

- **Foraging:** quality and availability of food and habitat required for foraging;
- **Shelter and breeding:** quality and availability of habitat required for shelter and breeding;
- **Mobility:** quality and availability of habitat required for mobility; and
- **Threats:** absence of threats.

The habitat indicators to be monitored at each site are outlined in sections 3.3.2.1 to 3.3.2.3.

3.3.2.1 Koala

- Foraging
 - Presence and abundance of forage tree
- Shelter and breeding
 - Presence and abundance of refugial habitat
- Mobility
 - Habitat patch size
 - Connectivity to suitable habitat
- Threats
 - Potential for predator species
 - Roads or adverse infrastructure

3.3.2.2 Greater Glider

- Foraging
 - Presence and abundance of forage tree
- Shelter and breeding
 - Presence and abundance of refugial habitat
- Mobility
 - Habitat patch size
 - Connectivity to suitable habitat
- Threats
 - Presence of adverse infrastructure

3.3.2.3 Squatter Pigeon

- Foraging
 - Within 3 km of a water source
 - Grass species richness
 - Percentage of bare ground
- Shelter and breeding
 - Within 1 km of a water source
 - Presence of underlying suitable geology
 - Percentage of vegetation cover
- Mobility
 - Connectivity to suitable habitat

- Threats
 - Risk of habitat loss and fragmentation
 - Presence of weeds
 - Overstocking
 - Predation risk

3.4 GDE habitat quality threshold criteria

As detailed in Section 1.2, this Program intends to determine GDE habitat quality threshold limits for GDEs associated with MNES values, representing significant declines in habitat quality and providing triggers for environmental offset requirements.

GDE habitat quality threshold criteria have been developed from BioCondition class, and methods to measure BioCondition class are described in the 'BioCondition Assessment Manual, Version 2.2' (Eyre *et al.* 2015). The methodology defines four condition classes; where Class 1 represents a functional biodiversity condition and Class 4 represents a dysfunctional biodiversity condition (Eyre *et al.* 2015).

Table 4 provides the BioCondition class and the associated BioCondition score to determine GDE habitat quality.

Table 4: Threshold criteria

BioCondition class	Associated BioCondition score
1	> 0.80
2	> 0.60 – 0.80
3	0.40 – 0.59
4	< 0.40

A decline in class condition by two BioCondition classes, relative to a site's baseline class, will indicate an overall condition decline in the vegetation of the site/s. A decline in Biocondition is considered to represent a potentially significant decline in GDE habitat quality. A decrease in BioCondition of two classes is the threshold limit to trigger additional requirements (Table 5).

Table 5: Threshold limit for each assessment method to trigger additional requirements

Assessment method	Threshold limit to trigger additional requirements
BioCondition assessment	Decrease of ≥ 2 BioCondition classes (BioCondition score declines by $\geq 40\%$) relative to baseline.

3.5 Actions triggered if threshold limit exceeded

Exceedance of the BioCondition threshold limit will trigger an assessment against the 'Significant Impact Guidelines 1.1: Matters of National Environmental Significance' (DoE 2013) for relevant MNES (AARC 2024) by a suitably qualified person (i.e., Ecologist). This will occur after implementation of any GDE mitigation measures implemented under the GDEMMP.

Species habitat assessment scores collected during the monitoring program may be used as an assessment tool to support significant impact assessments for the Project, to determine whether biodiversity offsets are required.

3.6 Adaptive Program management

The Project's GDE management approach provided under the GDEMMP is intended to be adaptive, and this Program has been designed in accordance with this approach. As such, the threshold criteria defined in this Program (Table 5) may be adapted during the baseline assessment or during ongoing management, dependent on monitoring results and any future information gaps identified. Any changes will be reported in accordance with the process defined under the GDEMMP and provided in Section 4.

4 Program reporting and review

Reporting for GDE habitat quality will be completed after each monitoring event, as outlined in Section 3.3, Table 3. Results will also be incorporated into a consolidated report after the four baseline monitoring events have been undertaken. For this Program, the results of monitoring will determine whether there has been a decrease in habitat quality using the threshold limits for GDE habitat quality (after allowance for implementation of any mitigation measures under the GDEMMP). The results will be used to determine whether a significant impact to GDE habitat has occurred.

Where an exceedance of the GDE habitat quality threshold limit is detected, a significant impact assessment (SIA) will be required to be completed by a suitably qualified person. The outcome of the SIA will be used to determine requirements for biodiversity offsets. All supporting documentation, including data collected from BioCondition and species habitat attributes assessments, together with any previous monitoring reports will be attached to the SIA report, as necessary.

A data review will be undertaken following the completion of the monitoring program, in conjunction with the GDEMMP, to guide further monitoring requirements.

The Program will be subject to review every five years or under the following conditions:

- a change in GDEMMP methods/frequency of ongoing monitoring following completion of baseline assessment;
- a change to approval conditions and/or reporting requirements; or
- a significant change to current mine plan/operations.

5 References

3D Environmental 2023, *New Lenton Project: Groundwater Dependent Ecosystem Assessment*.

3D Environmental 2024, *New Lenton Project: Groundwater Dependent Ecosystem (GDE) Monitoring and Management Plan*.

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